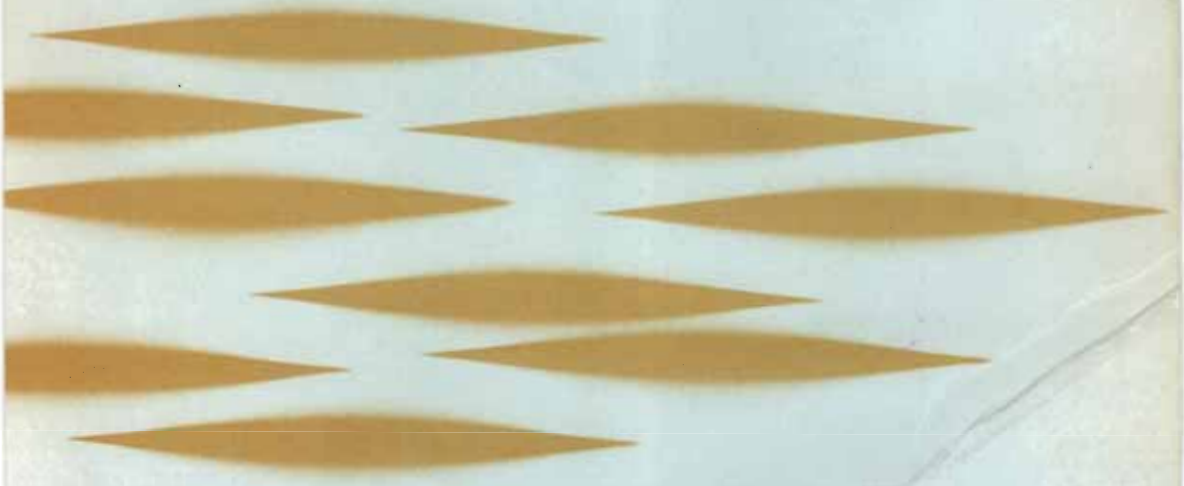
AUDITORY REHABILITATION

for Hearing–Impaired Blind Persons



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AUDITORY REHABILITATION

FOR

HEARING-IMPAIRED BLIND PERSONS

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FOREWORD

It had been my pleasure to join with the staff of this Project in many of its discussions over the past three years and to feel party to a significant step forward in the development of a new service for blind persons with hearing impairment.

For more than 45 years it has been my good fortune to be associated with and administrator of The Industrial Home for the Blind in Brooklyn. This multiservice agency, because its distinguished, progressive Board of Trustees has wanted to probe into the possibilities for a better life for blind persons, has been able to introduce new procedures and new techniques, new services and new programs designed to provide the best possible opportunity for blind persons to live a fuller and richer life. As a corollary, it has also been interested in the more obscure areas of study and development, reaching for the tangents that will help blind persons use to the full all remaining faculties and abilities. In this pursuit, it has inevitably been confronted with the multihandicapping problems which are common to most men but which become severely disabling where there is a primary sensory handicap such as blindness. Early in its history, communicative disorders arising out of secondary impairments became a first order of business, and the deaf-blind population received a substantial part of its consideration.

The pilot demonstration project conducted in cooperation with the Federal Office of Vocational Rehabilitation on the rehabilitation of deaf-blind persons, completed in March of 1958, was one example of such consideration; another was related to the most efficient use of remaining vision for those blind persons with severe visual impairment, classifiable as blind. A program of low-vision refraction and correction was begun some years ago and continues today. Other equally important programs for blind children, for aging blind persons, and for vocationally incompetent blind persons who need sheltered workshop programs as well as recreational and day center programs have been developed over the years. Finally, in 1958, after many years of frustrating efforts to find adequate service for hearing-impaired blind persons, we proposed a plan to the Federal Office of Vocational Rehabilitation designed to meet the needs of such persons in a setting where all of the rehabilitative problems arising out of blindness would be familiar to the staff. The Project reported on here is the result of this proposal.

In all of the work that I have enjoyed at the IHB, I have had with me a group of understanding associates in administration who were interested in and could help in the development of special programs and inquiries. One of these associates,

George E. Keane, has been active in several of the IHB program developments; and, because he himself, in addition to being blind, has some hearing impairment severe enough to require a hearing aid, he had a particular interest in this study and agreed to organize and direct its development.

As usual, we found the staff of the Federal Office of Vocational Rehabilitation interested, curious, and enthusiastic about any plan that might shed some light on the problems arising out of multiperceptive impairments. The magnificent cooperation of this group deserves our particular gratitude. For Keane and the staff, may I express to Mary E. Switzer, James F. Garrett, Gilbert R. Barnhart, and all of those who have had an interest in this program our heartfelt thanks. Without their cooperation the IHB, though audacious, would not have had the daring nor the funds to proceed with this plan. Without their interest and support, neither this program nor an earlier program for deaf-blind persons could have been undertaken.

I sincerely believe that the report that follows will make a very substantial contribution to the body of knowledge available to the field of rehabilitation in the United States. I congratulate Keane, Bergman, and the entire Project staff on the excellent service that has been established and on this report related to it.

Peter J. Salmon, LL.D.
Executive Director
The Industrial Home for the Blind

INTRODUCTION

BY

GEORGE E. KEANE, PROJECT DIRECTOR

Communication, physical orientation within an environmental setting, and mobility within this setting are the primary areas that are limited by impairment of sight or hearing. Presumptively, insofar as possible, any visual or auditory impairment will have, or at least should have, complete medical and surgical care as a first step in restoration. When medical science has gone as far as it can, educational rehabilitative procedures must be introduced to help the handicapped patient achieve his fullest possible capacity.

The Industrial Home for the Blind is and always has been an organization for the education and rehabilitation of blind persons, and its approach to the problems arising out of blindness and hearing impairment will necessarily be educational and rehabilitative in nature. Its approach to the research demonstration study reported on here has been, therefore, a practical, down-to-earth effort to bring efficiency in the use of residual hearing to blind persons with auditory impairment. It has taken existing knowledge, skills, and equipment; and with trained personnel, it has applied this knowledge and these skills to the problem.

Early in 1958, when we were reviewing the completed study on rehabilitation of deaf-blind persons, we discovered that we had learned a great deal, not only about deaf-blindness but, coincidentally and inevitably, about hearing impairment less than deafness, which had been screened out of the study on deaf-blindness by definition.

We had introduced into the program for the deaf-blind a number of persons from various disciplines with unusual skills who had observed, in the course of the study, the IHB method of rendering service to blind persons with hearing loss that was still subject to improvement through a hearing aid or auditory training, or both. As a result, a meeting was called to review these procedures and to discover, if possible, what could be done to make the service more adequate. At this meeting it was learned from IHB staff members that our efforts to employ community resources — that is, existing speech and hearing centers, otologists, audiologists, and hearing aid companies and dealers — had been very unsatisfactory, always frustrating, and only rarely successful, not because of a lack of skill on the part of any of those rendering these services in their specialties, but because of the lack of understanding and knowledge common to these resources of the problems arising out of blindness. From our experience with the program for the deaf-blind, it had become clear to the specialists in communication disorders that there were many special

problems which made it necessary for the otologist, the audiologist, and the speech therapist to reorient their thinking where hearing impairment is accompanied by blindness. It was not clear to any of us what the nature of this reorientation might be. It was very clear to all of us, however, that where blindness exists, hearing becomes the primary perceptive faculty, the primary channel of communication, and the primary source of physical orientation and perspective; and therefore, it takes on such significance and importance as to require attention beyond that of the population without visual impairment.

We asked the audiologist, therefore, to assist us in the design of a program that would be developed uniquely for blind hearing-impaired persons. We wanted to explore a number of areas of interest, and we felt that we needed to identify these areas before a facility was planned for testing, training, and correcting. Those skills already available for testing would be adapted to the new facility, but in addition, we wanted improved measuring devices, a "vocabulary" of sounds for auditory training, and equipment for sound localization and identification. We wanted this program to be an integral part of the broad rehabilitation program already available at the IHB for blind persons so that personnel throughout the rehabilitation program would be familiar with the problems being studied. We wanted to be very certain that some evaluation was made in each case of the relationship of the proposed hearing center to the ongoing rehabilitation program — the degree to which the hearing center itself was valid in terms of the real-life situation.

We thought then that there should be two broad approaches to the problem: (a) a highly skilled audiological study, and (b) an equally skilled social research study. A design was planned and a request made of the Federal Office of Vocational Rehabilitation to assist in the launching of a research and demonstration project. The OVR was interested and, after review, agreed to participate in a three-year developmental study.

The report that follows has been edited and revised substantially by the authors for special presentation as an American Speech and Hearing Association monograph. We are, indeed, privileged to have our findings presented to the sophisticated audience reached by such monographs. We present it with the full awareness that it does not answer all of the questions that will be raised, that it is not a completed demonstration, and that much more needs to be done throughout the country. We do believe, however, that it presents some rather exciting findings, a few unique approaches, and at least one positive contribution to the field of work for the blind — the relating of the skills of audiology to the problems of rehabilitation for blind persons. We express our sincere thanks to the editorial staff of the American Speech and Hearing Association for the work they have done on this monograph, and to the United States Office of Vocational Rehabilitation for its financial support which made the publication possible. The authors also acknowledge freely that this work is a synthesis of the contributions of a very large staff of workers and consultants to whom we are all grateful.

Chapter 1

THE SPEECH AND HEARING PROJECT

The purpose of the Speech and Hearing Project was to develop a pilot program of rehabilitation services for hearing-impaired blind adults. It was apparent that these persons have special problems in physical orientation and foot travel, in communication, and in the psychological, social, and vocational areas that are related to the double handicap. It appeared, further, that the techniques of rehabilitation developed for normal-hearing blind persons, for hearing-impaired sighted persons, and for deaf-blind persons could not adequately meet the special needs of this group. These considerations suggested the desirability of initiating a program that would (a) delineate the specific problems of this double disability, (b) develop information and techniques for meeting these problems, and (c) demonstrate the feasibility and effectiveness of the rehabilitation measures developed.

PREVIOUS STUDIES

The bulk of the literature in the area of hearing loss and blindness is about deaf-blind children and adults. One of the most extensive recent publications is a seven-volume report on the rehabilitation of deaf-blind persons by the U. S. Office of Vocational Rehabilitation and the Industrial Home for the Blind, Brooklyn, New York (1958-59). Volume 2 of that report, which deals with the problem of communication, revealed that most of the deaf-blind adults studied had too little hearing, or hearing too little stimulated, to benefit from the use of amplification. Manual communication was the preferred method. There are, of course, many references to the habilitation of deaf-blind children.

Relatively little has been written about the rehabilitation of adventitiously hearing-impaired adults. A perceptive article on the subject by Heffler (1952) posed some of the problems and indicated some of the areas needing development. Stressing the importance of auditory information for blind persons, Heffler advocated annual audiometric screening of all blind persons, diagnostic testing for those who show hearing loss, and hearing re-education (auditory training) combined with amplification for those who cannot be helped medically or surgically. Since Heffler's article predated the marketing of binaural hearing aids, he confined his advice on achieving sound localization to hints about where to sit or stand in a room.

While the Project reported here was in progress, two other projects, supported in part by the OVR, undertook investigation of the nature of auditory clues useful to blind travelers. In the project conducted by the Cleveland Society for the Blind (Norton, 1960), binaural recordings were made to provide practice in recognition of common sounds and training in the location of sounds by associating their points

of origin with the positions of clock hands. The second study, by the C. W. Shilling Auditory Research Center (Harris, 1961), also involved the development of binaural tape-recordings concerned mainly with training in identifying outdoor sounds as cues to foot travel. Both of these studies utilized earphones in the training and were intended primarily for blind persons with normal hearing.

THE SETTING FOR THE PROJECT

From past experience at The Industrial Home for the Blind, it appeared that the rehabilitation of blind persons with hearing impairments requires a multidiscipline service developed in relation to a total rehabilitation program. Therefore, one appropriate setting for such a rehabilitation program is in an agency for the blind. The general rehabilitation program in a well-organized agency for the blind is able to provide the necessary self-care services related to the adjustment to blindness itself, a mobility training program, an evaluative and diagnostic program for vocational guidance, and an adquate reporting system. It has available to it all of the professional personnel and services essential to rehabilitation — social caseworkers, rehabilitation counselors, psychologists, therapists, instructors (including foot travel instructors), a cooperating medical program, and a vision rehabilitation center for low-vision correction. In planning the project reported here, the availability of these services in the IHB led to the establishment of the speech and hearing services at its Long Island Rehabilitation Center for Blind Persons.

THE PROJECT SURVEY

Before attempting to analyze the population reached by the Speech and Hearing Project, it would be well to consider the background of the sponsoring agency, and the methods it used in approaching the problem of case-finding. The IHB, established in 1893, originally limited its services to blind men residing in Brooklyn. Later, residents of Queens were included, but it was not until 1950 that the service area was extended to cover Nassau and Suffolk Counties, and still later that the services were opened to both men and women in these counties. There are many blind men in Brooklyn who have been beneficiaries of IHB services for most of their lives and consequently have warm feelings of gratitude and loyalty to the organization. These factors undoubtedly had some influence on the composition of the group included in the speech and hearing service, as will be seen presently.

Case Finding

When the Speech and Hearing Center was established, an effort was made to offer its services as widely as possible among the blind residents of the IHB service area. Services were offered not only to blind persons who were conscious of having hearing loss but also to those who felt that their hearing was normal, partly in order to determine, if possible, what proportion of the known blind population suffered from defective hearing, and partly to discover what proportion of those who had a hearing loss were unaware of the fact.

As a first step, a form letter was sent to all blind adults on the IHB register telling them of the Project and inviting them to have hearing tests at the Center or in their own homes, without charge. This first form letter (see Appendix A) stressed the importance of the research aspects of the Project. On this basis, all blind persons were urged to take advantage of the hearing tests, not only for their own benefit but as a matter of cooperation with the research activities of the IHB. The letters were sent out in instalments so that there would not be more applications at any time than could be taken care of by the available Project staff. Responses to this first letter were limited. When the entire register had been circularized once, a second letter was sent to those who had not responded to the first. The second letter was somewhat less detailed than the first (see Appendix A) but brought similar responses.

In the latter part of 1960, after the Project had been underway for more than two years, the service was extended to blind persons in the area who were not registered clients of the IHB through the cooperation of the New York State Commission for the Blind. The Commission sent letters about the hearing-test service to all blind adults in four adjacent counties who were not on the IHB list. Requests for screening tests were received from 173 persons as a result of the Commission's letters.

In the meantime, beginning early in the life of the Project, certain special client groups had been screened en masse — the employees in the IHB special workshops, the residents at Burrwood (the home for aging blind), and the participants in the IHB Day-Center activities for older clients. Trainees in the Long Island Rehabilitation Center for Blind Persons and candidates for IHB travel training, some of whom were from outside the IHB service area, were also routinely screened. As the Project continued, the IHB social workers became alerted to clients' hearing losses and referred clients for screening or evaluation, as did other members of the IHB staff.

As a result of these various factors in the selection of blind persons for screening, the population of the study cannot be considered a random selection.

Test Procedure and Personnel

Two types of hearing tests were employed in the survey of the foregoing populations: (a) For large-group screening, the standard pure-tone sweep-check technique was employed. Test frequencies were 500, 1 000, 2 000, 4 000 and 8 000 cps at an audiometric level of 15 dB. (b) If a subject did not respond appropriately at the screening level, the test was continued with standard threshold-finding techniques.

Diagnostic pure-tone audiometers were employed in the survey. The test personnel included audiologists, caseworkers trained in the screening-test technique, and audiology students from Hunter College in New York City.

THE STUDY POPULATION

The group analyzed were the first 1 000 clients screened for hearing loss or receiving audiologic evaluation on direct referral to the Speech and Hearing Center without preliminary screening. This group did not include children under 16 years of age, since they were covered in a special study at the New York Institute for the Education of the Blind. Nor did it include residents of the Home for the Jewish Blind, who were screened as a special project.

TABLE 1.1. Comparison of the study population with the total registered blind population (10 years of age or over) in four counties of New York City.

Area	*Registered Blind Population*	*Study Population*	*%*
Kings County	5 339	578	10.8
Queens County	2 093	155	7.4
Nassau County	828	130	15.7
Suffolk County	652	95	14.6
Total — All counties	8 912*	958**	10.7

*Excluding 286 persons for whom age was unknown.
**Excluding 42 persons residing outside the study area.

All clients had been classified by the New York State Commission for the Blind as blind within the legal definition of blindness. All cases were documented by eye reports in the files of the IHB.

Study Population Compared with the Total Known Blind Population in New York State. The New York State Commission for the Blind maintains a register of all known blind persons in the state. Table 1.1 compares the study population and the registered population of New York City.

The study population constituted almost 11% of the registered blind population 10 years of age or over in the area. The lower percentages in Kings and Queens Counties may be accounted for by the fact that in those areas there are other multi-function agencies for the blind, whereas the IHB is the only voluntary agency offering a broad program of services in Nassau and Suffolk Counties.

Distribution by Sex and Age. The 1 000 cases were distributed by sex as follows: male, 61.6%; female, 38.4%. The distribution of the registered blind population for the area is reported by the Commission for the Blind as 49% male and 51% female. The larger proportion of males in the study population is attributable to the fact, mentioned above, that for many years the IHB served only men.

TABLE 1.2. Age distribution of the total registered blind population and the study population.

Age Group	*Registered Blind Population*		*Study Population*		
	N	%	N	%	*Prop. of Regis. Age Group* %
10 to 19	507	5.7	37	3.9	7.3
20 to 29	384	4.3	63	6.5	16.4
30 to 39	725	8.1	112	11.7	15.4
40 to 49	860	9.7	117	12.2	13.5
50 to 59	1 225	13.7	202	21.1	16.5
60 to 69	1 647	18.5	201	21.0	12.2
70 to 79	1 719	19.3	156	16.3	9.1
80 years or over	1 845	20.7	70	7.3	3.8
Total	8 912	100	958*	100	10.7

*Excluding 42 persons residing outside the study area.

It appears from Table 1.2 that the study population between the ages of 20 and 60 is fairly representative of the registered blind population. The small percentage of persons in the two older age groups is partly due to the fact that many of these older persons are mentally or physically infirm and were unable, therefore, to take advantage of the screening service. It is also possible that the figures for the upper age groups are somewhat inflated due to unavoidable lags in removing the names of deceased persons from the register. The study group included only 7.3% of the registered blind population between the ages of 10 to 19 years, because the study was limited to adults (persons over 16) except for special cases.

On the whole, it may be said that the study population, while not a true cross-section of the total blind population of the area, is fairly representative of those of employable age who have been or might be subjects for rehabilitation services.

Categories of Hearing Status. Experience in testing older persons for the Project survey indicated clearly that many persons with slightly subnormal hearing manifested no noticeable difficulty in communication. It became apparent that any interpretation of the communication problems and adequacies in such a special population, particularly in view of the major visual impairment, should be based upon realistic appraisal rather than on standard criteria. In brief, it was felt that the categories of impairment reported in our survey should reflect our judgments about the actual effects of various hearing levels on subjects' ability to communicate adequately for their needs. Consequently, the following arbitrary categories of hearing impairment were established for the analysis of the survey data:

Category 1

Maximum Hearing Levels

a. No more than 20 dB at 500 cps
b. No more than 20 dB at 1 000 cps
c. No more than 30 dB at *both* 2 000 and 4 000 cps

Hearing that fell into this category was considered adequate for communication purposes. The high prevalence of sharp drops in hearing at 4 000 cps in an older age population was thus not permitted to influence significantly a determination of adequacy of hearing. Threshold dips at this frequency alone seldom interfere with the understanding of speech to which older blind persons are exposed.

Category 2

Maximum Hearing Levels

a. 30 dB at 500 cps
b. 30 dB at 1 000 cps
c. 40 dB at *both* 2 000 and 4 000 cps

Hearing levels specified for this category were considered to indicate a mild loss of hearing. If the social need and the audiologic complaint required further investigation, the client was brought to the Center for a complete audiologic evaluation and additional rehabilitation procedures, as indicated.

Category 3

Ears that showed hearing levels poorer than those established for Category 2 were classified in Category 3. A loss of hearing of this magnitude was considered sufficient for automatic referral to the Center for a full audiologic evaluation and rehabilitation follow-up, as indicated.

The foregoing categories were employed in arranging the incidence data included elsewhere in this report. Data provided by other agencies were similarly categorized so that they could be grouped with our own data for a complete report on prevalence.

It is interesting to note that although the categories were designed at the end of the Project on the basis of our subjective analysis of the relationship between hearing loss and hearing impairment in the older age groups, the statistical information relating hearing category to need for services at the Speech and Hearing Center appears to support the category values dramatically. The overwhelming percentage of persons who were referred to and subsequently received rehabilitation services at the Speech and Hearing Center were those who were in Category 3 for both ears. A more detailed discussion of the relationships between the categories and services received is given in the statistical analysis elsewhere.

SURVEY RESULTS

Table 1.3 shows the distribution of cases in the various combinations of categories. Each number represents an ear; for example, 1-2 means that a client had one ear in Category 1, while the other ear fell into Category 2. The second and third columns include all cases served on the Project, including the 903 who were screened and the remaining 97 who were evaluated in the Center without previous screening. The latter group, of course, included many persons previously known to the IHB to have significant hearing impairment. The last two columns show the distribution of hearing levels among the screened population only, eliminating the 97 who were not screened, mainly because of previous information about hearing condition.

Table 1.4 shows the results by age, sex, and category. The extremes in this

TABLE 1.3. Distribution of hearing-level categories in the IHB population studied in the Speech and Hearing Project.

Hearing-Level Category (Each Ear)	*Total Population*		*Screened Population Only*	
	N	*%*	*N*	*%*
1-1	499	49.9	492	54.5
1-2	62	6.2	60	6.6
1-3	66	6.6	61	6.8
2-2	69	6.9	68	7.5
2-3	68	6.8	64	7.1
3-3	236	23.6	158	17.5
Totals	1 000	100.0	903	100.0

TABLE 1.4. Distribution of hearing-level categories in each age group by sex for 1 000 cases served by the IHB.

Age	*Number*		*Hearing-Level Category*											
			1-1		*1-2*		*1-3*		*2-2*		*2-3*		*3-3*	
	M	*F*	*%M*	*%F*	*%M*	*%F*	*%M*	*%F*	*%M*	*%F*	*%M*	*%F*	*%M*	*%F*
10-19	30	16	96.7	100.0	.....	.....	3.3	.....	.....	.....	.....	.....	.....	.....
20-29	53	16	88.6	62.5	3.8	.....	1.9	18.8	1.9	.....	.....	6.2	3.8	12.5
30-39	85	34	70.6	76.5	4.7	5.9	5.9	5.9	4.7	.....	3.5	.....	10.6	11.7
40-49	87	45	54.0	48.9	9.2	6.7	8.0	11.1	3.5	2.2	2.3	2.2	23.0	28.9
50-59	129	75	51.9	57.3	7.0	5.3	6.2	6.7	5.4	2.7	7.8	5.3	21.7	22.7
60-69	120	83	43.4	42.2	8.3	9.6	5.0	13.3	12.5	8.4	10.8	10.8	20.0	15.7
70-79	78	79	25.7	25.3	3.8	5.1	7.7	5.1	16.6	8.9	10.3	12.6	35.9	43.0
80 or over	34	36	5.9	8.3	8.8	5.6	2.9	2.8	11.8	13.9	8.8	11.1	61.8	58.3
Totals	616	384	52.6	45.6	6.3	6.0	5.7	8.0	7.6	5.7	6.3	7.6	21.5	27.1

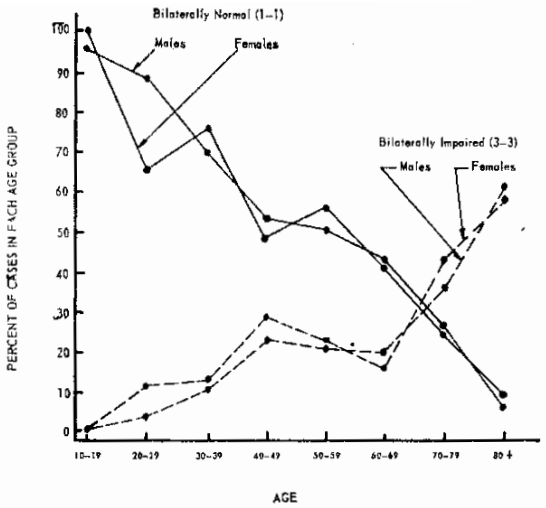


FIGURE 1.1. Prevalence of hearing impairment by age and sex for the IHB cases. The solid lines indicate bilaterally normal hearing; the dashed lines indicate significant hearing loss bilaterally.

table, bilaterally normal (Category 1-1) and significantly impaired bilaterally (Category 3-3) are charted by age and sex in Figure 1.

Studies Conducted on Other Populations of Blind Persons

The findings reported in the study conducted by the New York Association for the Blind (Lighthouse) and our tests of the aged residents of the New York Guild for the Jewish Blind (New York Guild), and of the children of the New York Institute for the Education of the Blind (NYIEB), in addition to the IHB population study, are summarized in Table 1.5.

General trends as well as apparent discrepancies in prevalence appear in Table 1.5. The differences between the IHB and the Lighthouse survey results will be considered shortly. At this time, we would like to note the obvious differences between the IHB-Lighthouse figures on the one hand and the New York Guild figures on the other.

TABLE 1.5. Distribution of hearing-level categories in surveys conducted by the New York Association for the Blind (Lighthouse), the IHB, the New York Guild for Jewish Blind (NY Guild), and the New York Institute for Education of the Blind (NYIEB). The percentages are based upon the survey population in each study.

Hearing-Level Category	*IHB*		*LIGHTHOUSE*	*NY GUILD*	*NYIEB*
	Project Pop. N=1000 %	*Screened Pop. N=903* %	*N=600* %	*N=83* %	*N=146* %
1-1	49.9	54.5	63.0	7.2	88.4
1-2	6.2	6.6	5.7	2.4	0.0
1-3	6.6	6.8	12.0	1.2	2.7
2-2	6.9	7.5	1.0	20.5	0.7
2-3	6.8	7.1	3.3	16.9	0.7
3-3	23.6	17.5	15.0	51.8	7.5
Totals	100.0	100.0	100.0	100.0	100.0

The population of the New York Guild Home for the Aged shows a very high prevalence of significant bilateral hearing impairment, with approximately 52% of the total population occurring in the 3-3 Category. When the slight to severe hearing loss Categories (2-2, 2-3, and 3-3) are grouped together, approximately 90% of the population in that institution shows moderate to severe hearing loss bilaterally, whereas only 19% of the Lighthouse population and 37% of the IHB population fall into these categories. However, these differences are due to the high percentage of older persons included in the Guild study. It is also probably true that those who have chosen or have been recommended for resident care are more dependent persons, and tend to have more than one physical disability. On the other hand, it is apparent that the NYIEB population shows the greatest number in Category 1-1, as would be expected for a population of young children. The surprisingly high prevalence for a children's survey, of 7.5% in Category 3-3 is related to the inclusion of a department for the deaf-blind at the Institute. It is well-known, also, that institutions specializing in the training of blind children tend to serve multihandicap cases, whereas the superior, singly handicapped blind child may find his education in the regular, noninstitutional schools.

The differences between the IHB and the Lighthouse results should be examined further. First, let us compare the distribution of ages in the two surveys shown in Table 1.6. A fairly similar grouping of ages included in the two surveys is evident from this table. An explanation of the discrepancy in results, therefore, must be sought elsewhere.

From a study of the IHB and Lighthouse survey results shown in Figure 1, it is clear that, except for a sharp departure of the Lighthouse survey curve for males at age 65, the main discrepancies occur in the age decades between 40-49 and 50-59. In the IHB figures the majority of cases previously known to have hearing impairment or referred directly to the Project because of suspicion of hearing impairment were in the 40-69 age groups. It should be noted further that both the Lighthouse and the IHB surveys of persons in these age groups drew upon factory and workshop employees. Older age groups in the surveys were drawn in the Light-

TABLE 1.6. Age distribution in the hearing surveys conducted by the IHB and by the New York Association for the Blind (Lighthouse).

	IHB		*LIGHTHOUSE*	
Age	*N*	*%*	*N*	*%*
10-19	46	4.6	21	3.5
20-29	69	6.9	69	11.6
30-39	119	11.9	60	10.2
40-49	132	13.2	91	15.1
50-59	204	20.4	131	21.8
60-69	203	20.3	141	23.4
70-79	157	15.7	72	11.9
80-89	65	6.5	15	2.5
90 or over	5	0.5	....	....
Totals	1 000	100.0	600	100.0

house project from recreation clients, while the IHB were from the more sedentary day center groups, since the IHB did not test its recreations groups as a group. It should be noted, also, that the workshop groups of the IHB and the Lighthouse appear to be samples from different populations. The Lighthouse workers tend to be selected for productivity and an ability to carry on the job successfully, based upon relatively good health, whereas the IHB workshop population is made up, for the most part, of persons who could not compete successfully in outside employment. The latter group includes many with secondary handicaps, and would, therefore, be more apt to include persons who are less healthy than the Lighthouse population of comparable age groupings. The method of surveying may also have produced a biasing factor, since the IHB population was appealed to through a letter, and would, therefore, be more likely to bring responses from those who suspect that they have hearing impairment.

It would be desirable to compare the prevalence of hearing impairment in the IHB survey with prevalence figures obtained on general, sighted populations. Unfortunately, there are no figures based upon the categories established for the purposes of this study. Certain estimates can be made, however. From a recent study by Glorig and Nixon (1960), it appears that approximately 10% of the persons in the 50-59 age group would fall into Category 3 as defined in this report. In contrast, the IHB figure, if the entire study population of 1 000 is included, was 22.5%. The IHB population, including only the 903 who were screened, includes approximately 16% in this Category, while the Lighthouse population shows approximately 11%. Although the comparability of these statistics is somewhat questionable, it appears that the prevalence of severe hearing impairment in the Lighthouse survey is about the same as for the general population, whereas the IHB survey shows somewhat greater prevalence.

THE POPULATION SERVED AT THE SPEECH AND HEARING CENTER

Of the 1 000 IHB cases included in this Project, 352 were referred to the Speech and Hearing Center for a complete audiologic evaluation. Of this number, 62 were found to have hearing within Category 1, either in both ears, or in one ear with the other ear falling into Category 2 (mild loss). Very few of the 62, therefore, required further services. In fact, none of them received recommendations for hearing aids. Only eight were sent for otologic evaluation, and eight others received either speech therapy or counseling in connection with their hearing. Of the group having unilateral deafness, that is, one ear in Category 1 and the second ear in Category 3, indicating a significant loss on the one side, only 30 of 61 originally screened were referred for an audiologic evaluation; the remainder indicated a lack of interest or need for further investigation of their hearing conditions. Nine of the 30 who were evaluated audiologically required no further audiologic services, while 21 did. Hearing aids were recommended for three of this group, based upon the audiologist's opinion that the unilateral hearing loss would be benefited by the use of an aid on the poor ear for localization.

Of 132 cases with the better ear or with both ears in Category 2 (mild loss), 72 were followed-up with an audiologic evaluation. 33 were judged not to require any further audiologic services, while 39 received either otologic examinations, auditory training, speech therapy, or hearing-aid evaluation. In six cases, all of whom were in the 2-3 Category, that is, one ear with a moderate loss and the other ear with a significant loss, hearing aids were recommended.

The category of hearing impairment which provided the largest number of cases for audiologic service was Category 3-3, that is, where both ears showed significant impairment of hearing. Of 236 cases in this category, all but 48 received audiologic evaluations at the Speech and Hearing Center. Those who did not, were either not referred or chose not to follow-up on the referral, for reasons such as the following stated by the Project caseworker: "In the particular circumstances and environment of this client, it was felt that further service would not provide benefits." This phrase covered the situation of clients, particularly those who were aged and infirm, who had learned to live with their hearing loss and felt that the potential improvement was not sufficient to justify the trouble of further testing. It covered also those who were already using hearing aids which, although perhaps not optimum, gave them practical benefits; those with very restricted activities in which the hearing aid would be of limited use (for example, the homebound and those in nursing homes); and those for whom the audiologist felt that the benefits to be derived from the hearing aid were not likely to be sufficient to motivate the client to accept it. Of the 188 who did receive audiologic evaluations, 49 were deemed not to be in need of further services, usually for the reasons just given. The remaining 139 received otologic examinations, auditory training, speech therapy, or hearing-aid evaluations, or a combination of several or all of these services. Hearing aids were recommended in 71 cases in this category.

It is interesting to note that, although the categories of hearing impairment were established at the close of the Project, and without knowledge of how the distribution of results would look, the need for services and the benefits derived from them, are concentrated heavily in Category 3-3, as expected. Since the maximum loss for each category was greater than that usually considered for normal hearing or mild hearing loss, it appears that the relatively small numbers of persons in Categories 1 and 2 who required service must be related to the advanced age of the IHB population and the relatively minimum need for good hearing in this population. A realistic appraisal of the hearing needs of older blind persons, therefore, should be based upon experience such as that gained in this Project, rather than on the usual estimate of hearing handicap based upon experience with younger persons.

Chapter 2

EVALUATION PROCEDURES

Clients who were referred to the Speech and Hearing Center were scheduled for evaluation which usually included audiologic, otologic, and speech assessments. The otologic examination was conducted in the consultant otologists' private offices as described later, while the audiologic and speech evaluations took place at the Center.

PHYSICAL FACILITIES

The Speech and Hearing Center included a test-room and control-room suite and an office, which served also for therapy. Various travel, physical orientation, and auditory training sessions with hearing aids were conducted throughout the IHB Rehabilitation Center for Blind Persons, of which the Speech and Hearing Center was a part. The Rehabilitation Center was particularly well-suited to such training since it was designed for home-living and travel orientation, including a typical apartment and a "street."

Test Environment

The audiology test room measured 13′ 5½″ square (inside measurement), while the control room was 13′ 5½″ by approximately 4′ 6″. In order to assure sufficient illumination (60 ft. candles), fluorescent lights were used, in contrast to the usual practice in an audiology center. The noisy ballast units were placed above the ceiling of the new construction to eliminate the possibility of spurious noises. The area in which the new construction was planned showed a preconstruction ambient noise level as follows:

Noise Level Readings in dB re 0.0002 Microbar in Each Octave Band (Over All SPL = 66 dB)

37.5 to 75	75 to 150	150 to 300	300 to 600	600 to 1 200	1 200 to 2 400	2 400 to 4 800	4 800 to 10 000
58	50	52	55	56	57	56	44

The new construction was discontinuous in form, with the floor set on isolators, the ceiling hung on isolation hangars, and the walls of the inner room separated from the walls of the outer room by wall isolators. After construction was completed, attenuation readings were taken, although a noise analyzer was not available. The resultant readings which follow are, therefore, over-all levels only. (All levels are re 0.0002 microbar.)

(a) With 93 dB (C scale) of white noise generated just outside the door to the new construction, the reading in the control room was 46 dB on the A scale, yielding an attenuation of 47 dB, and 52 dB on the B scale, yielding an attentuation of 41 dB.

(b) With the same noise at the outside of the door to the new construction, readings within the test room were approximately the same as in the control room. The lack of additional attenuation between the outside area and the control room is apparently explained by the fact that the noise seemed to enter both the control and the test rooms through an air intake duct.

(c) With 94 dB of white noise (C scale) generated in the control room, the readings in the test room were as follows: 35 dB on the A scale, for an attenuation of 59 dB between the two rooms, and 45 dB on the B scale, for an attenuation of 49 dB.

(d) With 94 dB of white noise (C scale) generated in the test room, the readings in the control room were 37 dB on the A scale, for an attenuation of 57 dB, and 50 dB on the B scale, for an attenuation of 44 dB.

It can be seen from the foregoing figures that the attenuation provided by the construction was of a high order. In addition to the test-room and control-room suite, the Project staff had an adjoining office which enjoyed a common window with the control room, so that staff members, visitors, and others could observe the activities in both the control and test rooms from the adjoining office. An intercommunication system was installed permitting two-way conversation between the office and the control room, and one-way reception from the test room to the office. Thus, staff members could converse with other staff members performing the test and could listen to the patient's responses, without accidentally interjecting sound into the test room.

Equipment

The basic auditory testing equipment used in the Project was a Beltone 15-C Audiometer. A Magnecorder stereo record-playback unit (with remote power amplifiers and loudspeakers for auditory training with stereo tapes), and a Revere Model 202 monophonic tape-recorder were fed to the Beltone audiometer for speech audiometry. A Revere Model 204 tape-recorder (with provisions for mono record and stereo playback), and a stereo disc-player were added later. The Revere stereo tape-player and the Magnecorder were both required so that one two-channel tape-player would always be available as part of the testing console in the control room, while the other could be used simultaneously for auditory training purposes in another area of the Rehabilitation Center. A sound-survey meter was employed to measure sound pressure levels of the signal in the test room for various studies as described later. The main equipment used in this project for special purposes, such as localization and selective listening studies, was contained in a custom-built console, the block diagram for which is shown in the accompanying illustration, Figure 2.

This equipment was basically a two-channel arrangement with appropriate noise generators, pre-amplifiers, and so forth, and contained two completely independent banks of switches controlling all test loudspeakers in the test room. For localization studies, eight 10-inch loudspeakers, housed in Q-Sonics cabinets and set on wooden legs, were employed, while for presentation of the main test signal and for routine sound field or speech audiometry, a double 12-inch loudspeaker assembly, housed in a large Q-Sonic cabinet, was used. In brief, the main console assembly included the following:

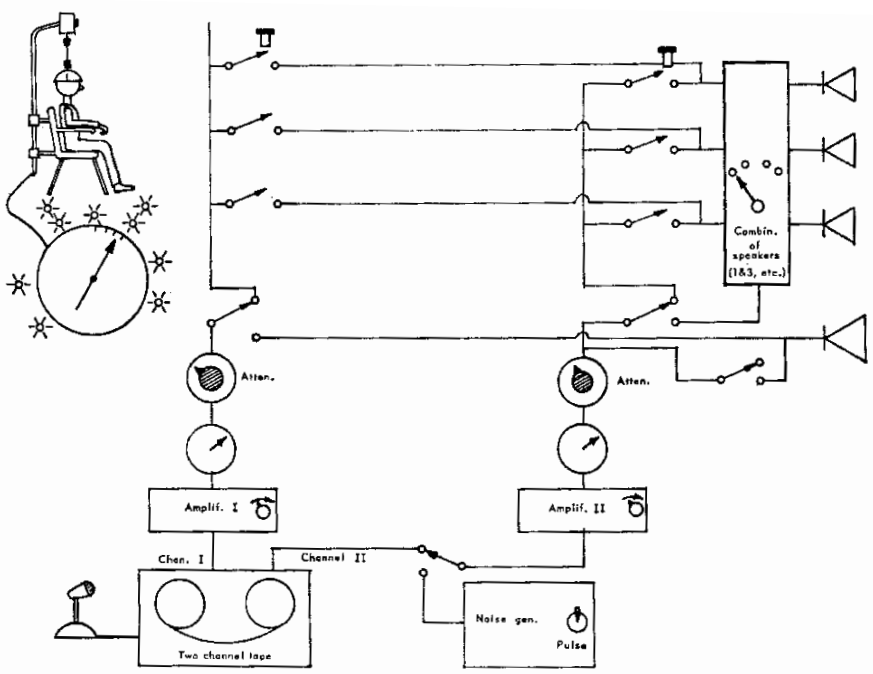


FIGURE 2.1. Equipment assembly for localization studies with blind subjects.

Inputs. One Electro-Voice Model 630 Microphone, the Magnecorder stereo recorder-player, the stereo disc-player, the Beltone 15-C audiometer, and the custom-built noise generator. The noise generator had an automatic pulsing device so that noise could be presented in predetermined exposure patterns.

Amplifiers. The microphone and noise generators fed pre-amplifiers, which were situated in the control console. The input signals of each channel were fed to an associated 10-watt line amplifier, and then through VU meters and 110-dB attenuators to the output switches. These switches were of the push-button type, and were arranged to permit the selection of any of the eight 10-inch loudspeakers. In addition, the Channel 1 switch bank contained one position for selection of the main (12-inch) test loudspeaker and its associated power amplifier. An additional switch in the Channel 2 bank permitted the ganging of loudspeakers so that combinations of two and four loudspeakers could be selected for fusion tests and for flooding the test room with noise while the signal was being presented through Channel 1 on the main test loudspeaker. The control console also contained a dial and face-plate arrangement to indicate localization responses by the subject. This indicator unit contained rows of lights, white for one channel and blue for the other channel, in positions around the periphery of the indicator corresponding to the

loudspeaker positions around the subject in the test room. The indicator needle was activated by a selsyn (self-synchronous) motor situated above the subject's head in the test room. The motor was controlled by a shaft extending down from it to a headpiece that rested on the subject's head. As the subject turned his head or turned in his chair to located the source of the test sound, the movement was communicated through the shaft and the selsyn motor to the "slave" motor underneath the indicator needle on the control console, thus activating the indicator needle itself.

In addition to the foregoing assembly, three KLH Model 6 loudspeaker systems and associated power amplifiers were installed in the test room, one directly in front of the subject, one 45° to the right of center in front of the subject, and one 45° to the left of center in front of the subject. These systems were used for playback of the stereo tape-recordings made in the Project. The use of the middle KLH loudspeaker eliminated the problem of the "hole in the middle" so that movement across the field in front of the subject would occur smoothly, rather than appearing to jump from one point to another.

THE AUDIOLOGIC EVALUATION

Orthodox Procedures

The evaluation began with an interview conducted by the audiologist, who explored the client's communication needs. The audiologist then administered a battery of auditory tests, generally including the following:

Monaural (earphone) tests

1. Pure-tone thresholds by air and bone conduction
2. Speech audiometry consisting of
   a. Speech-reception threshold
   b. Discrimination test at 35 dB SL
3. Additional orthodox audiological tests such as loudness recruitment (alternate binaural loudness balance and isophonic contours), tolerance thresholds, and so forth as needed

Sound field (loudspeaker) tests

1. Speech-reception threshold
2. Discrimination test

New Audiologic Procedures

The following two additional tests were developed as a part of the audiological battery for persons with major loss of vision:

Localization. Following the conventional audiologic evaluation, a metal headband was placed over the client's head for localization testing as follows:

The client was seated in the center of the test room, surrounded by eight loudspeakers set at 45° angles from the client's position. He was told that he would hear a sound at any point around him, and was instructed to turn bodily toward the sound, facing it as directly as he could. The test signal was white noise activated in the control room by the audiologist and delivered to each of the eight loudspeakers in a random order. As the client turned, the headband, attached to an overhead selsyn (self-synchronous) motor, caused a remote motor in the control console facing

the audiologist in the adjoining room to turn exactly as the client turned his head. An indicator dial, driven by the shaft of the remote motor in the console, showed where the client's head was with respect to the position of each of the signal loudspeakers. Two exposures were presented from each loudspeaker in random order, for a total of 16 exposures; and a record was kept of the number of correct responses. Routine tests of localization ability were performed at an SPL of 48 dB. If this low level resulted in slow or absent responses by the client, the test level was raised. When the test was repeated with hearing aids, the test level was 48 dB SPL.

Fusion. This test, developed by the coordinator of the Project, became part of the routine test battery employed in the evaluation of stereophonia in each client. A signal was presented identically through two loudspeakers, one at 45° to the left of the point 5 feet in front of the subject, the other at 45° to the right of the same point. At a low test level, the stimulating sound is perceived as emanating from the point directly in front of the listener if his hearing is "balanced," although equal sensitivity is apparently not required. If "balance" is absent, the stimulating signal is perceived as coming from one or the other loudspeaker. This test is particularly helpful when binaural hearing aids are employed, as it indicates whether the relative gain-control positions of the two instruments are, in fact, providing "balanced" hearing. Fusion tests were routinely performed at a level of 45 dB re audiometric zero. A simple test without equipment involved talking to a client from a point either directly in front of or directly behind him, making certain that he could not see the talker. If the client reported that the sound appeared to come from either the right or left side, the gain controls of the hearing aids were adjusted until a central localization was reported.

THE OTOLOGIC EXAMINATION

Following the audiologic evaluation, the clients were examined by one of several otologists in their private offices. One otologist, who maintained separate records on these referrals, saw 110 Project patients, 58 males and 52 females, distributed by age as follows:

Age	*Number*
7	1
20-29	2
30-39	9
40-49	17
50-59	25
60-69	27
70-79	23
80 and over	6

Of the foregoing, 6 had essentially conductive impairment, 23 had a mixed loss, and 81 had a sensory-neural loss.

Among the causes of hearing loss were diseases of childhood followed by middle ear infections with occasional mastoiditis, congenital malformations, congenital lues, diabetes, arteriosclerosis, and diseases involving the central nervous system such as meningitis. Colds and upper respiratory infections were common. There were not enough cases in any category to relate the hearing defect to visual pathology.

In practically all cases, the hearing loss was progressive and of long duration, extending in many cases into decades. Tinnitus, constant or intermittent, unilateral or bilateral, was a frequent complaint.

Cleansing of the external canals to permit taking an impression for an ear mold was a routine procedure for the otologist. Very often, the external canals contained hard and impacted cerumen, which necessitated either washing or instrumentation. There were occasional discharging ears, which were treated with suction and local as well as general therapy. Granulations were cauterized. Eustachitis was a frequent finding; inflations and catheterizations of the Eustachian tube were done. Occasionally, further treatments were recommended, including complete physical and dental work-ups whenever indicated.

The greatest number of clients were in the middle and old age group, suffering from progressively impaired hearing of long duration and involving mainly the cochlea or auditory nervous pathways. The causes, some of which were enumerated above, were varied.

THE SPEECH EVALUATION

No mass screening of speech was performed in the population studied in this Project. In the early period of the Project, however, all clients referred for audiologic services at the Speech and Hearing Center were routinely evaluated for speech deviations during the audiologic work-up. After many months of this service, it was found that the population seen at the Center showed an almost total lack of speech or voice problems other than mild to moderate foreign accents. It was decided, therefore, that formal speech evaluations would be suspended; only those persons who demonstrated, or complained of, or were reported to have speech or voice deviations other than foreign accents were scheduled for a formal speech analysis.

A study of the speech deviations discovered in this population seemed to indicate that there are no special speech problems associated with blindness in adults compared with other populations of the same age groups. It must be emphasized that blind populations are mainly older-age populations. Consequently, there is a high prevalence of hearing impairment with associated speech and voice change in such groups. In the Project, 21 clients had speech problems as follows: 5 showed severe bilateral hearing loss and markedly distorted speech; 2 were deaf-blind with primitive speech and language patterns; 1 had a severe lisp associated with a prognathic jaw; 3 were judged to be in need of speech and voice conservation because of the type of hearing loss; 1 had cleft-palate speech; 1 was treated for excessive voice volume, which was apparently associated with both the hearing loss and a personality factor; 1 manifested a severe accent problem and vocabulary deficiency, but was of advanced age, and showed insufficient intelligence for therapy; and 7 had mild speech and voice changes associated with hearing loss, but were not accepted for therapy since the need for such service was not clear.

Chapter 3

THE HEARING-AID EVALUATION AND FOLLOW-UP

The rehabilitation phase of the Project included 84 clients. Of this group, 39 had not previously used a hearing aid while 28 others came to the Project using monaural, on-the-chest aids. These aids were replaced at the Center by binaural ear-level instruments. The remaining 17 clients had new monaural aids substituted for their older, less adequate instruments.

RELATIVE ADVANTAGES OF BINAURAL AIDS TO BLIND PERSONS

Localization of Sound Sources. An important aspect of hearing for a blind person is the ability to localize sound sources. It was demonstrated repeatedly during the Project that this ability is seriously impaired when the listener has unilateral hearing. This was true whether the client had not previously used a hearing aid, or had had previous hearing-aid experience with monaural aids mounted on the chest. Apparently some skill can be developed in localizing a continuous sound if the listener has sufficient time to move his better ear across the field of the sound source, thus locating it by relative intensities. For sounds of short duration, however, unilateral hearing apparently has no compensatory mechanism for localization. The substitution of binaural for monaural hearing results in immediate demonstrable improvement in localization ability for short-period sounds. Experimental investigations of localization ability, methods for testing it, and methods for improving it are included in the section of this report devoted to research.

Selective Listening. Another important advantage of binaural hearing over monaural hearing is that of selective listening. Selectivity is apparently related to the ability to localize sounds in space. The ability to listen selectively to the desired conversation of one person while rejecting competing, undesired sounds is an aspect of audition with which all persons, sighted and blind alike, are concerned. For the blind person, however, there are *additional* desired auditory skills, to wit, the capacity to listen not only to the desired signal, such as a person's conversation while ignoring undesired noises, but the reverse as well. It is often important to a blind person to keep informed about changes in the immediate environment even while he is talking with another person. In brief, the sighted person has the single task of listening to conversation while ignoring environmental noises, but the blind person must listen to each selectively while paying attention to each sufficiently to follow its meaning. Apparently, the listener alternately samples the desired speech of his conversant and the surrounding environmental noises. Such sampling

appears to be more difficult in unilateral hearing, with the accompanying inability to separate two signals in space.

The need for selective hearing is demonstrated dramatically for older clients in the situation at church or synagogue, often an important activity for them. The acoustics of such surroundings usually favor considerable reverberation of sound. Because of the precedence effect, two-eared hearing permits discrimination of the voice coming directly from the minister, while suppressing the delayed reverberated sounds coming from the surfaces of the chapel. In one-eared hearing these functions cannot be accomplished effectively. Hence, the clinicians heard the recurring complaint by older clients that even this desirable activity is frustratingly complicated for them.

The advantages of selective listening for *mobility* are quite apparent, since it is often necessary for a blind traveler to sift and sort auditory clues out of a chaos of environmental noises.

Sound Identification. A major benefit provided by binaural hearing is the identification of common sounds. Audio engineers have long known the difficulty of reproducing accurately various sound effects through a monaural amplifying or recording system. It has been their happy experience that many of these previously uncooperative common sounds can now be effectively recorded and reproduced through the medium of stereophonic recordings. Similarly, tests of the ability to recognize everyday sounds through the use of a single hearing aid compared with the use of a binaural hearing aid quickly revealed the superiority of the latter. The development of stereophonic recordings as part of this Project was an attempt to enhance the ability of hearing-aid users to recognize common sounds through binaural hearing aids.

Ease of Listening. Binaural hearing provides easier listening, partly because of increased ability to listen selectively. That is, less effort is required to listen through a binaural hearing-aid system than through a monaural system, which becomes more trying as the distance between the talker and the listener is increased. A noticeable saving in energy through a working day was reported by many of the binaural hearing-aid users in this Project.

Sound Quality. From an esthetic standpoint, the quality of sound received binaurally is markedly superior to that heard through one ear alone. The superior quality is readily demonstrated even by listening to a mono recording or radio program first through one earphone, then with two. This latter example, while not truly stereophonic, demonstrates the quality improvement of hearing with two ears, an improvement which is even greater when substituting a truly binaural system, such as the use of two hearing aids, for a monaural system.

Limitations. While binaural hearing is generally a desirable goal in the hearing-aid guidance program for the blind, it is not always possible to achieve. It requires hearing of at least moderate sensitivity in both ears, so that on-the-head hearing-aid models can be employed. Where there is profound hearing loss bilaterally, the binaural hearing may have to be provided by high-gain on-the-chest double instru-

ments, with a separate hearing aid for each ear, as in the on-the-head models. While certain benefits, such as localization, are notably reduced, some of the aspects of stereophonia do occur even in this arrangement.

Binaural hearing may also be prescribed for a blind person who has normal or near-normal hearing in one ear and a moderate loss in the other. Through the use of the test of fusion, described in the section devoted to the audiologic examination, it can be determined whether the use of a hearing aid in the poor ear provides the benefits of stereophonia for such persons.

There are some cases in which the client's physical condition, advanced age, social isolation, or other factors make the use of binaural hearing aids infeasible.

TESTS FOR EVALUATING THE ADVANTAGES OF BINAURAL HEARING

Testing for Fusion. A simple test, employing a signal presented simultaneously by two loudspeakers, one on each side of the subject, has been described in Chapter 2. This test may be employed to evaluate benefits of stereophonia from the use of binaural hearing aids, or from a single hearing aid mounted near the poor ear in cases of unilateral deafness. When this test is presented to persons with bilaterally normal hearing, they have the experience of a single sound occurring directly in front of them not referrable to either ear. It is assumed that this is the normal perceptive mechanism for coordinated hearing by the two ears. Success in reproducing the stereophonic abilities of normal hearing through the use of hearing aids, therefore, was evaluated through the use of the fusion test at various levels of intensity, particularly at an average conversational speech level (approximately 65 dB SPL).

Testing for Localization. These tests were carried out through the assembly of eight loudspeakers and the selsyn motor indicator described in Chapter 2. White noise was employed as the test signal.

Very shortly after the Project was begun, it was noticed that the localization scores obtained on clients who had unilateral hearing depended upon the time pattern of the noise used in the test. For continuous noise, for example, even subjects with unilateral hearing showed little error if they were given the time to move about to find the point at which the sound appeared loudest. If pulsed sound was used, however, with three pulses presented in rapid succession, following which the client was asked to turn to where he had just heard the sound, there were very significant differences between persons who had bilateral hearing and those who were hearing unilaterally. These tests were conducted first before a hearing aid was tried, then with a single hearing aid, and finally with binaural hearing aids. The performance score was the number of correct localizations in the 16 exposures (two for each loudspeaker). In the experience gained so far, it was noted that with the microphones of on-the-head models placed above, in front of, or to the rear of the auricles, there is often front-back reversal; that is, sources coming from in front of the subject are localized to the rear and vice versa. Some preliminary experimental work was begun in this Project to determine whether this error disappears if the microphones are placed within the hollow of the external canal of

the ear with the auricle forming a sound shadow as it does for the normal ear. Results are not sufficient to be reported, as yet.

Speech Discrimination in a Noise Background. In an extension of a procedure often included in hearing-aid fittings, the conventional test of speech discrimination, employing 50 phonetically-balanced words, was presented through the main test loudspeaker while the subject was surrounded by white noise coming from four other loudspeakers, two to each side of him. The noise and the PB test words were presented at the same sound intensity. After the test was conducted with a monaural hearing aid and with binaural instruments, the test scores were compared to determine whether the binaural arrangement provided significant improvement as indicated by the per cent of test words repeated correctly.

Optimum Speech-to-Noise Ratio. A new test developed by the coordinator of the Project was concerned with the client's subjective optimum ratio of signal (continuous speech) and noise in the monaural and binaural conditions. Briefly, the subject listened to continuous speech coming through a loudspeaker directly in front of him in the presence of competing noise presented through four loudspeakers surrounding him. The subject was encouraged to instruct the audiologist to either raise or lower the intensity of the speech so that he could hear it and understand it comfortably through the competing noise. The results were evaluated on the premise that the superior listening condition would permit the subject to hear the speech comfortably when the level of the speech was lower than, that is, less above the intensity of the competing noise, thus indicating an ability to hear more selectively in a noisy environment. Experimental results with this test are given in Chapter 4, The Audiologic Research.

Identification of Common Sounds. The stereo recordings developed through the Project and described elsewhere in this report were employed as a test of the ability of the subject to identify common sounds that occur within the home. The recorded sounds were presented in random order in one presentation and in logical sequence in another presentation. The test score consisted of the number of items identified correctly. Identifications were made without pretest training. Test scores obtained monaurally and binaurally were compared.

Localization and Selectivity Combined. A more difficult test of localization combined this perceptual activity with that of selectivity. The localization test, described earlier, was repeated, this time using recorded voice as the signal, while white noise was presented simultaneously to the right and left of the subject. Sixteen randomized exposures to the localization signal were presented in each sequence as before, but this time the ratio of intensities of the signal and of the competing noise was varied as follows: (a) in one sequence, the signal (recorded speech) was presented 10 dB below the competing noise (S/N = −10 dB); (b) in the next sequence, the intensities were equal (S/N = 0 dB); and (c) in the third sequence, the signal was presented 10 dB above the noise (S/N = +10 dB). Each sequence was separated by a rest period. The entire sequence was presented while the client was using a monaural hearing aid and again, in a binaural hearing-aid condition.

The results were then compared to determine whether any advantages were gained with the binaural versus the monaural hearing-aid condition.

HEARING AID FOLLOW-UP WITH CASE EXAMPLES

The most important aspect of the hearing-aid service began after the comparative tests were carried out. In this Project, each client was loaned the selected hearing aid for an extended period. Usually he returned to the Center once a week to relate his experiences with the aid and to receive further guidance. During this time, problems concerning the hearing aid and its use were explored and dealt with, and auditory training was conducted. The client returned to the Center as long as there were unresolved problems.

When the problems had been met, a contact was made by a caseworker for a final interview and observation of the client; and reports were prepared on the impact of the hearing aid on the client's functioning.

Six months later, the client returned to the Center for a re-evaluation. If no new problems had developed, the case was closed; otherwise, the client was given additional guidance or training as necessary.

Example 1. An example of the guidance and training offered in the follow-up period is the case of a blind client who had been provided with a low-gain binaural hearing aid to meet his complaint that he had difficulty in hearing when he was involved in meetings, while interviewing clients in his organization, and when attending the theatre. Fusion tests indicated that when listening unaided, he enjoyed stereophonia for signals of average conversational intensity but not for soft sounds. The binaural instrument provided the stereophonia at the desired lower intensities at the time of the hearing-aid tests. His wife later reported that he failed to turn appropriately to persons talking to him, even while using the binaural aids. It was determined by the audiologist that the client was not balancing the gain controls of the aids properly. After a period of training at the Center involving both the client and his wife, the problem appeared much reduced. Several months after cessation of auditory training, a follow-up visit to the client revealed that he was able to balance the gain controls without help and was deriving considerable benefit from the use of the aids in the situations which were previously troublesome to him.

Example 2. Another example is the case of a blind client who had a long-standing history of impaired hearing apparently associated with middle ear abscesses. He had used a monaural, on-the-chest type hearing aid for approximately 13 years. He reported that he heard satisfactorily with this instrument but suffered a distressing inability to localize sounds and frequent disorientation in foot travel. In preparation for the hearing-aid testing sessions, the audiologist observed this client's behavior at an IHB day center. The client appeared to be very tense and dependent. Although he had attended the day center for quite some time, he was still unable to locate the lavatory, the front desk, and the staircase unless guided. When he was addressed by others, it was evident that he was unable to locate the direction of the voice and that he was having marked difficulty in understanding speech in a room that was noisy and reverberant.

Substitution of a binaural instrument for his monaural aid resulted in modest improvement in localization of static sources and questionable ability to locate moving sources. A twice-a-week auditory training program was planned.

At the first training session, the client suddenly demanded that the binaural instrument be removed from him and showed obvious relief when it was replaced by his monaural aid. He was instructed to wear the monaural aid in his usually-unaided ear for short periods at home, in support of new attempts to use a binaural instrument. After the fourth training session, the client reported that he was able to hear "clearer" with the binaural aids and was given the opportunity to try them at the day center. After ten minutes use in the day center, he abruptly asked to have the instrument removed. He complained that he was "hearing too much" and that this made him "very nervous."

The next few auditory training sessions were held in the sound-treated room where the acoustic environment could be better controlled. Localization practice was given to the client by switching live voice into various loudspeakers which surrounded him. He soon learned to be quite accurate in pinpointing the sound source. After this success, he was exposed to stereophonic tape recordings of plays where the players gave the listener the illusion that they were moving from one side of the room to the other. His success in following the position of the recorded voices was dramatic.

Since one of the major problems in this case was speech discrimination in competitive noise backgrounds, an artificial situation was set up to approximate the day center's acoustic environment on a noisy day. Recorded "cocktail party" conversation was played through four surrounding loudspeakers while microphone voice was fed to a loudspeaker facing the client. Although greatly annoyed at first, he was able to handle a conversation under this same condition satisfactorily several auditory training sessions later.

Following this success, he was instructed to sit in the outer office of the day center where the ambient noise level was moderately high. With the binaural instruments in place, he was able to function well. By this time, he looked forward to coming for his biweekly auditory training sessions. When it appeared that he could function quite well in a moderately noisy environment, he was taken into the street where the background noise was more complex. At first, the exposures were short. Later, he was taken for a long walk along one of the busiest streets. He was able to hold a conversation with ease even though the competitive noise was intense. He was amazed. He claimed that he had never experienced such ease of listening with his own hearing aid under such an adverse hearing situation. On this walk, he would stop to listen to a bus passing on the right side or a horn of an automobile blowing at his left. As he walked up the block, he could hear and identify the sound of a shoemaker's hammer on his right side. These experiences seemed new to the client, and he showed great excitement and joy.

Next, the binaural instrument was loaned to the client one day while he attended the day center. By this time, he was a sophisticated binaural user. At the end of the day, the day center supervisor reported that the client was able to find

the lavatory by himself, and that it was now easier to hold a conversation with him, for he seemed to "hear more." When asked about his experience during the next auditory-training session, he confirmed the supervisor's report. He was puzzled, however, about one thing. He asked if someone had sound-treated the day center, for he could not remember experiencing such a quiet and relaxing day there. This observation was apparently related to the binaural effect of squelching reverberations.

After these positive experiences, arrangements were made to procure these binaural hearing-aid glasses for the client. Although there were some negative pressures exerted by his family toward the wearing of two hearing aids, this problem was resolved with the help of the caseworker.

In retrospect, one can recall the first meeting with the client. Today, he is quite changed. He gives the appearance of being calmer and more self-assured. He now has the benefits of binaural hearing and stereophonia. His family and other observers feel that his foot traveling has improved quite markedly.

It is interesting to note from this case that the benefits from binaural hearing may not be easily demonstrated immediately on a new binaural wearer. It took time and training before this client was able to localize well and to develop the ability to understand conversation in a competitive noise background.

SUMMARY OF THE AUDITORY REHABILITATION PROGRAM

1. A pilot speech and hearing project for hearing-impaired blind persons was developed by The Industrial Home for the Blind, Brooklyn, New York, and sponsored in part by the U. S. Office of Vocational Rehabilitation. In order to coordinate the new services with the agency's ongoing blind rehabilitation program, a Speech and Hearing Center was established at the IHB's Long Island Rehabilitation Center for Blind Persons in Queens, New York City.

2. The Project was activated with a survey of approximately 11% of the adult blind population of the area who were on the register of the New York State Commission for the Blind.

3. The study reports the results of the hearing tests of the first 1 000 clients screened. Approximately 39% showed significant hearing impairment in at least one ear while 17.5% had significant loss bilaterally. Impairment-by-age analysis showed a rise of prevalence in males from 4% of the 20-29 group to 62% of those over 80, and from 12.5% to 58% in females.

4. Detailed auditory evaluation at the Speech and Hearing Center on those who failed the screening test included various tests of stereophonia in addition to standard pure-tone and speech audiometry.

5. Otologic examinations revealed predominantly sensory-neural impairments with fewer cases of mixed impairment and relatively little incidence of conductive loss.

6. Hearing-aid evaluations included routine tests of such aspects of stereophonia as localization, lateralization, fusion, sound identification, and selective listening.

7. Follow-up included auditory training particularly directed at achieving the benefits of aided binaural hearing, and close supervision in the field by the Project caseworker. Illustrative case histories are included.

Chapter 4

THE AUDIOLOGIC RESEARCH

The major emphasis of the Project was on the development of a pilot program for hearing rehabilitation services for hearing-impaired blind persons. The auditory research program was carried on as part of the service program by the service personnel and by the coordinator of the Project.

The findings of the investigation are somewhat limited since the population was drawn mainly from older groups. In addition to the limitation placed upon interpretation of findings, the procedures were all painstaking and unusually drawn-out, because of the slow reactions of the population. The problem of transporting older blind persons to and from the Center to participate in the research was another obstacle in the development of that aspect of the program. Absences because of many illnesses, cancellations due to unfavorable weather, and so forth constituted additional obstacles. Because of the foregoing problems, the population samples in each of the experiments is relatively small.

LOCALIZATION

The desirability of a blind person being able to locate a sound source is discussed elsewhere in this report and is well known to all persons engaged in the rehabilitation of blind clients. There are many problems related to evaluating this ability both in persons with normal hearing and in those with impaired hearing. The superiority of binaural over monaural hearing for localization has been reported by many investigators such as Bergman (1957), Di Carlo and Brown (1960), and others. Bergman demonstrated that this superiority manifested itself as long as the intensity of the stimulating signal was above the threshold of the poorer ear.

In the current Project, localization studies were performed routinely on all clients being considered for the use of a hearing aid. The apparatus utilized for these tests has been described in the section about equipment in Chapter 2. In brief, it consisted of loudspeakers surrounding the client in the test room, activated in random order by the tester in the adjoining control room. The routine localization test employed white noise presented continuously while the patient was permitted to turn in his swivel chair until he indicated the position of the stimulating loudspeaker. The signal was presented at two different intensitics, 45 dB and 65 dB SPL. In addition to the following experimental results, the superiority of binaural over monaural hearing through the use of binaural hearing aids was demonstrated daily in the routine localization tests in the clinical program.

Localization with Pulsed versus Continuous Test Signals

Subjects with Unilateral Hearing Loss. In the construction of the test for locali-

TABLE 4.1. Localization performance for pulsed and continuous signals for subjects with unilateral hearing loss.

		Per Cent Correct Localization Responses	
Subject	*Good Ear*	*Pulsed Signal*	*Continuous Signal*
1	Right	62.5	100.0
2	Left	25.0	81.0
3	Left	31.0	87.5
4	Left	25.0	100.0
5	Left	12.5	56.0
6	Right	50.0	81.0

zation, a decision had to be made about the temporal pattern of the test signal. It was readily apparent that a continuous signal, which permits the subject to move through the angle of the source to the position of greatest intensity, is easier to locate than pulsed signals. This difference was made clear in a study of six clients who had unilateral hearing impairment. These subjects were tested for localization with both a continuous noise source, which permitted them to search for the sound by a loudness judgment, and with a pulsed tone, which was presented three times in rapid succession before the subject was permitted move. In all but one case, the signal was presented at an intensity level of 45 dB re 0.0002 microbar. In the sixth case, this level was insufficient to be heard even by the better ear, so the signal was raised 10 dB. The relative performances of these subjects with the pulsed versus the continuous signal are shown in the Table 4.1.

It is apparent from Table 4.1 that, given the time to move the head about while listening to a continuous noise source, localization performance will be clearly better than for a short signal not permitting a searching movement of the head.

Sighted Subjects with Monaural and Binaural Aids. In a similar study in which two sophisticated sighted subjects were tested intensively, the effects of pulsed versus continuous source material were observed as the subjects listened with a monaural hearing aid in one series and with binaural hearing aids in another. Both subjects were long-time users of hearing aids. One had had no previous experience with binaural instruments, while the other had used a binaural eyeglass-type hearing aid for approximately three years. Their monaural and binaural scores on the tests are shown in Table 4.2.

Once again, as in the cases of the unaided unilateral hearing condition, the con-

TABLE 4.2. Localization performance for pulsed and continuous signals for two sophisticated hearing-impaired subjects listening with monaural vs. binaural hearing aids.

	Per Cent Correct Localization Responses			
	Inexperienced Binaural User		*Experienced Binaural User*	
Condition	*Pulsed Signal*	*Continuous Signal*	*Pulsed Signal*	*Continuous Signal*
Monaural aid	33	67	57	93
Binaural aids	50	99*	76	100

*There were many (81%) front-back reversals in this series. They have not been classified as errors in accordance with precedent (Stevens and Davis, 1938).

TABLE 4.3. Comparison of localization performance for pulsed and continuous signals for 20 subjects tested while using binaural on-the-head hearing aids balanced in gain settings.

	Per Cent Correct Localization Responses		
Subject	*Pulsed Signal*	*Continuous Signal*	*Note*
1	19	0	Reversed
2	56	100	
3	50	100	
4	100	100	Both 100
5	69	100	
6	44	100	
7	44	63	
8	0	19	
9	100	100	Both 100
10	69	100	
11	100	100	Both 100
12	100	100	Both 100
13	0	19	
14	100	100	Both 100
15	56	69	
16	63	75	
17	75	63	Reversed
18	25	44	
19	94	100	
20	50	100	

tinuous sound sources permitted a significantly higher accuracy of localization than did the pulsed sources in both the monaural and binaural hearing-aid conditions. It is interesting to note that the binaural hearing aids gave superior scores over the monaural condition in both the experienced and nonexperienced binaural hearing-aid users, although the former's scores are consistently superior. The experienced binaural user did not confuse front and back sources as did the nonexperienced user when listening with binaural instruments.

Binaural Aids, Balanced Gain. Since the preceding study included only two sighted subjects, the tests were repeated on 20 blind clients who had been newly fitted with binaural hearing aids. As in the preceding studies, white noise, pulsed and continuous, was presented through each of the loudspeakers surrounding the subjects in randomized sequence. Sixteen exposures were given for each condition. The signal in all cases was presented at 65 dB re 0.0002 microbar. The results shown in Table 4.3 were obtained with the hearing-aid gain settings balanced by the fusion technique previously described. Note that subjects 4, 9, 11, 12, and 14 attained perfect scores with both pulsed and continuous signals. In all other cases, except for subjects 1 and 17 where there was a reversal of the trend, the performance with the continuous signal as a source was superior to that attained with the pulsed signal.

Binaural Aids, Unbalanced Gain. The 20 subjects included in this study were tested once again, this time with the gain settings of the hearing aids deliberately unbalanced. Table 4.4 presents the scores obtained under these conditions. The subject numbers are identical with those in Table 4.3.

TABLE 4.4. Comparison of localization performance for pulsed and continuous signals for 20 subjects tested while using binaural on-the-head hearing aids unbalanced in gain settings.

	Per Cent Correct Localization Responses	
Subject	*Pulsed Signal*	*Continuous Signal*
1	0	0
2	63	100
3	88	100
4	81	94
5	38	63
6	0	13
7	13	38
8	0	0
9	75	88
10	25	44
11	100	100
12	0	31
13	No test	No test
14	44	63
15	25	31
16	44	63
17	63	63
18	100	100
19	94	100
20	0	31

In no case under this condition was the pulsed signal performance better than the continuous signal performance, although five subjects showed the same performance under the two conditions. In general, the performance with the unbalanced hearing aids was inferior to that with the balanced instruments.

Summary

It is clear from the studies described here that the localization of a continuous sound source is superior to the localization of a fleeting signal. This superiority is apparently true whether the listener hears the signal monaurally or binaurally, aided or unaided. It is apparently true also for hearing-aid users employing binaural hearing aids which are not properly balanced.

It is evident that localization tests utilizing pulsed signals and those using continuous signals will produce different results. If the intent of a localization test is to determine how well an individual functions in a continuous noise source, then the continuous signal would be appropriate for test purposes. If, however, it is desired to evaluate the subject's ability to localize transient sounds, the pulsed-signal test would be more appropriate. A word of caution is in order here. If the continuous-source approach is employed, it is essential that the subject be permitted and encouraged to turn his head freely in the sound field before making his judgment of the location of the source. This statement is based upon the results of a brief but intensive study of the localization performances of the two sighted, hearing-impaired subjects reported earlier. For both subjects, the localization scores obtained for the pulsed and continuous material were identical when the subjects were not permitted to move about in the sound field, but were required to make a judgment

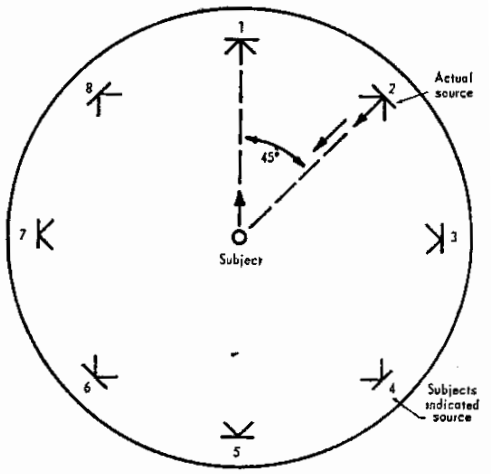


FIGURE 4.1. Calculation of the *extent* of error in localization. (After S. Gordon Taylor.) The actual source is 'speaker #2. S indicated #4, an error of 2 positions. The maximum possible error is 4 (to 'speaker #6) since erroneous indication of 'speaker #7 would be an error of only 3, figured counterclockwise from 'speaker #2, which is the same as for erroneous indication of 'speaker #5 figured clockwise.

from a rigidly-held posture facing the front of the test room. This lack of difference between the performance with pulsed and continuous noise is in sharp contrast to the results given in Tables 4.3 and 4.4, where the subjects were permitted to move about in the sustained sound field.

Scoring Localization Performance

Two methods were used for scoring the localization errors. One was simply to total the number of exposures in which the subject failed to identify the signal source correctly. The other, suggested by S. Gordon Taylor (personal communication), utilized the displacement of loudspeakers to determine the *extent* of each error. That is, since each loudspeaker was displaced from its neighboring loudspeaker by 45°, a correct localization was recorded when the subject indicated the source within 22½° on either side of the proper loudspeaker. If the response indicated the sector next to the correct one, the error was considered equivalent to a displacement of one position. If the response indicated a loudspeaker three positions removed from the correct one, the error was noted as 3 to indicate the displacement of three positions. In a test involving exposures from each of eight loudspeakers, therefore, the maximum error that could occur on one exposure would be four positions. After the fourth position, the error would be on the other side of the axis and would again be 3, 2, or 1. For a total of eight exposures on each of eight different loudspeakers, the maximum possible error score is 4 for each loudspeaker times eight loudspeakers, or a total error score of 32. If the test requires three exposures from each of the loudspeakers, the total possible error score would be 96 positions. See Figure 3.

If it is desired to present the results in terms of the percentage of errors in localization, the subject's total error score in position becomes the numerator, and the maximum possible error score, the denominator. For example, a score of 8 errors of a possible 32 would constitute 25% localization errors.

It was desired to evaluate the usefulness of a test of lateralization or fusion or both in the routine balancing of the gain controls of binaural hearing aids in hearing-aid selections. Fifteen clients who were being fitted with binaural hearing aids were tested as follows: Seated in a chair in the center of the room and surrounded by the eight test loudspeakers described previously in this report, the subject was asked to indicate whether the test sound was to his right, to his left, or somewhere in the center. There followed a series of 12 exposures for each condition (aided, unaided, and so forth), in which the sound was presented either directly to his right or directly to his left.

After the lateralization test, the subject was given a fusion test in which the test sound was presented simultaneously and in phase from loudspeakers at 45° to the left of center in front of him and 45° to the right of center in front of him. If the subject continued to indicate that the sound was either to his right or to his left, he was considered to lack fusion. If, however, he reported that the sound source was somewhere along the midplane either directly in front of him, in his head, or directly behind him, he was considered to have successfully fused the two sounds into one sensation not referrable to either side.

In order to study the effects of different test levels, one approximating the level of soft speech and the other approximating average conversation, each subject was given the lateralization and fusion tests at 40 dB and at 65 dB re 0.0002 microbar while listening with binaural aids.

Results

Referring back to Tables 4.3 and 4.4, it can be seen that in the majority of cases the localization performance for both pulsed and continuous signals was superior when the hearing aids were set to provide fused hearing (balanced in gain).

Results for lateralization and fusion tests at sound pressure levels approximating soft speech and average conversation are shown in Table 4.5.

Certain observations may be made of the tests summarized in Table 4.5:

1. The correct lateralizations in the unaided condition were usually to the side of the better ear.

2. Similarly, after a monaural hearing aid was in place, the correct lateralizations tended to be consistently to the side of the aided ear.

3. In many cases where lateralization was poor at the lower test level (40 dB), the lateralization was clearly better at the higher test level (65 dB). This result agrees substantially with Bergman's (1956) published findings that when the stimulating signal is above the threshold of sensitivity in the poorer ear, localization becomes as accurate as though the ears were equal in sensitivity.

4. In no case was the lateralization score with a monaural hearing aid better than 50%, since with few exceptions, the subject lateralized both right and left sound sources consistently to the side of the aided ear.

5. In 9 of the 15 subjects, lateralization was superior at the average conver-

TABLE 4.5. Lateralization and fusion performance at two test levels under three listening conditions. Each lateralization score is based upon 24 exposures. NT means not tested.

Subject	Test Level	Per Cent Correct Lateralizations			Achieved Fusion		
		Unaided	Monaural Aid	Binaural Aids	Unaided	Monaural Aid	Binaural Aids
1	40 dB	0	42	100	No	NT	Yes
	65	100	42	100	Yes	NT	Yes
2	40	0	50	100	No	No	Yes
	65	67	50	100	No	No	Yes
3	40	0	25	100	No	No	Yes
	65	50	33	100	Yes	No	Yes
4	40	0	42	100	No	No	Yes
	65	100	33	100	Yes	No	Yes
5	40	0	42	100	No	No	Yes
	65	100	50	100	Yes	No	Yes
6	40	100	50	100	Yes	NT	Yes
	65	100	50	100	Yes	NT	Yes
7	40	0	42	100	No	No	Yes
	65	100	42	100	No	No	Yes
8	40	50	50	100	No	No	Yes
	65	100	50	100	Yes	No	Yes
9	40	0	50	100	No	No	Yes
	65	0	50	100	No	No	Yes
10	40	0	25	100	No	No	No
	65	100	33	100	No	No	No
11	40	0	42	50	No	No	No
	65	0	50	100	No	No	Yes
12	40	0	0	83	No	No	No
	65	0	25	100	No	No	Yes
13	40	0	50	92	No	No	Yes
	65	50	50	100	No	No	Yes
14	40	50	50	100	No	No	Yes
	65	50	50	100	No	No	Yes
15	40	0	50	100	No	No	Yes
	65	0	42	100	No	No	Yes

sational intensity for the unaided condition when compared with the monaural hearing-aid condition. Such a finding may contraindicate the use of a monaural hearing aid by a blind client.

6. Except for three subjects, all achieved 100% lateralization with the binaural hearing aids when tested at the lower intensity.

7. As in lateralization, a number of subjects achieved fusion at the higher test level, although they failed at the lower level. The success or failure to achieve fusion in the unaided state was closely related to the extent of hearing impairment in the poorer ear, in accordance with the principle stated in 3 above.

8. In no case was fusion achieved at either test level with a monaural hearing aid.

9. In all but one case, fusion was achieved at the higher test level when binaural

hearing aids were used. Similarly, in all but three cases, fusion was achieved at the lower test level with the binaural aids in place.

10. In general, there was close agreement between the lateralization scores and the achievement of fusion at the two test levels. There were cases, however, in which 100% lateralization was achieved at the higher level without similar success in fusion, and vice versa.

Clinical Usefulness of the Fusion Test — Case Examples

The fusion test proved to be particularly useful in clinical applications as demonstrated by the following case examples.

Example 1. Mr. T. A., a blind person with a monaural hearing loss, complained of difficulty in operating his street newsstand especially when it was necessary to turn toward the customer who was requesting a newspaper. This client scored well in the lateralization test at both test levels, unaided. In the fusion test, however, he did not fuse unaided at either level. With a monaural hearing aid on the poor ear, he did not achieve fusion at the low level but did fuse at the average conversational level. A hearing aids was prescribed on the basis of this test. He reported that he was now able to both localize and discriminate speech more effectively in the background of street noises. The fusion test results apparently were more predictive in this case than the lateralization results.

Example 2. The usefulness of the fusion test, even when applied in crude form, is demonstrated by the case of Mr. P. who, when fitted with binaural hearing aids at the Speech and Hearing Center, achieved fusion on the loudspeaker test as previously described. One week later, the client's wife complained that he no longer turned appropriately toward a speaker as he had when first fitted with the instrument. A return visit to the Center revealed that he was setting the gain controls of his hearing aids in an unbalanced relationship, and that he no longer demonstrated fusion when tested at the low conversational level (45 dB). When his aids were properly "balanced" in gain to achieve fusion in the loudspeaker test, he demonstrated again his ability to turn appropriately to the source of a sound. His wife was instructed to talk to him from a point directly in front of him to determine whether he could localize that position as a reference for balancing the instruments. Follow-up studies conducted after this visit demonstrated that, with this crude test as a guide for balancing the aids, the client no longer had difficulty in localizing a speaker appropriately.

Example 3. In another case, where there was a moderate loss of hearing in one ear and a profound loss in the other, there was a question about the efficacy of fitting binaural hearing aids. Lateralization tests clearly established the superiority of the client's skill with binaural aids compared with a monaural aid. A happy by-product of the use of binaural instruments in this case was the improvement of the speech-discrimination score from 36% monaurally to 74% binaurally. These results were validated by repeated testing.

Conclusions

In this Project, the fusion test became a routine tool in all attempts to provide

clients with improved localization either through the use of binaural hearing aids or through the use of a hearing aid on the poorer ear in cases of unilateral hearing impairment. It provided a convenient and apparently accurate method for determining the proper gain control settings of the hearing aids to achieving stereophonia.

THE EFFECT OF MOTIVATION ON PB DISCRIMINATION SCORES

Clinical audiologists have recognized the instability of repeated PB discrimination test scores (Shore, Bilger and Hirsh; 1960). Unhappily, in routine clinical practice there has been a tendency to accept differences in such scores, with little hesitancy, on a single set of comparisons. The patient's motivation and expectation of performance under different conditions have received little attention.

We have been struck by the role of suggestion and expectation of improvement in hearing and in discriminating speech through the use of a hearing aid particularly in patients who have borderline loss of hearing. Specifically, it appeared that the benefits provided by a hearing aid in some of these cases were more the result of the patient's desire to achieve improved hearing with a hearing aid than of the amount of help the instrument could be expected to provide.

It has been both written and stated that auditory training can improve the discrimination of speech, although the literature contains little quantitative information about its effects (Carhart, 1960).

It is well known, also, that the test level and other presentation factors may affect PB scores critically. The present study, however, was restricted to the effect of suggestion on discrimination scores when the test technique, intensity level, acoustic environment, and other factors related to the presentation of the test material are kept constant. For the study, it was important that the patient's condition of hearing be essentially unchanged. That is, he must hear *all* word lists *unaided* whether he *believes* he is hearing through a hearing aid or not.

Subjects and Procedures

Subjects. The study was conducted on a population of blind persons who had a mild loss of hearing with sufficient impairment in the high frequencies to produce a discrimination loss. Their speech reception thresholds were only mildly subnormal.

The following report includes case studies of clients who appeared to be positively affected by the suggestion introduced into the tests. These subjects were clearly disturbed by their hearing impairments and looked to the hearing aid for relief.

Procedure. The test material was recorded PB-50 word lists presented at 75 dB SPL through a loudspeaker 4 feet directly in front of the subject. Simultaneously, white noise was presented, also at 75 dB SPL, through four loudspeakers situated around the subject at clock-face points comparable to 2 o'clock, 4 o'clock, 8 o'clock, and 10 o'clock. The speech-to-noise ratio, therefore, was zero.

Five PB tests were administered to each subject under the following conditions: first, unaided and without the suggestion of a "hearing aid"; second, with a suggested "hearing aid" on the subject; third, unaided as in the first test; fourth, with the suggested "hearing aid" again; and, finally, unaided for a third time.

The pseudo hearing aid was in two forms: one was simply the insertion of the hollowed-out shell of a standard ear insert into the subject's ear with the suggestion that it was a new type of miniature hearing aid, while the other was an eyeglass model introduced with the explanation that it delivers amplified sound through the bones of the head. It was routinely turned on to the point where feedback could be heard, then with an apology for the "excessive gain" level, the gain control was turned down and off.

Results

Fifteen subjects were tested. Positive results, that is, markedly better discrimination scores, were obtained with the pseudoaids in five of these subjects. The details in these cases follow.

Case 1. During the initial contact, this subject complained of a hearing loss which existed for approximately six to seven years. He reported that he would be willing "to do anything" if his hearing difficulty could be alleviated and was positively motivated toward the use of a hearing aid.

After an audiometric evaluation, he was given a hearing aid evaluation. Substantial improvement in the test for speech discrimination was demonstrated when he was tested with a monaural hearing aid selected for its high-frequency emphasis. His unaided discrimination score at a test level of 45 dB above audiometric zero was 76%. With the hearing aid, the discrimination score at the same presentation level was 90%. The validity of this result was questioned at a staff conference. The subject was subsequently tested with pseudoaids in a noise background to explore the role of suggestion in the apparent improvement. Speech and noise were presented at equal levels from separate loudspeakers. The results are shown below.

Test 1	Test 2	Test 3	Test 4	Test 5
Unaided	Pseudoaid (mold)	Unaided	Pseudoaid (eyeglass type)	Unaided
58%	76%	42%	70%	56%

Extended auditory training and a home trial with a hearing aid were initiated for this subject. During a two-month period he was gradually weaned from the hearing aid as follows: He was instructed to use the aid at first only during daytime hours and to remove it in the evening. Later he was to use the aid only until noon each day, then only three hours one day, not at all on the following two days, two hours on each of the next two days, etc. He received auditory training once a week during this period. Finally, he spontaneously reported that he no longer needed the hearing aid. He was "hearing well" without it. During the final auditory training session he reported, "I realize I *do* have trouble, but it is not too bad. I can live with it." A repeat discrimination test, presented as before at a signal-to-noise ratio of zero, showed the following:

Unaided: 54% Pseudoaid (mold): 58%

Apparently, he was demonstrating his last remark by showing no further improvement with an "aid." Two months later on a similar test, the subject again failed to show improvement through the pseudoaided hearing over his unaided hearing. That is, the potential of 70% to 76% discrimination could no longer be demonstrated, although the subject reported having made peace with his hearing problem.

Case 2. On his first visit, this subject produced a high-gain monaural body-type instrument given to him by the welfare department. The subject reported he had used this instrument for only one day, without benefit. Shortly afterward, he had made contact with a hearing-aid dealer who implied that an over-the-ear aid would give him "close to normal" hearing. After our audiometric evaluation was completed, the subject insisted that he wanted only an over-the-ear aid. In a quiet test environment and unaided, his discrimination score at an audiometric level of 45 dB was 64%. With an over-the-ear aid, at the same intensity, the discrimination score was found to be 76%, an apparent improvement. The subject was then tested with pseudoaids in noise (S/N = 0), with the following results:

Test 1	Test 2	Test 3	Test 4	Test 5
Unaided	Pseudoaid (mold)	Unaided	Pseudoaid (eyeglass type)	Unaided
40%	56%	36%	58%	38%

The client reported during this test that he liked the pseudoaid (mold) better than the real aid because the pseudoaid did not "hiss."

Case 3. This subject reported at the first interview that he had difficulty understanding conversation at a distance and in the presence of competing talkers. He appeared highly motivated toward the use of a hearing aid. He was subsequently tested with pseudoaids with the following results:

Test 1	Test 2	Test 3	Test 4	Test 5
Unaided	Pseudoaid (mold)	Unaided	Pseudoaid (eyeglass type)	Unaided
50%	64%	40%	68%	42%

The subject was given auditory training for a two-month period after which he reported increased ability to discriminate without the hearing aid. Since he had some residual sight, auditory training and lipreading seemed to ease his hearing problem.

Case 4. This subject's main complaint was that he could no longer hear his watch tick. He therefore concluded that he was "going deaf" and needed a hearing aid.

After an audiometric evaluation, he was tested with a pseudoaid (mold) and revealed an increase in discrimination, as noted on the following test results:

Test 1	Test 2	Test 3	Test 4	Test 5
Unaided	Pseudoaid (mold)	Unaided	Pseudoaid (eyeglass type)	Unaided
56%	70%	50%	72%	54%

During the same test session, the subject was told that his hearing was "quite good" for his age, although he had a mild loss which accounted for his not hearing his watch tick. Since this report was given by an "authority," the client appeared to be convinced that he no longer had the problem he thought he had.

Case 5. This subject reported that most of her difficulty in discrimination took place in noisy and reverberant surroundings. She had heard that a hearing aid corrected hearing difficulties and was highly receptive toward the use of such an instrument. She was given discrimination tests with a pseudoaid (eyeglass type). Her discrimination score in noise increased substantially, as follows:

Test 1	Test 2	Test 3	Test 4	Test 5
Unaided	Pseudoaid (mold)	Unaided	Pseudoaid (eyeglass type)	Unaided
60%	84%	54%	80%	58%

Implications

1. The instability of PB scores in some cases is apparently related, in part, to motivation and desire.

2. The difference between the routine PB test score and the motivated PB score probably indicates the minimum improvement in discrimination that could be expected from auditory training.

3. The results of the pseudoaid tests are another indication of the role of the central auditory mechanism in the perception of speech, that is, hearing for speech does not depend solely on the state of the peripheral hearing mechanism.

4. In hearing aid counseling, aided gains in discrimination, particularly in noise, in borderline hearing loss should be studied for the effect of suggestion. The technique used in this study is one method of checking the apparent improvement with a hearing aid before final recommendation for the acquisition of such an instrument is given.

OPTIMUM SUBJECTIVE SIGNAL-TO-NOISE RATIO, MONAURAL VS. BINAURAL

It has been claimed that with binaural hearing the ability to listen selectively to a desired signal, such as the conversation of a speaker, while disregarding competing undesired background noises is superior to the monaural listening condition.

One method that has been attempted to determine this advantage has been to test the discrimination score for speech in the presence of competing noises. To date, various researchers have published directly conflicting reports in this matter (Belzile and Markle, 1959; Jerger, Carhart and Dirks, 1961). Another approach to the problem is to permit the subject himself to indicate the separation he desires in the intensity levels of the speech and of the competing noise in order to provide comfortable listening for the speech. Utilizing this approach, we conducted a study on 25 clients.

Procedure

With the subject seated in the middle of the test chamber, white noise was introduced through four loudspeakers at a level of 65 dB SPL. In relation to the subject, the loudspeakers were situated in clock-face positions comparable to 2 o'clock, 4 o'clock, 8 o'clock, and 10 o'clock. Continuous speech was then introduced through the main test loudspeaker directly in front of the subject. The subject was instructed to signal the audiologist to raise or lower the intensity of the continuous speech until the subject felt that he could hear the speech comfortably despite the noise. The speech was presented first below the client's level of awareness; then the intensity was gradually increased until the subject began to signal his desire to have it raised or lowered. When the subject was satisfied with the level of the speech, he so indicated to the tester, who noted the ratio of intensities of the speech and the noise.

Results

The more favorable result was considered to be the ratio in which the separation in levels between the speech and noise was minimal. That is, if in one listening condition, such as the binaural, the subject required less signal intensity in the presence of the 65 dB noise than he did for the other listening situation, the monaural, the result was taken to favor the binaural listening condition. In the 25 subjects studies, the binaural condition proved to be superior 64% of the time. When this condition was superior, the advantage averaged 6.9 dB. That is, on the average, the subjects required approximately 7 dB less intensity of the desired speech in the binaural than in the monaural listening condition in order to hear speech comfortably through the noise. Of the 16 cases, which comprised the 64%, 10 showed a 5 dB superiority for the binaural condition, while 6 showed a 10 dB advantage. In 8 of the remaining cases, the subject indicated the same optimum level for the desired speech when listening in either the binaural or monaural condition. Only 1 subject indicated a superiority, in the amount of 5 dB, for the monaural over the binaural listening condition.

In view of the scatter of scores, it is felt that a larger study must be conducted to establish more firmly the trend shown in this sample. On the basis of this limited study, however, it appears that the binaural condition results in easier (more "comfortable") listening for speech in a noisy environment.

FOCUS OF ATTENTION

It is desirable that a blind person be able to turn appropriately to face other persons talking to him from different positions about him. It is difficult to construct a test of this ability without contaminating the results as soon as the subject is instructed as to the purpose of the test. That is, once he is told that his ability to look at the source of sound is being tested, he will usually make a conscious effort to face the sound if he can localize it. Some blind persons will not do so of their own accord, however, even when binaural hearing has been restored by hearing aids. In order to evaluate the focusing pattern of blind persons fitted with binaural hearing aids, spontaneous turning or the lack of turning toward the source of sound was observed during the test for lateralization, described previously in this report.

Results

A total of 22 clients were included in this study. Only 9 clients demonstrated appropriate focusing by turning their heads to the sound source immediately after the binaural hearing aids were in place. Of these 9 persons, 3 had normal hearing in one ear with a loss in the other ear, on which the hearing aid was placed; 3 had moderate bilateral loss; and the last 3 had severe bilateral loss. The remaining 13 clients failed to turn appropriately to the source of sound. The latter clients were given special instruction in focusing during a minimum of six auditory-training sessions. Follow-up was carried out from three to six months after the training and revealed that only one client failed to show a continued skill in this activity.

QUALITY JUDGMENTS

The following brief report is based upon clinical experiences, not experimentation, since quantative results are not available in the matter of quality preferences of binaural versus monaural hearing aids. A formal study under controlled conditions was not developed, partly because of the contaminating role of suggestion. The experience of the past three years, however, has shown an almost universal preference for binaural hearing aids as being "more natural," particularly by former monaural hearing-aid users. A spontaneous and consistent observation was that the binaural amplification permitted selective listening in situations in which the use of the hearing aid had previously been very frustrating, particularly in noise environments.

The advantage of binaural hearing was not always apparent when the binaural hearing aids were first tried on the clients. An example is that of the client with a severe hearing loss who had used a monaural hearing aid for a considerable period before being seen at the Center and who complained mainly of not being able to hear selectively in a noise environment. At first, when binaural hearing aids were tried on him, he observed that the sound was not "natural." He reported continuing difficulty in group conversations and in selective listening. A concentrated period of auditory training with the binaural instruments resulted in reports by the client of increasing ability to select desired sounds while rejecting undesired competing sounds, to discriminate speech more clearly both in noise and quiet, to focus his attention by apparently looking at the source of sound, to localize sounds

correctly, and to appreciate a "fuller" quality of sound. Three other clients with severe hearing loss, who had also previously used monaural hearing aids, reported immediate improvement in the quality of sound when the binaural hearing aids were tried. A common observation was that it was now "easier" to listen and required less strain of attention. For some cases of clients with severe hearing loss, there was a history of failure to realize benefit from hearing aids. Following the provision of binaural instruments and auditory training, these clients showed acceptance and consistent use of the instrument. No experimental supportive evidence was collected for these cases.

STEREOPHONIC TAPE-RECORDINGS

An important part of the developmental aspects of the Project was the stereophonic recording of common sounds, and the use of the recordings in an auditory training program. The purpose of the recordings was to explore the feasibility of augmenting the sound identification and utilization aspects of the foot-travel training program for blind hearing-impaired clients through structured listening exercises.

At the beginning of the Project, there was considerable discussion among the staff concerning the form the recordings should take. Specifically, the question was raised as to whether earphone or loudspeaker reproduction should be planned. There were, and continue to be, a number of objections to the use of either approach, since neither, in the present state of the recording art, faithfully reproduces a real life situation. The decision to use loudspeaker reproduction was based primarily upon the necessity for clients of this Project to listen with hearing aids. It has been noted by other investigators that "natural" listening for sounds in space about us requires the free movement of the head in the sound field. When training for localization is conducted through the use of earphones, it is observed that the subject often fails at first to move his head freely and naturally in the sound field, even though he is instructed to do so, when carryover is attempted to the open field with the earphones removed (Norton, 1960).

In the case of the binaural hearing aid user, it is particularly important that the training period include balanced adjustment of the instrument's gain-control settings, as well as the guidance for judicious movement of the head in the sound field. For this reason, the recordings in our Project were designed for reproduction through multiple loudspeakers.

Two main sound sequences were recorded. One sequence was made in an apartment and included sounds of the home. The other was an outdoor sequence which included specific situations that are described in one of the following sections.

Equipment

The stereo recordings were made with an Ampex Model 350-2 tape recorder fed by two Sony C-37 microphones with associated preamplifiers. The microphones were placed 6 inches apart on a common floor stand with a microphone diaphragms facing 90° away from each other. The recording engineer was a professional, with much previous experience in stereophonic recording, who was engaged specifically for this aspect of the Project.

The Indoor Sequence

The first sequential recording was made in a typical apartment consisting of a kitchen, a bedroom, a living room, a bathroom, and stairways leading down to a street door. Two versions of this recording were prepared for auditory training sessions, one in logical sequences, the other including the same sounds but in randomized, nonsequential order. The sequential recording includes typical sounds, some of which are intended merely for identification and localization of both stationary sounds, such as a refrigerator motor humming to the right of the recording microphone, and moving sounds, such as the lady of the house walking from the kitchen to the dining area to set the table. The following is a list of specific events highlighted in the recording.

Water glass being filled and emptied
Toilet flushing
Electric shaver being used
Teeth being brushed
Water glass being filled — gargling — airplane passing overhead
Sliding closet doors opening and closing
Venetian blinds moving up and down
Dresser drawers opening and closing
Door opening and closing
Utensil drawer being opened — dishes being removed — table being set with dishes
Butter sizzling in pan
Egg being dropped in pan and frying
Cup and saucer being placed on table — egg being scraped from pan to plate
Footsteps on kitchen floor moving back and forth
Coffee being poured into cup — spoon stirring — coffee being drunk
Dishes being cleared from table and placed in sink
Water pouring from sink — dishes being washed and dried
Water rinsing frying pan — water running down drain
Outside voices (women and children) as utensils being placed in drawer
Dishes being put in cupboard
Knives, forks, spoons being dropped into drawer
Broom closet opening — broom being removed
Sweeping kitchen floor — replacing broom
Vacuum cleaner operating
Carpet sweeper operating
Door buzzer sounding — buzzer being answered — door closing
Footsteps (man) ascending stairs
Footsteps (woman) in kitchen — bottles being removed from refrigerator
Table being set — glasses being placed on kitchen counter
Bottle cap being removed — carbonation escaping — liquid pouring — outside voices
Second bottle being opened — carbonation escaping — liquid pouring into glass
Footsteps (man) descending — door opening — door closing
Phone being dialed — receiver being hung up

As noted previously, the same sounds were randomized on another reel of tape for practice by clients who had developed more sophisticated skills in this task.

The Outdoor Sequences

In our early attempts to record outdoor sounds it was apparent that most of the recording would be too "busy," because of the cacophony of intermingling and confusing noises. Consequently, although some of the sequences were recorded during the active daytime periods, others were made in the evening when the major traffic

and street activities had abated. The recordings were then graded for complexity of identification and localization tasks. The following three examples are illustrative.

Example 1. A recording was made in the relative quiet of evening on a side street near the Speech and Hearing Center. There was a minimum of ongoing traffic and pedestrian sounds at this time. This recording was designed to provide an example of the temporal ordering of events important to a foot traveler. The recording microphones were located at a street corner where a traffic light was operating. The recording included an automobile approaching from the right of the microphones to a position approximately in front of them, then stopping for the red light with the motor idling noticeably for a period of time while the driver waited for the traffic light to turn to green. Finally, the automobile motor was gunned as it started off to the left. The sequence demonstrated the direction of traffic and the time sequence between lights.

Example 2. A recording was made during a period while elevated trains were periodically clattering by, approximately a block away from the recording microphones. At the height of these noises, recordings were made of a single set of footsteps walking toward and past the microphones on the left side then on the right side, then across the microphones from left to right and from right to left, and two sets of footsteps (representing two persons walking by) approaching the microphones from opposite directions and crossing each other. One set of footsteps was that of a man walking rapidly, the other of a man walking slowly. Other similar recordings included female footsteps. Finally, the sound of running footsteps was recorded proceeding from one side of the microphone to the other. The purpose of these recordings was to provide identification and localization in the presence of ongoing and distracting background noises.

Example 3. A more difficult listening task was recorded at a bus stop. The scene opens with the whistling of a boy nearby. While the whistling continues, a bus approaches the stop from the left, comes to a halt in front of the microphones with the doors slightly to the right of the microphones' position. The doors open and we hear some footsteps walking toward the bus from our far right. The footsteps mount the stairs leading into the bus, and we hear the sound of coins being deposited in the coin receptacle. The bus does not leave immediately, however, but the motor continues to be heard idling in front of us while other buses and trucks come to a stop, gun their motors and start off directly in front of us, since there is a traffic light at the corner nearby. As our main bus remains in front of us, we hear the sound of voices talking from inside it. Finally, we hear the airbrakes of this bus suddenly released, followed by a second air release as the bus moves forward a few feet, apparently waiting for the traffic light to change. After a matter of seconds the bus clearly starts off to our right, and the sounds fade away in that direction. The purpose of this recording is to provide practice in listening for a logical sequence of sounds associated with the main bus, on which our attention is focused, in spite of similar misleading sounds, such as that of other buses and trucks moving past the microphone area.

In another recording an attempt was made to provide a combination of indoor and outdoor sounds by taping the noises of the mammoth waiting room of a railroad station. Repeated hearings of this recording revealed a rich collection of common sounds, but identifying and localizing them was clearly an advanced task for the more sophisticated listener.

Comment

The indoor sounds present a much easier learning situation than the more complex, "busy" outdoor recordings. The former, presented in the usual temporal sequence, provides for identification by context and is, therefore, an excellent tool for the first auditory training lessons. The randomized version of this recording has been used as an adjunct to the auditory evaluation given to blind clients at the beginning of their training period. It is our feeling that this application of a "basic sound vocabulary" recording shows promise both as a proficiency and an achievement test for blind persons in a rehabilitation program.

The stereo recordings have been played, through appropriate reproducing equipment, for various groups of blind and sighted persons. It is clear from their reactions that there is a great range of performance in identifying and localizing recorded sounds. The skilled blind listener shows dramatic superiority over the nonskilled blind or sighted listener. For example, the skilled listener is able to identify many of the subtle transitory sounds which are missed by the nonskilled person who is striving to interpret the more obvious noises. Thus, in the indoor sequence, at the opening of a bottle of beer, the skilled listener will note the *whoosh* which occurs just as the seal between the metal cap and the bottle is broken, whereas this detail consistently escapes the nonskilled listener. Similarly, in the recording of a woman sweeping the floor with a corn broom, the skilled listener will detect a change of direction of the sweeper's walk by a subtle variation in the walking rhythm, which is consistently undetected by the nonskilled listener. The skilled listener will note such details as whether a drinking glass is made of glass or is plastic. It is apparent from our brief experience with these recordings, however, that once such subtle sounds are pointed out to the listener, listening habits can be improved rapidly so that similar noises begin to be noted and discriminated more readily.

No quantitative treatment has been made of the performance of our clients on the recordings. It is hoped that a careful validation study can be done by others in the future. At this time we should like to emphasize our impression that the recordings have been highly useful in the auditory-training program, and that they seem to hold promise for training blind hearing-impaired persons as well as blind normal-hearing persons in the future.

This report should not be construed to imply that the recorded training devices described here can replace the real-life training program with an instructor, orientor, or others working with the blind person. Much investigation must yet be undertaken before the carryover benefits of this training approach can be properly evaluated. Nevertheless, these two stereophonic tape-recordings, a sequence of everyday sounds and a sequence of outdoor sounds, are a promising achievement of the research phase of the Project.

SUMMARY OF RESEARCH FINDINGS

The main purpose of the Project was the development of a pilot rehabilitation program for hearing-impaired blind persons. Therefore, the auditory research reported here was concerned primarily with extending the standard battery of hearing tests for use with and without hearing aids in order to provide more specific information about the auditory problems of such subjects, and with the techniques for developing and utilizing a library of stereophonic tape-recordings as a tool in the specialized auditory training required for blind individuals who must use hearing aids.

Localization Studies

In studies of localization ability, subjects were tested at low and average conversational levels in a sound field produced by eight matched loudspeakers. A feature of the study was the design and fabrication of a new control console for localization and other tests of stereophonia and the use of selsyn motors to relay the head movements of the subjects in the test room to a calibrated indicator dial in the tester's control room.

Localization performance is clearly better for continuous noises than for transient signals, such as pulsed white noise. Localization is superior for continuous sounds whether the listener has an unaided unilateral hearing loss, or listens through a monaural hearing aid, binaural hearing aids with the gain-control settings balanced, or binaural hearing aids with gain-control settings deliberately unbalanced.

Since localization tests utilizing continuous and transient test signals produce different results in all conditions studied, it is clear that the purpose of a localization test must determine the type of signal employed. Furthermore, the studies indicated that the superior results obtained with continuous signals were nullified unless the subject moved his head freely in the sound field.

The results obtained in an intensive study of two sophisticated hearing-aid users, along with those collected in the daily hearing-aid selection program, consistently showed the superiority of the binaural condition for localization when compared with the monaural condition. The superiority of the binaural condition was especially marked when transient noise was employed as the test signal.

Lateralization and Fusion

Both lateralization (designation of right- versus left-sided source) and fusion (the blending of a simultaneous right- and left-sided signal into a single sensation experienced along the mid- or front-to-rear plane) tests were used in routine clinical procedures and, in more detailed form, on a study population. In cases of unilateral hearing impairment as well as in those who listened through monaural hearing aids, the lateralization of both left and right sources was consistently to the better of the aided ears at test levels below the threshold of the poorer or unaided ear. Lateralization improved when the signal level was raised above the threshold of the poorer or unaided ear.

In over half of the study population, lateralization was superior in the unaided condition over that in which a monaural hearing aid was employed. When listening

through binaural hearing aids, all but one of the study population achieved 100% lateralization for signals of average conversational intensity (65 dB SPL); and all but three produced similar results at a low signal level (40 dB SPL).

The fusion test results in the study population were similar to those obtained for lateralization. No subject achieved fusion at either of the foregoing test levels with a monaural hearing aid. There were instances, however, when fusion was achieved without lateralization, and vice versa, when all test conditions, unaided, with monaural aids, and with binaural aids, were considered.

The fusion test was found to be particularly useful in clinical applications, as illustrated in several case histories presented in the foregoing text.

The Motivation Effect of PB Discrimination Scores

Test scores are presented for five cases in which the suggestion of hearing through a hearing aid not actually operating repeatedly produced dramatically better PB scores than in the "unaided" condition. The significance of these findings for determining the benefits to be derived from the use of an aid in the types of cases studied is discussed in the foregoing text.

Optimum Speech-to-Noise Ratio

A new test is suggested for studying the benefits of binaural over monaural hearing aids. A preliminary study indicated the test's usefulness, but the scatter of scores obtained on the small study population indicates the need for a larger study.

Suggestions for Further Research

The brief research projects included in the three-year program of this grant were woven into the service program, which was given priority in time and personnel. The results obtained and observations made point to the need for continuing study of similar and related problems, particularly those problems associated with the use of binaural hearing and hearing aids in the rehabilitation of blind persons.

1. One of the more challenging projects undertaken during the period of the grant was the development of stereophonic recordings. It is recommended that the development of recordings designed for loudspeaker presentation be continued on a larger scale. It is suggested that stereo recordings be made on high-quality equipment, and that they include many additional common sounds for recognition and differentiation. For example, recordings should be made of the pouring of a liquid, such as water, into different types of vessels, such as soft polyethylene plastic, metal, glass, and pottery. Another set of recordings might involve activities associated with smoking: opening of a package of cigarettes, removing the cellophane, tearing open of the pack on one end, removing a cigarette, laying the pack down on a hard table top and on other types of surfaces, lighting the cigarette with a safety match from a matchbook, a wooden kitchen match, and a cigarette lighter followed by dropping the matches into an ash tray or placing the lighter down gently on a table. Travel noises should also be recorded for loudspeaker presentation. These noises should be in various environments, such as an enclosed corridor, outdoors, down a stairwell, and so forth.

A method of validating these and similar recordings should be developed. Such validation may take the form of relating the effects of clinical training with the recordings to increased skill in foot travel and in social alertness.

2. The localization investigations begun here need to be validated on large groups. A modest start was made, for example, on determining whether training improves the localization ability of persons with unilateral deafness and those with astereophonia, at low intensity levels, with or without the use of a hearing aid. This type of investigation should be continued. Similarly, the development of techniques for determining localization ability, reported here in connection with the study of two sighted, experienced hearing-aid users, one a binaural user and the other a monaural user, should be continued and expanded, since this holds the key to evaluation and training of this important ability for blind persons.

Selective localization studies should be made to determine the relationship between the ability to localize sounds in quiet and noisy backgrounds. The organization of such a study was worked out during this Project, but time did not permit gathering adequate data to include in this report.

Chapter 5

THE SOCIAL IMPACT OF A SPECIAL SPEECH AND HEARING SERVICE FOR HEARING-HANDICAPPED BLIND PERSONS

Hearing plays a crucial role in the adjustment of blind persons. Deprived of the numerous advantages of sight, the blind individual becomes more dependent upon his hearing for maintaining adequate contact with his environment. Thus, hearing becomes exceptionally important in such areas as interpersonal relationships, mobility, vocational adjustment, family adjustment, and self-concept. Despite the important role of hearing among blind persons, relatively little research effort has been devoted to the problem (Bergman, 1959; Krohn, 1956). In fact, throughout the United States, only a handful of agencies for the blind routinely assess the client's hearing function and apply rehabilitative measures when needed. As a result, the literature on this subject is sparse. The bulk of recent interest has been concentrated on deaf-blind persons, those who are legally blind and lack functional hearing (American Foundation for the Blind, 1955; Broadbent, 1958; Cohn, 1954; DiCarlo, 1960; Dinsmore, 1954; Justina, 1953; National Study Committee on Education of Deaf-Blind Children, 1954; Peageant, 1957; Remy, 1956; Salmon and Rusalem, 1959; Stelle, 1959; Smithdas, 1958).

Since hearing plays a critical role in the adjustment of blind persons, it is evident that a certain degree of hearing loss constitutes a real barrier to the achievement of life goals for a blind person. It seemed reasonable to assume, therefore, that improved hearing function would facilitate personal, family, community, and vocational adjustment.

THE SPEECH AND HEARING SERVICE STUDY PLAN

In order to determine the extent to which special attention to hearing would affect the adjustment of hard-of-hearing blind persons, 54 clients were involved in a study designed to provide amplification, or better use of amplification for clients already wearing hearing aids, and special training in hearing. Social casework and other IHB and agency services were also provided as a part of the program for improving the use of hearing.

The following hypotheses were formulated:

1. In addition to measurable clinical gains in hearing effectiveness, blind clients fitted with hearing aids in a special speech and hearing program will achieve favorable changes in selected areas of social functioning.

2. The most notable social gains will be in activities and attitudes most closely related to hearing effectiveness, such as the following: ease of communication in group and family settings; attitudes toward the hearing loss; use of radio, television,

and talking book; effective use of a hearing aid; and perceptions of the limitations imposed by the second sensory loss.

3. Clients who had not used hearing aids previously and were fitted with such aids during the Project will show more marked gains on selected social variables than those who had had previous experience with a hearing aid.

METHOD

Subjects. All of the clients participating in the study were legally-blind adults. The group included 33 men for whom the mean age was 63.6 years and 21 women for whom the mean age 63.8 years. Seven of the clients were totally blind, 25 had light perception up to and including 5/200 vision; 13 had between 5/200 and 20/200 vision; and 9 had more than 20/200 vision but with sharply limited fields.

Thirty-one clients entered the Project already wearing hearing aids; nevertheless, they seemed capable of deriving improved hearing efficiency through Project services. Twenty-three clients were fitted with hearing aids for the first time. All clients received an audiologic and a hearing-aid evaluation; and all were approved by the Project otologist for hearing aids. Auditory training was provided when arrangements for this service could be made. Clients received casework service either through the Project or through social workers on the staff of the IHB or other community agencies.

Follow-up. The clients were followed-up six or more months after making an initial adjustment to the hearing aid. The follow-up usually included one or more interviews with the Project social worker, an examination of case records, conferences with other workers at the IHB and other agencies, and re-evaluation by the Project audiologists.

Areas of Social Function. Through a study of case records and a series of conferences with professional workers in the field, the Project staff identified areas of living in which a hearing loss tends to impair the functioning of blind persons. These areas were reviewed by the audiologists, social workers, and research personnel assigned to the Project. The preliminary list of 25 areas was narrowed down to 17 as follows:

1. Mobility
2. Ease of Social Conversation in Groups
3. Ease of Communication in the Family Setting
4. Participation in Social and Recreational Activities
5. Use of IHB Professional Services
6. Vocational Status
7. Plans for the Future
8. Family Attitudes toward the Client
9. Client Attitude toward the Hearing Loss
10. Client Attitude toward Blindness
11. Physical Complaints other than Visual and Hearing Loss
12. Independence in Activities of Daily Living
13. Use of Radio, Television and Talking Book

14. Efficiency on the Job (limited to employed clients)
15. Safety on the Job (limited to employed clients)
16. Effective Use of a Hearing Aid
17. Client Perceptions of the Limitations Imposed by the Second Sensory Disability (the more recently acquired one)

The Social Factors Scale. A Social Factors Scale was constructed for each of the 17 areas. (See Appendix G.) These scales provided for estimates of positive and negative movement associated with participation in the Project. For each scale, the steps are based on behaviors that indicate five levels of functioning within a particular area of social competence. A sixth category, *unable to rate or not applicable,* was also included in order to permit the raters to indicate their inability to place a client in any of the five categories. The steps on each scale were developed after a series of conferences in which the judgments of a team of audiologists, social workers, psychologists, and research personnel were pooled. The initial scales were modified by the experience gained in two dry runs in which several clients were evaluated on their social functioning before and after service.

Rating Procedure. Each client was rated by a case conference attended by a minimum of four professional workers including a Project audiologist, the Project social worker, and two research workers. Other personnel attended some of the evaluation conferences, when appropriate. Such personnel included rehabilitation counselors, vocational trainers, recreational workers, optical-aids counselors, social workers, mobility instructors, and residence-home personnel. Workers from other agencies participated in conferences concerning five different clients.

Improvement ratings were assigned to the clients through a process of team interaction. Initially, it was planned to have the individual professional workers rate each client independently; however, it was found that this procedure resulted in low reliability. The process of team interaction seemed preferable since this procedure is used frequently by agencies and permits maximum use of all available data and observations about a client.

A total of 54 clients was rated in an equal number of case conferences. Thirty-one different professional persons, three of them from other agencies, participated in the conferences. Usually, five or more conferees were present at each conference. Although most conferences lasted a little more than a half hour, some required as long as an hour and a half. In a few cases, conferences were adjourned for periods of one or more weeks in order to acquire additional data to facilitate the rating process. The ratings reflected changes in status from the time of entrance into the Speech and Hearing Project to the point of follow-up some six months after the completion of service. Ratings were recorded on a form designed for the purpose, which listed all 17 social factors and the five steps for each as well as the unable-to-rate category.

RESULTS

The number of persons judged as improved, unchanged, declined, or not possible

to rate for each of the 17 areas of social functioning are shown in Table 5.1. Data for the 31 clients who entered the Project already wearing hearing aids (experienced) have been separated from the data for the 23 clients who had no previous experience with amplification (inexperienced), in order to allow comparisons between these subgroups. Table 5.2 contains the number and percentage of clients who improved. In this table the social factors are listed in the order of most to least improvement. Further analysis by subgroups according to experience with hearing aids appears in Table 5.3.

Mobility

Eight (15%) of the clients were rated as improved, 44 (81%) were rated as unchanged, and 2 (4%) were rated as declined in the ability to move about independently in the environment. Thus, about one in every six clients improved. Im-

TABLE 5.1. Number of clients rated improved, unchanged, declined, and unable-to-rate on the 17 Social Factors Scale according to experience with hearing aids at the beginning of the Project.

Social Factors	*Improved*	*Unchanged*	*Declined*	*Unable to Rate*	*Total*
Mobility					
Experienced	6	25	0	0	31
Inexperienced	2	19	2	0	23
Totals	8	44	2	0	54
Group Conversation					
Experienced	26	4	0	1	31
Inexperienced	21	1	0	1	23
Totals	47	5	0	2	54
Family Communication					
Experienced	8	14	0	9	31
Inexperienced	8	8	0	7	23
Totals	16	22	0	16	54
Social & Recreational Activities					
Experienced	11	18	0	2	31
Inexperienced	11	9	0	3	23
Totals	22	27	0	5	54
Use of IHB Professional Services					
Experienced	1	30	0	0	31
Inexperienced	1	21	0	1	23
Totals	2	51	0	1	54
Vocational Status					
Experienced	2	12	1	16	31
Inexperienced	2	10	0	11	23
Totals	4	22	1	27	54
Future Plans					
Experienced	0	24	0	7	31
Inexperienced	3	17	1	2	23
Totals	3	41	1	9	54
Family Attitudes					
Experienced	2	18	0	11	31
Inexperienced	4	12	0	7	23
Totals	6	30	0	18	54

TABLE 5.1. Continued

Social Factors	*Improved*	*Unchanged*	*Declined*	*Unable to Rate*	*Total*
Attitudes Toward Hearing Loss					
Experienced	17	14	0	0	31
Inexperienced	19	4	0	0	23
Totals	36	18	0	0	54
Attitudes Toward Blindness					
Experienced	2	28	1	0	31
Inexperienced	2	19	0	2	23
Totals	4	47	1	2	54
Physical Complaints					
Experienced	2	28	1	0	31
Inexperienced	1	22	0	0	23
Totals	3	50	1	0	54
Independence in Daily Living					
Experienced	5	26	0	0	31
Inexperienced	3	19	1	0	23
Totals	8	45	1	0	54
Use of Radio, Television, and Talking Books					
Experienced	3	23	0	5	31
Inexperienced	4	16	0	3	23
Totals	7	39	0	8	54
Job Efficiency					
Experienced	4	3	0	24	31
Inexperienced	6	2	0	15	23
Totals	10	5	0	39	54
Job Safety					
Experienced	2	5	0	24	31
Inexperienced	1	5	0	17	23
Totals	3	10	0	41	54
Limitations of Second Loss					
Experienced	11	9	0	11	31
Inexperienced	16	1	0	6	23
Totals	27	10	0	17	54

provement was usually manifested by such behaviors as reduced dependence upon sighted persons for assistance in getting about, enhanced ability to attend to relevant sound cues in the environment, increased safety in independent travel, and greater skill in using the cane in mobility activities.

Six of the experienced hearing-aid users improved, and 25 remained unchanged; 2 of the group who had not worn aids prior to the Project improved, and 19 remained unchanged. The two clients who became less mobile were from the inexperienced group.

Group Conversation

Most of the clients improved in the ability to participate in group conversation. Two of the clients could not be rated. Of the 52 clients who were rated, 47 (90%) improved, 5 (10%) remained unchanged. None of the clients was rated as declined. Improvement was usually evidenced by increased frequency of participation

TABLE 5.2. Number and percentage of clients rated as improved for each of the 17 Social Factors.

Social Factors	*Number Rated*	*Number Improved*	*Per Cent Improved*
Group Conversation	52	47	90
Limitations of the Second Loss	37	27	73
Use of the Hearing Aid (experienced clients only)	31	22	71
Attitudes toward the Hearing Loss	54	36	67
Job Efficiency	15	10	67
Social and Recreational Activities	49	22	45
Family Communication	38	16	42
Job Safety	13	3	23
Family Attitudes	36	6	17
Independence in Daily Living	54	8	15
Mobility	54	8	15
Use of Radio, Television, and Talking Book	46	7	15
Vocational Status	27	4	15
Attitudes toward Blindness	52	4	8
Future Plans	45	3	7
Physical Complaints	54	3	5
Use of IHB Professional Services	53	2	4

in informal and formal social groups, greater comfort in group situations, and improved ability to understand the ongoing flow of conversation in group settings.

Of the 30 clients with previous hearing-aid experience who could be rated, 26 improved and 4 remained unchanged; 21 of the 22 inexperienced hearing-aid users improved while 1 remained unchanged.

TABLE 5.3. Percentages of clients rated as improved on the 17 Social Factors according to experience with hearing aids at the beginning of the Project.

Social Factors	*Number Rated*	*Number Improved*	*Per Cent Improved*
Mobility			
Experienced	31	6	19
Inexperienced	23	2	9
Group Conversation			
Experienced	30	26	87
Inexperienced	22	21	95
Family Communication			
Experienced	22	8	36
Inexperienced	16	8	50
Social and Recreational Activities			
Experienced	29	11	38
Inexperienced	20	11	55
Use of IHB Professional Services			
Experienced	31	1	3
Inexperienced	22	1	5
Vocational Status			
Experienced	15	2	13
Inexperienced	12	2	17
Future Plans			
Experienced	24	0	0
Inexperienced	21	3	14

TABLE 5.3 Continued

Social Factors	*Number Rated*	*Number Improved*	*Per Cent Improved*
Family Attitudes			
Experienced	20	2	10
Inexperienced	16	4	25
Attitudes toward Hearing Loss			
Experienced	31	17	55
Inexperienced	23	19	83
Attitudes toward Blindness			
Experienced	31	2	6
Inexperienced	21	2	10
Physical Complaints			
Experienced	31	2	6
Inexperienced	23	1	4
Independence in Daily Living			
Experienced	31	5	16
Inexperienced	23	3	13
Use of Radio, Television, and Talking Book			
Experienced	26	3	12
Inexperienced	20	4	20
Job Efficiency			
Experienced	7	4	57
Inexperienced	8	6	75
Job Safety			
Experienced	7	2	29
Inexperienced	6	1	17
Limitations of Second Loss			
Experienced	20	11	55
Inexperienced	17	16	94

Family Communication

Nearly one-fourth of the clients could not be rated on this variable owing to limited opportunities for the team to observe the clients as they functioned in their family settings. In some cases, clients had no families; in others, home visits did not produce sufficient data bearing on the variable. Of the 38 clients who could be rated, 16 (42%) were considered improved in family communication on the basis of increased frequency of interaction with family members, greater willingness on the part of one or more family members to communicate with the client, reduction in the incidence of irritation on the part of family members growing out of the client's limited hearing ability, and greater sense of belonging in the family group. In no case did family communication become worse.

Comparing the 22 experienced and 16 inexperienced hearing-aid users who could be rated in this area, 8 of the former and an equal number of the latter group improved. These figures represent 36% of the experienced group and 50% of the inexperienced group.

Social and Recreational Activities

As far as social and recreational activities are concerned, nearly half of the 49

clients rated were improved. Twenty-two (45%) improved, 27 (55%) remained unchanged. None of the clients declined in this area. Improvement was shown in increased participation in organized social and recreational activities sponsored by agencies for the blind, greater comfort and satisfaction in formal or informal social and recreational activities, and resumption of participation in selected recreational areas that had been abandoned previously owing to the hearing loss.

Considering the 29 experienced and the 20 inexperienced clients who could be rated, 11 from each subgroup were judged to have improved, thus 38% of the experienced group and 55% of the inexperienced group improved.

Use of IHB Professional Services

Little improvement was shown in the use of IHB professional services. Two (4%) of the clients improved; 51 (96%) remained unchanged. One client could not be rated. Improvement was judged on the basis of greater acceptance of rehabilitation plans developed in the course of counseling, reduced resistance to such services as medical treatment or optical aids, and acceleration of progress toward rehabilitation goals.

One client in each of the subgroups improved, and one client in the group entering the Project without a hearing aid could not be rated. The remainder of clients in both subgroups were unchanged in their use of IHB professional services.

Vocational Status

Half of the clients could not be rated on vocational status since vocational goals were not feasible for them due to age and other factors. Among the 27 that could be rated, 4 (15%) improved, 22 (81%) remained unchanged, while 1 (4%) declined. Transfer from an unemployed to an employed status, resumption of types of employment that had been abandoned previously due to the hearing loss, and improved productivity and satisfaction with one's job, and greater effectiveness in dealing with the hearing demands made in employment situations were judged to indicate improvement.

Data for only those clients that could be rated in the two subgroups show that 2 of the 15 experienced hearing-aid users improved, 12 remained unchanged, and 1 declined. Twelve inexperienced hearing-aid users could be rated; 2 improved, while 10 remained unchanged. Approximately the same percentage in both groups could not be rated.

Future Plans

Only 3 (7%) of the clients improved in the area of more realistic future plans compared with 41 (91%) who remained unchanged, and 1 (2%) who declined. Nine of the 54 could not be rated. Criteria for improvement were abandonment of previously held goals for the future which had little possibility of realization, resumption of realistic planning after a period of time spent living from "one day to the next," or renewed faith in one's ability to work toward appropriate life goals beyond the immediate present.

The three clients who improved were from the group recently fitted with hearing aids. The one client who declined in this area of social functioning was from this

group also. Nearly one-fourth of the group with previous experience with hearing aids could not be rated on this variable.

Family Attitudes

Family attitudes could not be determined for one-third of the total group. Either the client had no family or team members were unable to make a sufficient number of observations to make judgments. Attitudes of the family for the 36 clients who could be rated improved in 6 (17%) cases and remained unchanged in 30 (83%) cases. Criteria for improvement were greater acceptance of the client by his family as revealed by family verbalizations and actual family conduct, greater family willingness to assume appropriate responsibility for certain areas in the client's rehabilitation program, and reduction of intra-family tensions partly attributable to the client's hearing disability.

Examined by subgroups, the family attitudes for 2 of the subgroup with previous hearing aid experience improved while family attitudes for 4 of the inexperienced hearing-aid users improved. These figures represent 10% and 25% of the respective subgroups.

Attitudes toward Hearing Loss

Considerable improvement in attitudes toward the hearing loss resulted from participation in the speech and hearing project. All clients were rated. Thirty-six (67%) improved, while only 18 (33%) remained unchanged in their attitudes toward this disability. The clients who improved showed greater acceptance of the realities of the hearing loss, greater willingness to accept such aspects of the hearing rehabilitation program as auditory training, speech training, and hearing-aid evaluation, and decreased feelings of shame and concealment of the hearing loss.

Nineteen (83%) clients fitted with hearing aids during the Project improved, whereas 17 (55%) of the clients with previous experience with amplification improved.

Attitudes toward Blindness

Only 4 (8%) of the clients improved in their attitudes toward blindness while the attitudes of 47 (90%) remained unchanged. One (2%) client's attitudes became worse, while two clients could not be rated. The criteria for improvement were greater acceptance of the realities of the visual loss; greater willingness to accept such aspects of the rehabilitation program as eye surgery, optical aids, and training in communication and daily living skills for blind persons; and decreased feelings of shame and concealment related to the visual loss.

Two clients from each of the subgroups improved. The client whose attitudes became worse was from the group with previous experience with amplification. The two clients whose attitudes could not be judged had been recently fitted with hearing aids.

Physical Complaints

Attention to improved use of hearing had little effect upon physical complaints. Of the total group, 3 (5%) improved in this respect whereas 50 (93%) remained

unchanged; 1 (2%) developed even more complaints during the course of the Project. Improvement was manifested by decreased frequency or intensity of physical symptoms appearing to have psychosomatic components, less sensitivity to physical complaints and greater tolerance for bearing them even when their expressed frequency and intensity did not seem to have decreased, and decreased frequency of interruptions in the rehabilitation program attributable to physical symptoms appearing to have psychosomatic components.

The client who became worse in this respect had come to the Project already wearing a hearing aid as did two of the three clients who improved.

Independence in Daily Living

About one in every six of the clients was judged to be more independent after Project service. Eight (15%) improved, 45 (83%) remained unchanged, and 1 (2%) declined. Improvement included increased independence in carrying on everyday life tasks in areas such as personal hygiene, appearance, dress, eating habits, and general self-care; and increased satisfaction of personal needs by techniques that are socially acceptable in our culture.

Two of the experienced hearing-aid users improved and one inexperienced hearing-aid user improved. One client in the latter group became more dependent.

Use of Radio, Television, and Talking Book

A number of clients (8 or 15%) could not be rated on their use of radio, television, and talking book. Of the 46 who were rated, about one in six showed improvement. Among those rated, 7 (15%) improved, while 39 (85%) remained unchanged. Criteria were greater ease and comfort in using these instruments; increased ability to adjust the volume to reasonable levels; and where appropriate, increased use of these instruments for personal pleasure.

Three of the group with previous hearing-aid experience improved, and 26 remained unchanged. In the group newly fitted with hearing aids, 4 improved, and 16 remained unchanged.

Job Efficiency

Only a few clients could be rated on this variable. The two major reasons were that a majority of the clients were not employed during the time the Project was operative, and in some cases, adequate opportunities did not exist for observing employed persons functioning on the job. Ten (67%) of the 15 clients who could be rated improved while 5 (33%) remained unchanged. Improvement was judged by increased productivity levels, lowered rates of waste and spoilage on the job, and higher employer ratings of the client's total job functioning.

Of the 7 clients who could be rated who had had previous experience with amplification, 4 improved, and 3 remained unchanged. In the other subgroup of clients newly fitted with hearing aids, 8 could be rated; 6 improved and 2 remained unchanged. Thus 57% of the experienced group improved compared with 75% of the inexperienced group.

Job Safety

The team was unable to rate about three-fourths of the clients on job safety for

the same reasons that they could not be rated on job efficiency. Thirteen clients were rated; 3 (23%) improved, while 10 (77%) remained unchanged. Improvement was usually manifested in greater ability to attend to sound cues that were helpful in preventing accidents and injuries on the job.

Examined by subgroups, two clients with previous hearing-aid experience improved compared with one client newly fitted with amplification. Five in each group remained unchanged.

Limitations of the More Recently Acquired Sensory Loss

Ratings could be made only if the team had available to it data concerning the client's functioning prior to the onset of the second loss. In a majority of the cases, the visual loss preceded the hearing loss. The IHB, as an agency for the blind, had data adequate for rating purposes on 69% of the clients. Twenty-seven (73%) of the 37 clients rated improved in realistic acceptance of and functioning within the reality limits of the second disability. Ten (27%) remained unchanged. Feelings of hopelessness about the second disability and the combined impact of both disabilities decreased; motivation to overcome the effects of the second disability increased. These clients experienced greater success in meeting life problems and implementing rehabilitation plans despite the double disability.

Twenty clients in the subgroup having previous experience with hearing aids could be rated; 11 improved, and 9 remained unchanged. In the subgroup recently fitted with hearing aids, 17 were rated; 16 improved, and 1 remained unchanged. Thus, 55% of the experienced group and 94% of the inexperienced group improved in the area of perceived limitations of the second, more recently acquired, sensory loss.

Use of the Hearing Aid

Ratings on this item were confined to the 31 clients who had had experience wearing hearing aids prior to participating in the Project. More than two in every three of the clients in this subgroup were rated as improved in the use of the hearing aid, since 22 (71%) improved, and 9 (29%) remained unchanged. Criteria for improvement were increased hearing aid-wearing time under appropriate conditions, greater sense of comfort and satisfaction with the instrument, and improved skill in using the aid in a greater variety of life situations.

Comparisons Among other Subgroups

Comparison by Age Groups. Clients in the age group 60 and over tended to show the greatest improvement in the use of radio, television, and talking book and in participation in social and recreational activities. This finding should be evaluated in the light of the fact that 14 of the 32 persons in this group were receiving recreation services from the IHB Center at the same time that they were being served in the Speech and Hearing Project.

Comparison by Sex. Male and female groups of comparable age and degree of disability did not differ from each other in the specific areas of rated improvement.

Vocationally Active Clients. Vocationally active clients — those receiving vocational rehabilitation services and those employed in industry or sheltered workshops — revealed the most marked improvement in mobility and independence in the activities of daily living. This finding should be qualified by the fact that 7 of the 21 clients were actively receiving rehabilitation services related to these areas at the same time they were rceiving service in the Project.

Homemakers. Homemakers were comparable to the total female sample in the areas in which they attained their greatest proportions of improvement ratings.

DISCUSSION

The percentage of the clients who improved in selected social variables ranged from 90% improved in the ability to participate in group conversation to 4% improved in the use of IHB professional services. Unfortunately, not all clients could be rated on all variables. The number rated along with the per cent improved are shown in Table 5.2.

In part, the improvement for the various social factors reflects the composition of the sample. In a client group containing a greater proportion of young persons and a higher degree of vocational promise, more improvement in the vocational variables will probably be achieved. Similarly, more improvement in mobility will probably be achieved in a group containing a greater proportion of younger, more vigorous individuals. Consequently, caution should be exercised in any attempt to apply these results to samples of hearing-handicapped blind persons fitted with hearing aids that differ from the current sample in age, severity of disability, or other relevant characteristics.

For this sample, the data on improvement ratings tend to support the hypothesis that, in addition to measurable clinical gains in hearing effectiveness, blind clients fitted with hearing aids in a special speech and hearing program will achieve favorable changes in selected areas of social functioning. Furthermore, the data shown in Table 5.2 support the hypothesis that the most notable social gains will be in activities most closely related to hearing effectiveness. These areas include group conversation, limitations of the second loss (which most often was hearing), use of the hearing aid, social and recreational activities, and family communication. Since these data were gathered about six months after completion of speech and hearing service, it is not possible to estimate the long-range impact of the service upon the selected social variables.

For this sample, the obtained percentage of clients who improved tended to favor those who had not worn hearing aids prior to entering the Project. Statistical tests of differences between the subgroups could not be made since the theoretical frequencies are too small to allow application of x^2; therefore, generalization beyond this sample is not warranted. On the basis of the present data, the areas of social functioning in which most improvement was shown by clients fitted with hearing aids through the Project, in comparison with clients already wearing hearing aids when the Project began, were limitations of the second loss (94% vs. 55%) and

attitudes toward the hearing loss (83% vs. 55%). Though these results are based on too few clients to be conclusive, it seems possible that in a larger sample differences between the two subgroups might obtain also in the areas of job efficiency, social and recreational activities, family attitudes, family communication, and future plans. In the present sample, the percentages favoring clients inexperienced with amplication were job efficiency, 75% vs. 57%; social and recreational activities, 55% vs. 38%; family attitudes, 25% vs. 10%; family communication, 50% vs. 36%; and future plans, 14% vs. 0%.

These data tend to partially support the hypothesis that clients who had not used hearing aids previously and were fitted with such aids during the Project will show more marked gains on selected social variables than those who had had previous experience with a hearing aid. The support seems strongest in relation to social variables which concern adjustment to the hearing loss rather than to the general rehabilitation problems of blind persons. It is suggested that some blind clients who have had previous experience with hearing aids have already surmounted the early adjustment to hearing loss, even if the aid was less than fully successful. Thus, as a group, they seem more ready to enter the next level of adjustment, that of entrance into a comprehensive rehabilitation program for blind persons. On the other hand, blind clients without previous experience with a hearing aid seem more likely to be engaged in attempts at making an initial adjustment to the hearing loss. As a result, much of their interest and energy tends to be channeled into their participation in the Speech and Hearing Program. Until the hearing rehabilitation process is well underway, they may be less prepared to enter into the other phases of a rehabilitation program for blind persons.

IMPLICATIONS

Team ratings of client improvement on social variables suggest that there are measurable social gains achieved by many blind clients in association with their participation in a speech and hearing program. Although these gains vary from client to client, they seem to appear in areas that have a direct relationship with the total rehabilitation program. Consequently it is suggested that, insofar as generalizations may be drawn from this sample, a speech and hearing service is an important component in a comprehensive rehabilitation program for blind persons. Although the data presented are indicative rather than definitive, it seems likely that clients without previous experience with hearing aids may need a period of intensive speech and hearing service prior to receiving certain other rehabilitation services developed for blind persons. The initial adjustment to the hearing aid seems to require much client energy and, indeed, the degree of success achieved by the client in using his aid may influence his participation in other aspects of the total rehabilitation program.

THE CASE STUDIES

The five brief case studies in this section were written to supplement the data presented above. It was felt that a presentation of selected cases would be helpful to

the reader in identifying the range of problems encountered and the procedures used to work with these problems.

These cases are illustrative rather than typical. Each provides a brief social history, a statement of the audiologic findings, a report of Project services, and data on follow-up. Summary observations are presented at the end of each case. These observations report what the staff felt it learned from offering service to this client. The high degree of individual differences in this client sample indicates that the observations made of one case should be applied to other cases only with the greatest caution.

The Case of Mrs. B. H.

Employment Status: Employed in industry

Previous Hearing-Aid Experience: None

Age: 49

Marital Status: Divorced

Vision: Diagnosis — dense scars of cornea, both eyes
Acuity — motion perception, some reading vision, both eyes

Referral: Mrs. H. requested Project services in response to an IHB letter sent to her offering a hearing test.

Social History: Mrs. H. has had both visual and hearing problems since early childhood. She is a graduate of an elementary school where she attended a class for the blind. She had been married for two years and had a young child at the time her husband entered military service. He did not return, and Mrs. H. was subsequently notified that he had secured a divorce and had remarried. She has had no further contact with him. During the past 15 years, Mrs. H. supported her daughter and herself by her employment in a paper box factory. At the time she requested Project services, she was concerned about her ability to continue working. She felt that a new foreman on her job was less sympathetic toward her handicaps than the previous one had been. Her social life has been centered about her maintenance of her home and infrequent participation in activities of organizations for the blind. These activities had been largely self-restricted because her hearing loss caused her embarrassment, and she was reluctant to enter into situations where she could not participate in the conversation. In addition to having a warm and close relationship with her daughter, she kept in touch with other members of her family.

Audiologic Data: At about age 17, Mrs. H. had purchased a hearing aid but had never been able to use it. She was found to have a moderate sensory-neural loss in the right ear and a very severe loss in the left. Her ability to discriminate was extremely poor. Following approval by the otologist, a monaural barrette-type instrument was fitted for the right ear. This aid is worn very inconspicuously, a factor of some importance to Mrs. H.

Project Services: Her hours of employment made it necessary for Mrs. H's appointments to be widely spaced. In addition to the hearing service, she was referred

to the vision rehabilitation service. These appointments were coordinated insofar as possible. Glasses were prescribed for distance and reading, and a telescopic lens was provided which enabled her to enjoy television. Mrs. H. was given help in accepting the hearing aid and glasses in spite of her inability to meet the full cost of these aids, and she did make a small payment toward the cost.

Follow-Up Evaluation: During the trial period with the hearing aid, Mrs. H. had been encouraged to participate in some social activities so that she could report on her experiences with the aid in these situations. By the time of the follow-up evaluation, she had begun to seek out as many opportunities as possible to join groups of friends in social functions. Her enjoyment was heightened by her ability to participate actively in these functions. Her relationship with her daughter became even closer because of her ability to join in the conversations when her daughter's friends visited. On the job, the Project audiologist advised her not to wear the hearing aid during working hours because the noise in the shop would prove too disturbing. However, she gained enough self-confidence to speak frankly to her foreman of both her visual and hearing handicaps. He had made necessary allowances for them. During the lunch hour, she had been able to wear the hearing aid and reported that her relationship with her fellow workers had improved as a result of her ability to converse with them. In addition, church attendance had become more satisfying. She commented on the fact that with the hearing aid she enjoyed privacy in the confessional. This previously had been a source of embarrassment to her.

Observations: Although Mrs. H. had a long-standing and handicapping hearing loss, she took no initiative in seeking out resources in the community. However, when an offer of services was made directly to her she was able to move into a hearing rehabilitation service. Without an aggressive case-finding program, the Project might not have reached this client. This case provides an instance in which improved hearing significantly broadened the client's social horizons.

The Case of Mrs. M. D.

Employment Status: An older person living with her family

Previous Hearing-Aid Experience: None

Age: 67

Marital Status: Widowed

Vision: Diagnosis — retinitis and retinitis proliferans plus mature cataracts, both eyes

Acuity — light perception, both eyes

Referral: Mrs. D. was referred to the Project by the IHB social worker, upon the request of the client.

Social History: At the time she was referred for Project services, Mrs. D. had been a very recent client of the agency. She had suffered a progressive loss of vision from the age of 30, but throughout the intervening years she had never received services from any agency. She had kept house competently, raised her two children,

and enjoyed a very close and happy relationship with her husband. He had died within the past year; and following his death, she had become very depressed and frightened of living alone. As a result, her son, his wife, and two children had moved into her home. The daughter-in-law had a domineering personality and tended to overwhelm Mrs. D., discouraging her from making her own decisions as she had apparently done prior to her husband's death. Early in her contact with the IHB, the client requested help with her hearing problem. Although her daughter-in-law attempted to discourage the referral to the Project on the basis that Mrs. D. was managing well enough, Mrs. D. persisted in her request.

Audiologic Data: Mrs. D. reported a gradual and progressive loss of hearing over the past six to eight years. Evaluation revealed a moderate bilateral sensory-neural hearing loss, with good ability both to discriminate and localize. The otologist approved of a hearing aid, and comparative testing resulted in the fitting of binaural instruments, worn behind the ears.

Project Services: Mrs. D. required only four auditory-training sessions once the hearing-aid evaluation had been completed. Her daughter-in-law or daughter accompanied her for these sessions. The Project social worker interpreted to both Mrs. D. and her daughter-in-law some of the problems and factors involved in the adjustment to the use of the hearing aid. Mrs. D. was encouraged by the information that she could expect improvement of her hearing problem with the use of aids. Her satisfaction with this improvement was immediate, and she quickly mastered the handling of the hearing aids. Her daughter-in-law also expressed enthusiasm over the improvement. She reported the conversation in the household had become less noisy and strained and Mrs. D.'s own voice had become better modulated. Mrs. D. participated in the purchase of the recommended aids and paid almost half the total cost.

Follow-Up Evaluation: Shortly after the purchase of the hearing aids, Mrs. D. sold her house and moved into her daughter's home. There, the value of the hearing aids became even more pronounced. Her daughter was able to leave Mrs. D. with the baby without hesitation, since Mrs. D. was able to be immediately responsive to the child's needs. Her son-in-law had an extensive record collection, and Mrs. D., with the improvement in hearing, was able to share his interest in music with great enjoyment. She was included in the visiting done with friends of her daughter and in these social contacts was able to follow the conversation with ease. After only six months of use of the aids, she reported that she could not imagine how she had ever functioned without them.

Observations: This client had a history of functioning as an independent person despite her disability. The hearing loss seemed to contribute to her increased dependency following the death of her husband. However, after hearing rehabilitation, the client seemed to recover some of her earlier independence and to assume a participating role in her daughter's household.

The Case of Mrs. P. L.

Employment Status: An older person living in a residential situation

Previous Hearing-Aid Experience: None

Age: 75

Marital Status: Widowed

Vision: Diagnosis — chronic glaucoma, both eyes

Acuity — light perception, right eye; left eye, nil

Referral: Mrs. L. was a resident at Burrwood, the IHB residence facility for older blind persons, when she was given an audiometric screening made available to all clients at this facility. Prior to the screening, the Burrwood staff had observed that Mrs. L. had had difficulty in following a conversation, especially in groups.

Social History: Mrs. L's visual difficulty began in early childhood. Her hearing difficulty became apparent after a mastoid operation in 1948. Despite the hearing problem, Mrs. L. was able to continue functioning as a homemaker until her husband died in 1957. Prior to this time, Mrs. L. did not feel a need for hearing service. Shortly after the death of her husband, staff members at the hospital where she was receiving treatment for diabetes felt that it was unwise for Mrs. L. to continue living alone. She was referred to the IHB where it was felt that the most suitable plan for Mrs. L. was entrance into Burrwood. She adapted quickly to the Burrwood pattern of life and formed one close association with another resident. Soon after entering the group living arrangement at Burrwood, Mrs. L. found that her hearing, which had been adequate for her home, was not adequate for Burrwood. Throughout her service from the IHB, Mrs. L. has been congenial, cooperative, and compliant.

Audiologic Data: Evaluation at the IHB Speech and Hearing Center revealed a severe loss of hearing in the right ear and a mild sensory-neural loss in the lower frequencies followed by an abrupt high frequency sensory-neural loss in the left ear. A body-worn monaural instrument was recommended for the left ear after approval by the otologist.

Project Services: The department of welfare was requested to purchase the recommended hearing aid. While awaiting approval of the request, Mrs. L. wore an aid loaned to her. She was given some help in understanding that the cumbersome instrument she was using was only temporary, and readily accepted this reassurance.

Follow-Up Evaluation: Evaluation was made several months after the satisfactory fitting of the hearing aid. Mrs. L. reported general satisfaction with the instrument, indicating that the aid permitted her to enjoy "soap opera" on a portable transistor radio. Previously, she had not heard well enough to grasp the continuity of these programs. She also reported that the aid enabled her to carry on conversations with greater privacy, since now she was better able to modulate her voice appropriately.

Observations: When Mrs. L. moved into an institution which stressed group living, her hearing problems became more handicapping, necessitating hearing rehabilitation. After receiving a hearing aid and training in its use, the client was able to adapt more successfully to institutional living.

The Case of Mr. J. S.

Employment Status: A person receiving rehabilitation services

Previous Hearing-Aid Experience: None

Age: 40

Marital Status: Single

Vision: Diagnosis — retinitis pigmentosa, both eyes
Acuity — 6/200, both eyes

Referral: Mr. S. was referred to the Project by the IHB social worker who, in her first contacts with the client, noted that he had a hearing loss.

Social History: Until he was 33 years old, Mr. S. and his family were sharecroppers in North Carolina. Both vision and hearing had been impaired since his childhood. He left school in the sixth grade. His only employment had been as a farm laborer. Five years prior to the first contact with the IHB, Mr. S. accompanied other members of the family when they moved to New York City. He was supported by his family and remained at home, engaging in no outside activities. He seemed to accept his situation; consequently, his original request from the agency was only for a talking book machine. He accepted a referral to the Speech and Hearing Project. The audiologic evaluation indicated that a hearing aid would probably be helpful; however, it was considered desirable to incorporate hearing services into a total rehabilitation program. As a result, Mr. S. was referred to the New York State Vocational Rehabilitation Service for the Blind and subsequently was accepted for evaluation at the Long Island Rehabilitation Center.

Audiologic Data: The audiologic evaluation revealed a moderate bilateral sensory-neural loss. The otologist approved the use of a hearing aid, and Mr. S. was fitted with a binaural eyeglass type instrument. The cost of the aid was met by the New York State Vocational Rehabilitation Service.

Project Services: Although the audiologic evaluation had been made early in Mr. S's contact with the agency, the hearing-aid evaluation and fitting were not undertaken until Mr. S. entered the Long Island Rehabilitation Center for evaluation, since it was planned to have Mr. S. receive both services simultaneously. Therefore, he spent the first month at the center without a hearing aid while the hearing evaluation was in process. It was noted during this period that his progress was slow. He required a great deal of instruction and did not seem to understand directions. Hearing Project services made it possible to fit him with the hearing aid and give him intensive training in its effective use. The rehabilitation center reports noted that his progress in the two weeks subsequent to the fitting of the aid had been more marked than in any previous period. He was found to have better comprehension of instructions and improved self-confidence. He was alert, interested, and aware of his surroundings. He had begun to initiate social contacts with other trainees. The changes were so marked that his rehabilitation center training was discontinued and he was transferred to the IHB workshops. There, his progress continued to be very satisfactory. His production rate increased rapidly, his attitudes were positive, and his relationships with his co-workers were excellent.

Follow-Up Evaluation: After Mr. S. had been wearing the hearing aid for six months, the follow-up evaluation indicated that this progress had continued. Within the family environment, he had gained status as a respected wage-earner. He had begun to express his own ideas and accept home responsibilities. In the workshop, his work performance continued to be good. He traveled independently and had enlarged the scope of his social activities. A psychological re-examination was made with the aim of determining the effect of hearing correction upon Mr. S's intellectual and general functioning. (A previous examination had been made at the beginning of Mr. S's rehabilitation center training). The psychologist's report noted "a greater interest and willingness to interact with his environment and an increased learning efficiency." It was the opinion of the psychologist that the gains made were "closely related to the help which he has obtained through the hearing rehabilitation."

Observations: The original plan was for Mr. S. to receive hearing rehabilitation and other rehabilitation services simultaneously when he entered the Long Island Rehabilitation Center. Thus, hearing service was delayed for several weeks. When Mr. S. did enter the Center, his hearing problems impeded his progress. If hearing service had been offered earlier, Mr. S. would have made more rapid progress in his total rehabilitation program. In this case, improved hearing was the key to improved performance in other phases of the rehabilitation program.

The Case of Mr. G. Z.

Employment Status: A person employed in industry

Previous Hearing-Aid Experience: None

Age: 46

Marital Status: Married

Vision: Diagnosis — malignant myopia, both eyes
Acuity — motion perception, both eyes

Referral: Mr. Z. requested a hearing test in response to the IHB letter offering Project services. He had been aware of a monaural loss of hearing for many years, but had done nothing about it. In his employment as a vending stand operator in a noisy indoor location, he was finding that this loss was creating frequent problems.

Social History: When he began to lose his vision at age 40, Mr. Z. had worked as a registered pharmacist for 19 years. Following the loss of vision and aided by loans from members of his family, Mr. Z. and his wife purchased a neighborhood dry-cleaning shop. They worked there together for a short time, but Mr. Z. felt that his contribution to the enterprise was negligible. Because of this feeling, he entered the Long Island Rehabilitation Center for evaluation and training while Mrs. Z. continued to manage the store. During evaluation, it was found that Mr. Z. had enjoyed the selling aspects of his pharmacy experience and had good abilities in this area. Upon completion of training, he was placed in the vending stand which he still operates. Although his income from the stand is not large, he feels that, in time, it will be increased. With the additional income from the dry-cleaning store,

Mrs. Z. and he are able to provide modestly for themselves and their daughter. An older child is no longer at home.

Audiologic Data: Mr. Z's hearing in the right ear is essentially normal, although there is a slight sensory-neural loss in the high frequencies. In the left ear, he has a mixed moderate loss of hearing dating back to his childhood. The otologist approved the use of an aid on the left ear, and Mr. Z. was fitted with a behind-the-ear instrument. He was able to pay a portion of the cost; the balance was met from Project funds.

Project Services: Because he was employed during the day, it was necessary to make special arrangements to work with Mr. Z. on Saturdays. After the hearing-aid evaluation had been completed, however, he required only one session of auditory training. His adjustment to his new aid was so immediate and effective that he required a minimum of other services.

Follow-Up Evaluation: Mr. Z's initial request for service was based upon specific job problems such as hearing customers who addressed him from his left side and separating voices from the noisy background. The hearing aid did succeed in solving these problems, thus enabling Mr. Z. to work with far less tension. In addition to solving his job problems, the hearing aid gave him other benefits which he had not anticipated; for example, increased ability to localize the direction of sound gave him a greater sense of security in travel. He no longer found it necessary to maneuver his position to hear conversations in social situations. Finally, his enjoyment of music was greatly enhanced. These gains proved to be lasting. When Mr. Z. was seen after he had been wearing the aid for six months, he reported that he had solved his earlier hearing problems resulting from his hearing impairment.

Observations: Mr. Z. originally came to the Project seeking help with hearing problems he was having on his job. Hearing rehabilitation enabled him to become more efficient and more comfortable in the performance of work tasks. In addition, he discovered that he had also made unanticipated gains in other areas.

REFERENCES

American Foundation for the Blind, *The Preschool Deaf-Blind Child: Suggestions for Parents.* New York: American Foundation for the Blind (1955).

BELZILE, M., and MARKLE, D. M., A clinical comparison of monaural and binaural aids worn by patients with conductive or perceptive deafness. *Laryngoscope,* **69,** 1317-1323 (1959).

BERGMAN, M., Binaural hearing. *Arch. Otolaryng.,* **66,** 572-578 (1957).

BERGMAN, M., Rehabilitating blind persons with impaired hearing. *New Outlook Blind,* **53,** 351-356 (1959).

BROADBENT, D. E., *Perception and Communication.* New York: Pergamon Press (1958).

CARHART, R., Auditory training. Chap. 13 in H. Davis and S. R. Silverman (eds.), *Hearing and Deafness.* New York: Holt, Rinehart and Winston (1960).

COHN, L., Substitute functions of the blind and the deaf and blind. *Brit. J. Ophthal.,* **38,** 680-684 (1954).

DICARLO, L., and BROWN, W., The effectiveness of binaural hearing for adults with hearing impairments. *J. aud. Res.,* **1,** 35-76 (1960).

DINSMORE, A. B., National approach to the education of deaf-blind children. *New Outlook Blind,* **48,** 1-8 (1954).

GLORIG, A., and NIXON, J., Distribution of hearing loss in various populations. *Ann. Oto. Rhino. Laryng.,* **69,** 497-516 (1960).

HARRIS, J. D. (ed.), Use of auditory cues by the blind for travel. *Interim Progress Report, Contract #RD-510, Department of Health, Education and Welfare, OVR.* Washington, D. C., July (1961).

HEFFLER, A. J., Rehabilitation of the acoustically handicapped blind. *New Outlook Blind,* **46,** 96-105, 1952.

JERGER, J., CARHART, R., and DIRKS, D., Binaural hearing aids and speech intelligibility. *J. Speech Hear. Res.,* **4,** 137-148 (1961).

JUSTINA, Sister M., The deaf-blind child — what are the needs and resources in the field of Catholic education? *Proceedings and Addresses,* 415-419 (1953).

KROHN, E., Out of the quiet shadows. *Volta Rev.,* **58,** 440-442 (1956). National Study Committee on Education of Deaf-Blind Children, *Report of the National Study Committee on Education of Deaf-Blind Children.* Washington, D. C., July, 1953; Council Bluffs, January, 1954.

NORTON, F.-T.M., *Training Hearing to Greater Usefulness: A Manual.* Cleveland, Ohio: Cleveland Society for the Blind (1960).

Pageant visits seven brave children. *Pageant,* **12,** 26-35 (1957).

REMY, *Les mains revetues de lumiere.* Paris: Librarie Plon (1956).

SALMON, P. J., and RUSALEM, H., Vocational rehabilitation of deaf-blind persons. *New Outlook Blind,* **53,** 47-54 (1959).

SHORE, I., BILGER, R. C., and HIRSH, I. J., Hearing aid evaluation: reliability of repeated measurements. *J. Speech Hear. Dis.,* **25,** 152-167 (1960).

SMITHDAS, R. J., *Life at my Fingertips.* New York: Doubleday (1958).

STELLE, R. M., National committee for the deaf-blind children. *Int. J. Educ. Blind,* **8,** 134-136 (1959).

STEVENS, S. S., and DAVIS, H., *Hearing, Its Psychology and Physiology.* New York: John Wiley (1938).

U. S. Office of Vocational Rehabilitation and The Industrial Home for the Blind, *Rehabilitation of Deaf-Blind Persons.* 7 vols. A report of a joint project. Washington, D. C.: Government Printing Office (1958-1959).

Appendix A

THE INDUSTRIAL HOME FOR THE BLIND

57 WILLOUGHBY STREET

BROOKLYN 1, NEW YORK

Telephone MAin 4-5152

As you may know, hearing is a most important sense for those of us who have lost our sight. We have known for a long time that there is much that might be done through hearing and the improvement of loss of hearing to make living with blindness easier.

The IHB has been honored by the Federal Department of Health, Education, and Welfare which, through its Office of Vocational Rehabilitation, has joined with us to experiment with this problem of offering service to those who have hearing or speech loss or who may benefit from a special service. We told the Office of Vocational Rehabilitation that we thought that you and many of our blind friends on Long Island would be interested in participating in this program and that you would be excited about the possibility of helping other blind persons throughout the country and possibly throughout the world by your participation.

Included in your part of the experiment would be two simple steps, the first of which might be all that was required of most of you. This step is the screening audiometric test to determine whether you have any hearing loss, with observation by the audiologist and social worker to determine also whether you have any speech problem. The second step would be participated in only by those of you who have some hearing loss or some need for auditory training. This step would involve your coming to the Speech and Hearing Center at our Jamaica Rehabilitation Center, where a complete series of tests and speech and hearing evaluation procedures would be offered

We hope that you will want to join us in this study and, if you do, would you be good enough to complete the enclosed Questionnaire and return it in the stamped, addressed envelope attached. If you have any questions, please call your social worker who is familiar with the procedure and will be glad to tell you about it.

It is always a pleasure to have a new service which may be of help to you and one in which you may participate in helping others

With best wishes, believe me,

Very sincerely yours,

Peter J. Salmon

Peter J. Salmon
Executive Director

PJS:Krm
Encls:
#8-10/58

THE INDUSTRIAL HOME FOR THE BLIND

57 WILLOUGHBY STREET
BROOKLYN 1, NEW YORK
Telephone MAin 4-5152

Some time ago, we wrote to you suggesting that you might like to take advantage of a unique program which is being carried forward at our Long Island Rehabilitation Center, 147-11 Archer Avenue, Jamaica. This program is a Speech and Hearing Project through which we are offering help to any blind person in our area who is troubled either with speech problems or with hearing problems.

Because hearing is so important to every blind person, we felt that all of our blind friends would like to have the opportunity to have a hearing test. While many of them have taken advantage of this offer, we did not hear from you -- it may be that you have no hearing problem at all and feel that you do not need a test but we would appreciate your letting us know that you have read this letter and either do or do not wish to be tested.

You will find enclosed a similar questionnaire to that which we sent to you before, with a return-addressed and stamped envelope for its return. Will you please take the time to answer and return it so that we will not be writing to you again if you do not wish the service?

With best wishes from all of us at IHB, believe me,

Sincerely yours,

Peter J. Salmon

PJS:Krm
Encls:
#26-3/62

Peter J. Salmon
Executive Director

Since 1893 . . .
the **I**nstitute for **H**elping the **B**lind
. . . to Help Themselves

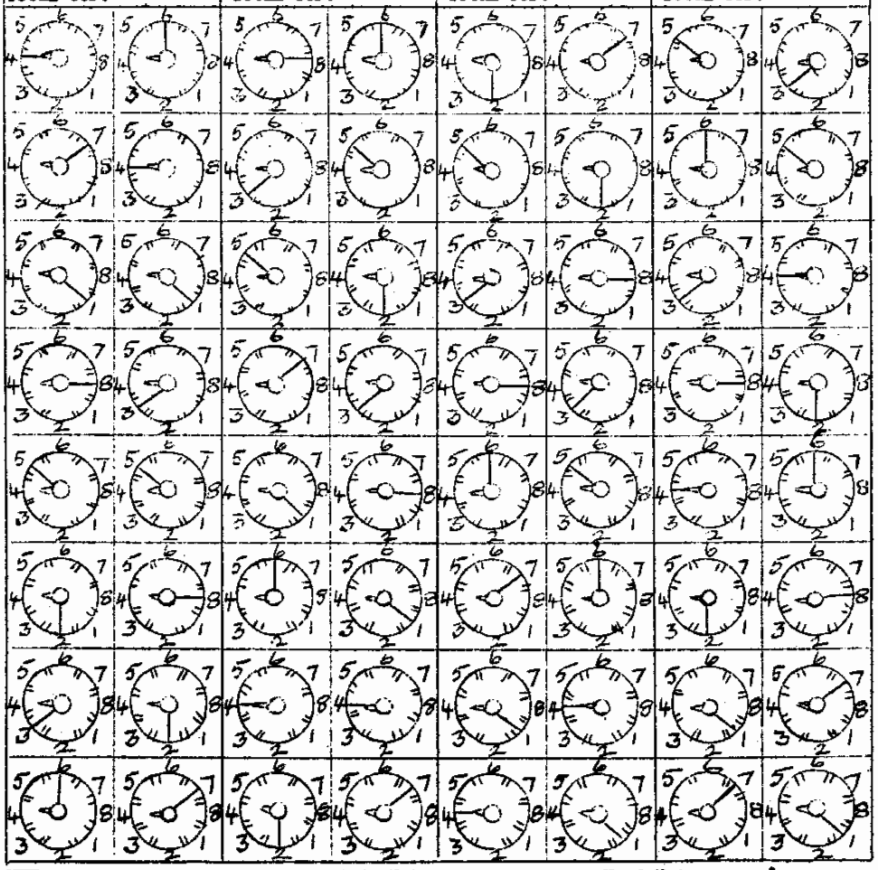
#24-8/59 Localization Test

THE INDUSTRIAL HOME FOR THE BLIND SPEECH AND HEARING PROJECT

Client: Date: Tester:

H.A.: Hrg. Cond:

Cond:	Cond:	Cond:	Cond:
Loc.Tecnic:	Loc.Tecnic:	Loc.Tecnic:	Loc.Tecnic:
Level:	Level:	Level:	Level:
Total Cor:	Total Cor:	Total Cor:	Total Cor:



KEY: Unaided:

Symmetrical:

R. Unilat:

L. Unilat:

Body H.A.:

Body H.A. - R:

Body H.A. - L:

Body H.A. - Bin:

Head H.A.:

Head H.A. - R:

Head H.A. - L:

Head H.A. - Bin:

Appendix B

TELEPHONE QUESTIONNAIRE

#28-6/60
THE INDUSTRIAL HOME
FOR THE BLIND

Telephone Questionnaire
SPEECH AND HEARING PROJECT

Client_____ Date_____

1. Some time ago, the IHB sent you a letter telling you about the new Speech and Hearing service and inviting you to use it. Did you receive this letter?

   __Yes __No

   Comments:

2. After reading the letter, what did you decide to do about this new IHB service?

3. Why did you decide this?

4. After you decided, you didn't write the IHB telling us what your decision was.

   Why?

5. Have you ever had any trouble with your hearing? (or with your hearing aid?)

   __Yes __No

   Comments:

6. Would you be interested in having us come to your home to test your hearing?

   __Yes __No

   Why?

7. Other Comments:

Worker_____

Appendix C

INTAKE AND INTERVIEW HISTORY FORMS

#1-7/58 (Intake Schedule)
THE INDUSTRIAL HOME FOR THE BLIND — Confidential SPEECH AND HEARING PROJECT

CLIENT_____ SEX____ CASE #_____
ADDRESS_____ COUNTY_____
DATE OF BIRTH_____ ___Unknown

MARITAL STATUS:

___Single ___Married ___Widowed ___Divorced
___Separated ___Unknown

RELATIVES HH, D, OR B (state who, and handicap):

_____
_____ ___None ___Unknown

EDUCATION:

SCHOOL (specify D (day), or R (residential)):
___Regular ___for Deaf ___for Blind
___Other (state)_____ ___None ___Unknown
HIGHEST EDUC. ACHIEVEMENT_____ ___None ___Unknown

MOBILITY:

Travels within home: ___Easily ___With difficulty
___Travels within local nghbrhd. ___Travels frequently outside local nghbrhd.
___Homebound (reason) _____ ___Unknown

MODE OF TRAVEL:

___Sighted person ___Guide dog ___Cane ___Unaided
___Other (state) _____ ___None ___Unknown

EMPLOYMENT:

PRESENT: ___Yes ___No ___Unknown
If YES: ___IHB (type)_____ Other (type)_____
If NO, why_____
BEFORE HANDICAP: ___Yes (type)_____ ___None ___Unknown
OTHER EMPL. INFO: _____

SOURCE OF INCOME:

___Empl. ___Family ___P.A. ___Other (state)_____ ___Unknown

PRESENT STATUS WITH IHB:

_____

OTHER DISABILITIES:

PHYSICAL: __Yes (state)_____ __No __Unknown

PSYCHOL: __Yes (diag.)_____ __No __Unknown

VISUAL ACUITY WITH CORRECTION (circle R or L eye):

(If Contr. Field, attach chart)

Date_____

R L __Absolute blindness

R L __Light percep. only

R L __Motion percep. to 5/200

R L __5/200 - 9/200

R L __10/200 - 19/200

R L __20/200

R L __Under 20/200 with contr. fld. (un. 20°)

R L __Over 20/200 with contr. fld. (un. 20°)

R L __Unknown

OPHTHALMOLOGICAL REPORT:

Diag: Primary R_____ __Unknown

L_____ __Unknown

Second. R_____ __None __Unknown

L_____ __None __Unknown

Etiology: _____ __Unknown

DATE OF ONSET OF BLINDNESS_____(Age____) __Unknown

DATE OF FIRST LEGAL CLASSIF._____(Age____)

HEARING LOSS:

AVERAGE LOSS AT 500-4000 CPS, OR PERCENT:

R_____ L_____ (Date_____) __Unknown

OTOLOGICAL REPORT:

Diag: _____ __Unknown

Treatment: _____ __None __Unknown

DURATION OF LOSS_____ __Unknown

HEARING AIDS HISTORY_____ __Unknown

OTHER SERV. RECVD. FOR HRG. PROBLEM_____

_____ __None __Unknown

IS CLIENT AWARE OF OR CONCERNED ABOUT HIS HRG. LOSS?___

SPEECH PROBLEM:

__Yes __No By whom determined?_____

SPEECH THERAPY RECVD._____ __None __Unknown

Completed by_____ Date_____

#30-8/60

THE INDUSTRIAL HOME FOR THE BLIND

Interview History
SPEECH AND HEARING PROJECT

To be filled out by Social Worker and sent to Otologist before Otological Examination

CLIENT_____ AGE_____ DATE_____

Impairment of Hearing

Duration_____ears __Unknown

__Progressive __Stationary __Unknown

__Unilateral __Bilateral __Unknown

Operations

__Mastoidectomy __Fenestration

__Paracentesis (lancing) __Stapes

__Other (specify)_____

__None __Unknown

Diseases of Childhood

__Measles __Scarlet Fever

__Mumps __Meningitis

__Encephalitis __Birth injury

__Congenital Anomaly (specify)

_____

__Prenatal Infection

__Other (specify)_____

__None __Unknown

Other Diseases or Conditions

__Diabetes __Syphilis

__Trauma (specify)_____

_____

_____

__Other (specify)_____

__None __Unknown

Drugs

__Streptomycin __Neomycin

__Dihydrostreptomycin

__Other (specify)_____

__None __Unknown

Family History of Deafness

__Otosclerosis

Who _____

__Other Deafness (specify)

_____

__None __Unknown

Tinnitus

Duration_____years __Unknown

__Constant __Intermittent __Unknown

__Unilateral __Bilateral

__In the head __None __Unknown

COMMENTS:

INTERVIEWER_____

Appendix D

OTOLOGIC AND SPEECH EXAMINATION RECORDS

#31-8/60
THE INDUSTRIAL HOME FOR THE BLIND

Otological History and Examination
SPEECH AND HEARING PROJECT

To be filled out by Otologist and returned to the Speech and Hearing Project

CLIENT_____ AGE_____

DATE OF EXAMINATION_____

ETIOLOGICAL FACTORS

__Frequent affections of URT (including "common colds")
__Otorrhea
__Constant
__Recurrent
__Acute infections of URT __Trauma
__Mastoidectomy (specify type)
_____

LABYRINTHINE DYSFUNCTION

__Dizziness __Vomiting __Disturbance in equilibrium __Nausea __Vertigo

PARACUSIS

Hears better: __In noisy places __In subway __On telephone

PHYSICAL EXAMINATION

Nose _____ Throat _____
Tonsils _____ Larynx _____
Drums: Right_____ Left _____
Hearing: Voice: Right_____ Left_____
Whisper: Right_____ Left_____
Tuning Forks: Right_____ Left_____
Weber Test: Right_____ Left_____
Rinne Test_____
Schwabach Test_____
Clinical Opinion_____

Diagnosis _____
Recommendations _____

Signature of Otologist_____

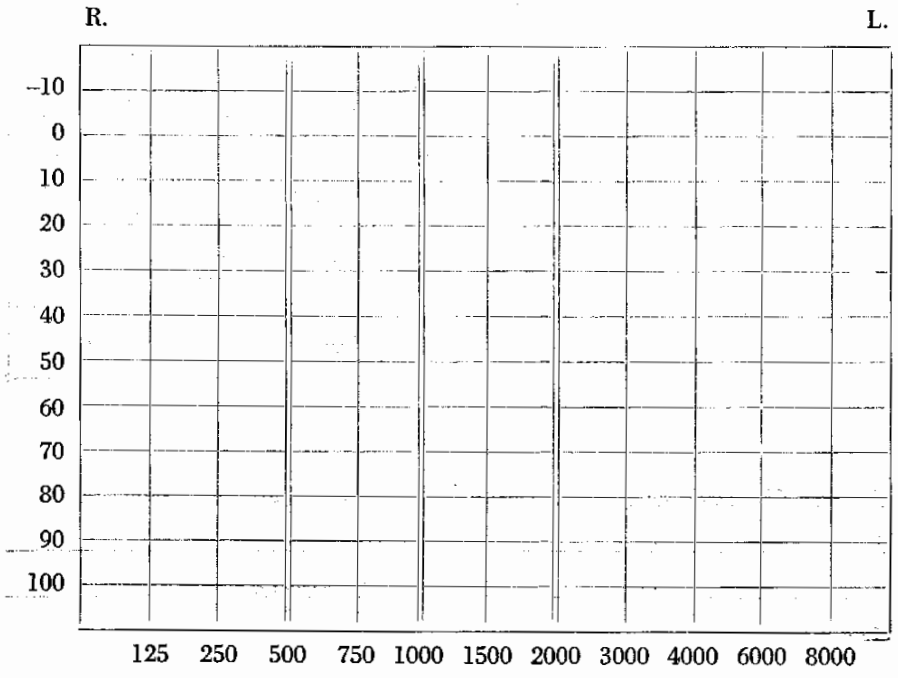
#3-7/58-Rev. 5/59
THE INDUSTRIAL HOME
FOR THE BLIND

Confidential
SPEECH AND HEARING PROJECT

Client_____ Age____ Sex____ Date_____

Address_____ County_____ Tel. #_____

Weber



	R.	L.	Sound Field
Pure Tone Average			
SRT	dB	dB	dB
Pb			
Level dB	%	%	%
Level dB	%	%	%
Level dB	%	%	%
Level dB	%	%	%
Thresh. of Intol.			
Localization			

Key

	Right (red)	Left (blue)
A/C	O	X
A/C no resp		
A/C $\overline{c}$ masking		
A/C $\overline{c}$ masking no resp		
B/C		
B/C no resp		
B/C $\overline{c}$ masking		
B/C $\overline{c}$ masking no resp		
Sound Field	●	

Tinnitus Characteristics:

R_____ Int_____

L_____ Int_____

Con-
stant_____

Inter-
mittent_____

Reliability:

Average _____

Questionable _____

Masking Level:

R_____ L_____

Comments:

Tester: _____

#12-11/58
THE INDUSTRIAL HOME
FOR THE BLIND

Speech and Voice Diagnosis
SPEECH AND HEARING PROJECT

Name_____ Age____ Date_____ Examiner_____

VOICE

VOLUME: __Excessive __Weak __Uncontrolled

PITCH: __Too high __Too low __Uncontrolled __Monotonous

QUALITY: __Nasal __Denasal __Retracted __Harsh thin __Dull
__Breathy __Hoarse __Strident

RATE: __Rapid __Too slow __Staccato __Monotonous

EXAMINATION AND MOVEMENT OF ARTICULATORS

LIPS _____

TONGUE _____

JAW _____

Comments _____

RELATED INFORMATION

1. Dental plates_____ Dentures_____ Bridges_____ Missing teeth_____
2. Marked overbite_____ Marked underbite_____ Open bite_____
3. Foreignisms_____ Regionalisms_____
4. Rhythm: __Staccato __Monotonous __Halting __Repetitions __Stutter
5. Intonation: __Not varied __Excessively varied __Foreign ( )
6. Phrasing: __Not varied __Excessively varied __Halting __Montonous
7. Pausing: __Excessive __Monotonous __Uncontrolled
8. Vocabulary _____
9. Grammatical structure_____
10. Brain injury_____
11. Mental deficiency_____
12. Significant psychological disturbance_____

REMARKS: _____

RECOMMENDATIONS: _____

ARTICULATION

CONSONANTS

	I	M	F	INC.
f				
v				
p				
b				
θ				
ð				
s				
z				
ʃ				
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t ʃ				
d ʒ				
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k				
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l				
w				
j				
h				

VOWELS and DIPHTHONGS

	I	M	F	INC.
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Appendix E

INTERIM REPORT

#19-1/59
THE INDUSTRIAL HOME
FOR THE BLIND

INTERIM REPORT
SPEECH AND HEARING PROJECT

To: _____ Name of Client: _____

cc: _____ From: _____ Date: _____

SOCIAL SERVICE

__Referral for preliminary Screening.
__SW contact made. Client ready for Evaluation.
__Transportation needed. __Guide __Driver
__SW contact made. Client not ready for Evaluation. Hold until advised.
__SW contact made. Hearing Aid costs arranged.
__DW __Client will pay __Loan __GSSA __AFB

AUDIOLOGY

__Preliminary Screening completed. Results negative. Client advised.
__Preliminary Screening completed. Needs complete Audiological Evaluation.
__Audiological Evaluation completed. Results negative. Client advised.
__Audiological Evaluation completed. Needs Hearing Aid Evaluation.
__Otological Consultation suggested.
__Otological Consultation suggested. Client resistive. SW please check.
__Hearing Aid Evaluation suggested. Client resistive. SW please check.
__Hearing Aid prescribed. Type _____ Cost _____
SW discuss cost with client.
__Auditory Training or other Auditory Rehabilitation to be scheduled as follows _____
__Audiological service completed.

SPEECH

__Speech Evaluation provided. Results negative.
__Speech Evaluation provided. Therapy to be scheduled as follows _____
_____
__Speech Evaluation provided. Resistive to Therapy. SW please check.
__Speech Therapy completed.

ADMIN.

__Appointment cancelled. Reason _____
To be rescheduled.
__Appointment not kept. Follow-up letter sent on _____
__Appointment not kept. No answer to above letter. SW please check.

OTHER INFORMATION: _____

Appendix F

HEARING-AID EVALUATION, LOCALIZATION, LATERALIZATION, AND FUSION RECORDS

#27-4/60
THE INDUSTRIAL HOME
FOR THE BLIND

Lateralization and Fusion Test
SPEECH AND HEARING PROJECT

Name of Client:_____ Date:_____

LATERALIZATION

40 db - SPL				65 dB - SPL			
Unaided		Aided		Unaided		Aided	
R:____	L:____	R:____	L:____	R:____	L:____	R:____	L:____
L:____	R:____	L:____	R:____	L:____	R:____	L:____	R:____
L:____	R:____	L:____	R:____	L:____	R:____	L:____	R:____
R:____	L:____	R:____	L:____	R:____	L:____	R:____	L:____
R:____	L:____	R:____	L:____	R:____	L:____	R:____	L:____
L:____	R:____	L:____	R:____	L:____	R:____	L:____	R:____

FUSION

40 dB - SPL (Speakers 3-5)		65 dB - SPL (Speakers 3-5)	
Unaided:_____	Aided:_____	Unaided:_____	Aided:_____

#23-7/59

THE INDUSTRIAL HOME
FOR THE BLIND

HEARING AID EVALUATION
SPEECH AND HEARING PROJECT

Name:_____ Date:_____ Tester:_____

PRESENT HEARING AID

MAKE							
MODEL							
OTHER IDENT.							
RECEIVER							
BATTERY							
EAR(S)							
INSERT							
HOW LONG USED?							
	UN-AIDED						
SRT COMF.							
SRT MAX.	X						
PB-MAX (SL 35)							
PB-LOW CONV. (25 dB)							
PB-AV. CONV. (45 dB)							
ADD'L %							
PB LEVEL							
PB in NOISE							
PB LEVEL							
NOISE LEVEL							
TOL. MAX.	X						
TOL. COMF.							
CLIENT'S OPINION	X						
LOCALZ. SCORE							
TEST LEVEL							

Hearing Aid Recommended:_____

Make Model

Rec. Batt. Tone Ear

Appendix G

CASEWORKER'S STATUS REPORT

#27-3/60

THE INDUSTRIAL HOME FOR THE BLIND

CASEWORKER'S STATUS REPORT
SPEECH AND HEARING PROJECT

Case No: _____ Date: _____

Match No: _____ Client: _____

RATINGS ARE TO BE MADE AS FOLLOWS:

The left column "PRE-EVALUATION STATUS" is to be based upon case materials relating to the client prior to the offering of service in the Speech and Hearing Project. Some of the data may also be restrospective, based upon findings of the caseworker, client and family, as well as other recollections of status prior to offering of service. The latter source of data is to be used only when the original case materials fail to reveal adequate information about the client's status prior to admission to Project activity.

The right column "POST-TREATMENT STATUS" is to be based upon data obtained by the caseworker in interviews with the client, his family, and professional workers. The Post-Treatment period will be considered to have begun at three months after the initiation of treatment for clients who have accepted service and at least three months after rejection of services for clients who have refused service.

PRE-EVALUATION STATUS *Comments*	*ITEM*	*POST-TREATMENT STATUS* *Comments*
	1. MOBILITY	
	a. Independent travel to unfamiliar places, using public transportation.	
	b. Independent travel to familiar places requiring the use of public transportation.	
	c. Independent travel to familiar places outside the home without using public transportation.	
	d. Uses seeing guide for out of home travel.	
	e. Rarely leaves the home. Then uses seeing guide.	
	f. Not able to rate or not applicable.	
	2. EASE OF SOCIAL CONVERSATION IN GROUPS	

PRE-EVALUATION STATUS Comments	*ITEM*	*POST-TREATMENT STATUS Comments*
	a. No problems at all in social group conversation.	
	b. Misses some items of conversation but able nevertheless to maintain connected discourse.	
	c. Misses large segments of conversation, but able to engage in normal frequency of group social conversation.	
	d. Misses large segments of conversation and has consequently had to reduce group conversational activities.	
	e. Misses large segments of conversation. Rarely engages in this activity.	
	f. Not able to rate or not applicable.	
	3. EASE OF COMMUNICATION IN THE FAMILY SETTING	
	a. Maintains typical family pattern of communication, consistent with his personality.	
	b. Has attempted to maintain typical family pattern of communication, but family has withdrawn.	
	c. Has inhibited family communication. Family has tried to maintain usual level.	
	d. Has inhibited much communication with the family and family has inhibited much communication with him.	
	e. Marked reduction in communication interaction between client and family.	
	f. Not able to rate or not applicable.	
	4. PARTICIPATION IN SOCIAL AND RECREATIONAL ACTIVITIES	
	a. Many active recreational outlets in which he takes initiative.	
	b. Many active recreational outlets in which he engages, if motivated.	
	c. There are some active recreational activities which he wants to enter but he is inhibited by his limitations.	
	d. Passive participation in some recreational activities.	

PRE-EVALUATION STATUS Comments	*ITEM*	*POST-TREATMENT STATUS Comments*
	e. Little or no participation in recreation activities.	
	f. Not able to rate or not applicable.	
	5. USE OF IHB PROFESSIONAL SERVICES	
	a. Accepts and uses IHB professional services considered appropriate for him by the agency with high motivation.	
	b. Accepts needed professional services, but with limited motivation.	
	c. Accepts needed services reluctantly.	
	d. Resists offers of professional services considered appropriate by the agency.	
	e. Seeks services agency considers inappropriate for him.	
	f. Not able to rate or not applicable.	
	6. VOCATIONAL STATUS	
	a. Fully self-supporting through his own efforts.	
	b. Partially self-supporting through his own efforts.	
	c. Has realistic plans for becoming partially or fully self-supporting.	
	d. Motivated to become partially or fully self-supporting, but has no realistic plans for attaining the goal.	
	e. Not motivated to become partially or fully self-supporting.	
	f. Not able to rate or not applicable.	
	7. PLANS FOR THE FUTURE	
	a. Has appropriate life goals and plans for achieving them.	
	b. Has appropriate life goals, but indefinite plans for achieving them.	
	c. Has appropriate life goals, but no plans for achieving them.	
	d. Life goals are inappropriate.	
	e. Appears to live from one day to the next without any particular life goals.	
	f. Not able to rate or not applicable.	

PRE-EVALUATION STATUS Comments	*ITEM*	*POST-TREATMENT STATUS Comments*
	8. FAMILY ATTITUDES TOWARD THE CLIENT	
	a. Real acceptance of the client and his disabilities.	
	b. Some acceptance of the client, but limited understanding of his emotional needs.	
	c. Family has a sense of obligation and responsibility, but no real warmth and understanding.	
	d. Family has a degree of tolerance of and apathy toward the client.	
	e. Overt rejection of the client.	
	f. Not able to rate or not applicable.	
	9. ATTITUDES TOWARD HEARING LOSS	
	a. Accepts hearing loss and its apparent irreversibility.	
	b. Acknowledges hearing loss, and is still seeking hearing improvement primarily through physiological means.	
	c. Verbally minimizes the hearing loss.	
	d. Exaggerates the hearing loss.	
	e. Rejects the hearing loss.	
	f. Not able to rate or not applicable.	
	10. ATTITUDES TOWARD BLINDNESS	
	a. Accepts blindness and its apparent irreversibility.	
	b. Acknowledges blindness and is still seeking vision improvement primarily through physiological means.	
	c. Minimizes the blindness.	
	d. Exaggerates the blindness.	
	e. Rejects the blindness.	
	f. Not able to rate or not applicable.	
	11. PHYSICAL COMPLAINTS (OTHER THAN VISUAL AND HEARING LOSS)	
	a. Client expresses practically no symptoms at all.	

PRE-EVALUATION STATUS Comments	*ITEM*	*POST-TREATMENT STATUS Comments*
	b. Client expresses fewer physical symptoms than would be expected at his stage of life.	
	c. Client expresses some symptoms, the number and types of which seem typical for his stage of life.	
	d. Client expresses numerous physical symptoms most of which seem related to real medical conditions.	
	e. Client expresses numerous physical symptoms most of which seem psychogenic.	
	f. Not able to rate or not applicable.	
	12. INDEPENDENCE IN ACTIVITIES OF DAILY LIVING	
	a. Client seems independent in most activities, to a degree consistent with the physical and social factors in his situation.	
	b. Client tries to be more independent than his situation warrants.	
	c. Client depends upon others to a moderately greater degree than would be expected in his situation.	
	d. Client is quite dependent upon others in many areas of living.	
	e. Client is almost totally dependent on others in most areas of living.	
	f. Not able to rate or not applicable.	
	13. USE OF RADIO, TELEVISION, TALKING BOOK, ETC.	
	a. These instruments have an appropriate part in his life despite hearing problems.	
	b. Client spends inappropriately large periods of time in using these devices despite hearing problems.	
	c. Client uses them less often than would be appropriate in his situation owing to hearing problems.	
	d. Client listens to them rarely owing to hearing problems.	

PRE-EVALUATION STATUS Comments	*ITEM*	*POST-TREATMENT STATUS Comments*
	e. Client never listens to them owing to hearing problems.	
	f. Not able to rate or not applicable.	
	14. EFFICIENCY ON THE JOB (LIMITED TO EMPLOYED CLIENTS OR THOSE SEEKING WORK)	
	a. The hearing loss does not constitute a barrier on the job.	
	b. The hearing loss reduces the client's effectiveness in his occupation, but client is still employable in this occupation.	
	c. The hearing loss makes the client ineffective in his occupation. May be employable in another occupation.	
	d. The hearing loss is the primary factor in the client's unemployability in any occupation.	
	e. The hearing loss is not dominant but in conjunction with one or more other factors such as visual loss, age, emotional factors, etc. is rendering the client unemployable.	
	f. Not able to rate or not applicable.	
	15. SAFETY ON THE JOB (LIMITED TO EMPLOYED CLIENTS OR THOSE SEEKING WORK)	
	a. The hearing loss does not in itself constitute a safety problem on the client's job.	
	b. The hearing loss in conjunction with other client limitations tends to create safety problems on the job. However, the client's safety record is still within employability limits without hearing aids.	
	c. Same as b., but with monaural hearing aid.	
	d. Same as c., but with binaural hearing aid.	

PRE-EVALUATION STATUS Comments	*ITEM*	*POST-TREATMENT STATUS Comments*
	e. The hearing loss has been a major factor in rendering the client unemployable on the basis of safety despite hearing aids of all types.	
	f. Not able to rate or not applicable.	
	16. USE OF A HEARING AID	
	a. Accepts a hearing aid and uses it effectively in many life situations.	
	b. Accepts a hearing aid and uses it in some life situations.	
	c. Accepts a hearing aid and uses it to a limited degree.	
	d. Accepts a hearing aid and rarely uses it.	
	e. Client rejects the use of a hearing aid. Never uses it.	
	f. Not able to rate or not applicable.	
	17. CLIENT PERCEPTIONS OF THE LIMITATIONS IMPOSED BY THE SECOND HANDICAP	
	a. Client does not feel that the second loss has materially changed his adequacy.	
	b. Client feels that the second loss has reduced his effectiveness to a slight degree.	
	c. Client feels that the second loss has reduced his effectiveness to a moderate degree.	
	d. Client feels that the second loss had reduced his effectiveness to a marked degree.	
	e. Client feels that the second loss has been catastrophic. He perceives himself as an exceedingly limited person capable of taking part in very few life activities.	
	f. Not able to rate or not applicable.	

Rater: _____