The Hearing Performance Inventory as a Tool in Fitting Hearing Aids

James J. Dempsey
Department of Communication Arts & Sciences
Queens College of C.U.N.Y.

This study investigated the effectiveness of the Hearing Performance Inventory (HPI) in measuring hearing aid benefit, defined as reduction in hearing handicap as a result of amplification. Twenty adventitiously hearing-impaired adults filled out the HPI before and after a six-week interval. During that interval, 10 subjects received personal hearing aids, while 10 comparison subjects did not. The hearing aid wearers demonstrated a significant decrease in hearing handicap for the Understanding Speech and Intensity sections of the HPI; the comparison group demonstrated no significant changes in any of the sections. Use of pre- and post-amplification HPI scores can be helpful in verifying hearing aid benefit and appropriateness of hearing aid selection. Inspection of individual profiles may be useful in planning aural rehabilitation.

Hearing aid benefit has traditionally been determined primarily through aided word-recognition measures (Hodgson, 1981). This approach has been criticized in recent years, as investigators have repeatedly revealed phonetically balanced word lists to be insensitive to small differences in hearing aid characteristics (Beattie & Edgerton, 1976; Jerger, Malmquist, & Speaks, 1966). Other measures of hearing aid benefit, such as functional gain, have been described as limited because they do not provide information regarding aided performance outside the test environment (Oja & Schow, 1984). In order to obtain a more complete picture of hearing aid benefit in real-life situations, the use of self-report questionnaires administered before and after dispensing a hearing aid has been suggested (Owens & Fujikawa, 1980; Tannahill, 1979).

One widely used self-report questionnaire is the Hearing Performance In-

James J. Dempsey, Ph.D. is an Assistant Professor of Audiology in the Department of Communication Arts & Sciences at Queens College of C.U.N.Y., Flushing, N.Y. 11367-0904.

ventory (HPI), first described by Giolas, Owens, Lamb, and Schubert in 1979. The HPI was developed to measure an individual's difficulty in everyday communicative situations. The current version of the HPI consists of 90 items which effectively measure degree of hearing handicap (Lamb, Owens, & Schubert, 1983). Hearing handicap has been defined by a Task Force of the American Speech-Language-Hearing Association (ASHA) as the disadvantage imposed by a hearing impairment on a person's communicative performance in the activities of daily living ("On the Definition," 1981).

Hearing handicap is a result of the interaction of many factors. Among the factors identified by the ASHA Task Force were: (a) present age of the individual, (b) age at the onset of impairment, (c) nature and extent of impairment, (d) the individual's communicative needs, (e) the individual's reaction and others' reaction to the impairment, and (f) the effect of the impairment on expressive communicative ability ("On the Definition," 1981). For adults with acquired hearing loss, the latter three factors are often difficult to determine, but are important in planning an aural rehabilitation program. The HPI has been shown to be useful in measuring such factors (Demorest & Walden, 1984; Lamb et al., 1983).

Understanding of an individual's hearing handicap is important particularly when working with first-time hearing aid users. Reduction in hearing handicap should be a primary goal of those who are fitting hearing aids. The purpose of this study was to determine if hearing aid benefit, which was operationally defined as a significant reduction in hearing handicap, could be detected through two administrations of the revised form of the HPI.

METHOD

Subjects

Subjects were 20 adults with moderate to severe sensorineural hearing loss who were considered to be hearing aid candidates but were not experienced hearing aid users at the outset of the investigation. They ranged in age from 40 to 85 years ($M = 64.5$ years). Their mean pure tone average for 500, 1000, and 2000 Hz in the better ear was 38.3 dB HL (ANSI, 1969). A composite audiogram for all 20 subjects is shown in Figure 1, and represents a variety of audiometric configurations. Six subjects had curves with a precipitously falling slope of 20 dB per octave or more across the frequencies 500 Hz to 2000 Hz. Eight had a more gradual slope of less than 20 dB per octave. Six had flat configurations differing by 5 dB or less at adjacent octaves.

The majority of the subjects (12) decided to have their hearing tested because either they or a family member had noticed progressive hearing difficulties over the past several years. Four others were experiencing specific communicative problems at the work place while the remaining four had failed a free hearing screening and were interested in a more complete description of their hearing sensitivity.

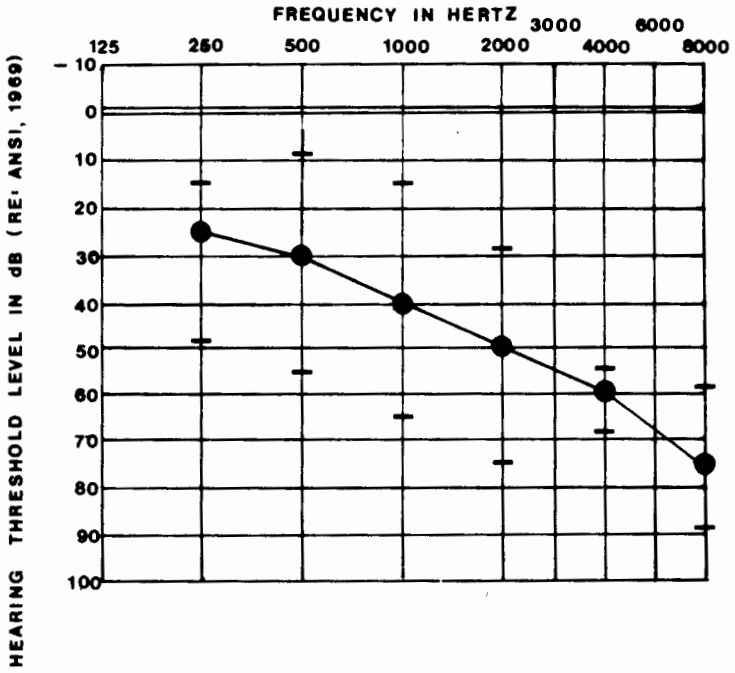

Figure 1. Mean air conduction thresholds (filled circles) and ranges (bars) for the better ear of 20 subjects.

Ten of the subjects (5 male; 5 female) received personal hearing aids as a result of clinical assessment. They ranged in age from 49 to 85 years ($M = 67.7$ years) and had a mean pure tone average for 500, 1000, and 2000 Hz of 41.7 dB HL (ANSI, 1969). The other 10 subjects (4 male; 6 female) formed a comparison group that chose not to obtain hearing aids during the course of the investigation or elected not to pursue amplification at all. The subjects in this group ranged in age from 40 to 83 years ($M = 61.8$ years) and had a mean pure tone average of 41.0 dB HL (ANSI, 1969).

Procedure

The hearing aid evaluation for the 10 subjects who received aids consisted of a comparative (modified Carhart) selection procedure, including aided and unaided word recognition scores as well as frequency-specific measures of functional gain. These subjects received a 30-minute hearing aid orientation when they returned to pick up their hearing aids. This session included instruction on the use, operation, and care of the instrument as well as proper earmold insertion and removal.

All 20 subjects were administered the 90-item revised form of the HPI on two occasions. The first administration was at the end of the initial audiologi-

cal evaluation. The 10 subjects who obtained a hearing aid completed the HPI a second time approximately six weeks after the aid was dispensed. This time interval was chosen because measurement of hearing aid benefit was part of the hearing aid evaluation and the areas in which change was expected — those directly related to amplification — should have been observable within a short time. Previous data have suggested that six weeks or less is sufficient to demonstrate reduction in hearing handicap following hearing aid use (Tannahill, 1979). The 10 subjects who did not receive an aid returned after six weeks and completed the HPI a second time.

A user satisfaction questionnaire was also given to the 10 hearing aid wearers at the time of the second administration of the HPI. It consisted of three questions addressing the hours of daily usage, performance with regard to expectations, and overall level of satisfaction with the instrument. Responses indicated that all subjects in this group were using their hearing aids on a daily basis and were generally satisfied with them.

The HPI attempts to assess the communicative difficulty experienced by hearing-impaired listeners in a wide variety of listening situations (Giolas et al., 1979). A sample question from the section on understanding speech is as follows: "You are with a male friend or family member in a fairly quiet room. Can you understand him when his voice is loud enough for you and you can see his face?" There are five alternative answers for each question ranging from *practically always* to *almost never*. Responses were scored using the conventional HPI technique of assigning numerical values to the five descriptive responses. For example, a response of *practically always* was assigned the numerical value of 1. A response of *about half the time* was assigned the value of 3 and *almost never* was assigned the value of 5. Questions are grouped into sections; average scores were obtained for each section. A section score of 5 suggests maximum difficulty, whereas a section score of 1 suggests very little difficulty in that area. Scores between these two extremes reveal varying degrees of difficulty in hearing. (When an answer of *practically always* indicated a poor response to a communicative situation, the numerical scoring procedure was reversed so that *practically always* received a value of 5, and so on.)

Five sections of the HPI were analyzed: Understanding Speech, Social, Response to Auditory Failure, Intensity, and Personal. A sixth section, Occupational, was omitted from the analysis because the majority of the subjects did not work outside of the home.

RESULTS

Figure 2 contains the mean scores for both administrations of the HPI for the hearing aid wearers. A Friedman 2-way analysis of variance (Madigan & Lawrence, 1982) revealed significant reduction in hearing handicap post-amplification for the Understanding Speech [x^2 (1, $N = 10$) = 6.4, $p < .01$]

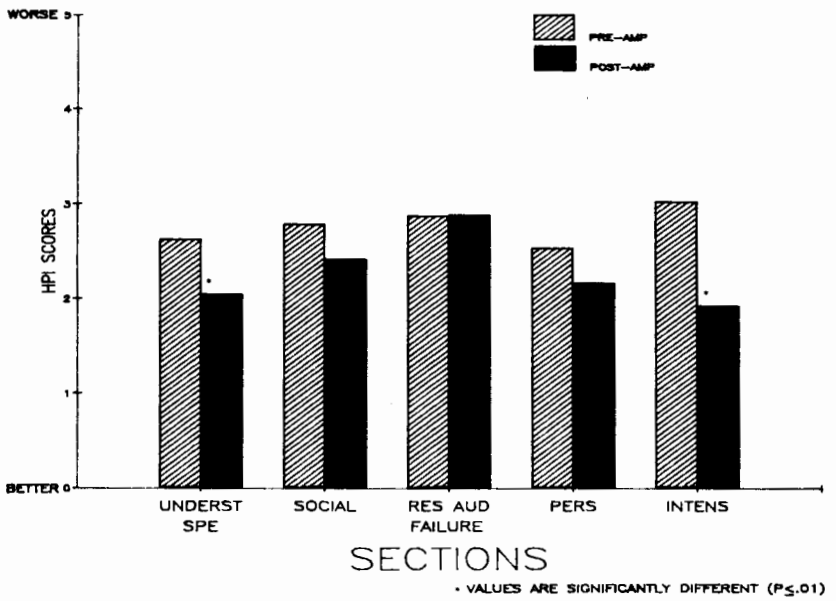

Figure 2. Mean section scores on the HPI, from 10 hearing aid users, obtained before (pre-amp) and after (post-amp) their first hearing aid was dispensed. The section labels are Understanding Speech, Social, Response to Auditory Failure, Personal, and Intensity. A lower score indicates better performance.

and Intensity [x^2 (1, $N = 10$) = 10.0, $p < .01$] categories.

The items in the Understanding Speech section assess comprehension of speech with and without visual cues in a variety of situations. Factors which are varied among items include the talker (male, female, friend, stranger), communicative situation (one-to-one and group), and environmental conditions (quiet and noise) (Lamb et al., 1983). One would expect an improvement in this section due to hearing aid use.

The items in the Intensity section are designed to assess detection of environmental sounds such as soft speech, public address systems, television, and radio, as well as non-speech sounds such as doorbells, music, and ringing telephones. It is logical that amplification would improve ability to detect sounds. A significant change was, therefore, also expected for this section.

Responses to three sections of the HPI were statistically similar before and after initiating hearing aid use. The Social section, comprised of items from the Understanding Speech and the Response to Auditory Failure sections, assesses performance in group conversational situations (Lamb et al., 1983). The Response to Auditory Failure section assesses the frequency of use of compensatory behaviors in difficult communicative situations. These behaviors include informing others of the hearing loss and asking for repetition. The Personal section concerns the subjects' feelings regarding hearing impair-

ment.

Figure 3 contains scores for both administrations of the HPI for the comparison group. A Friedman 2-way analysis of variance revealed no significant change in hearing handicap for this group ($p > .05$).

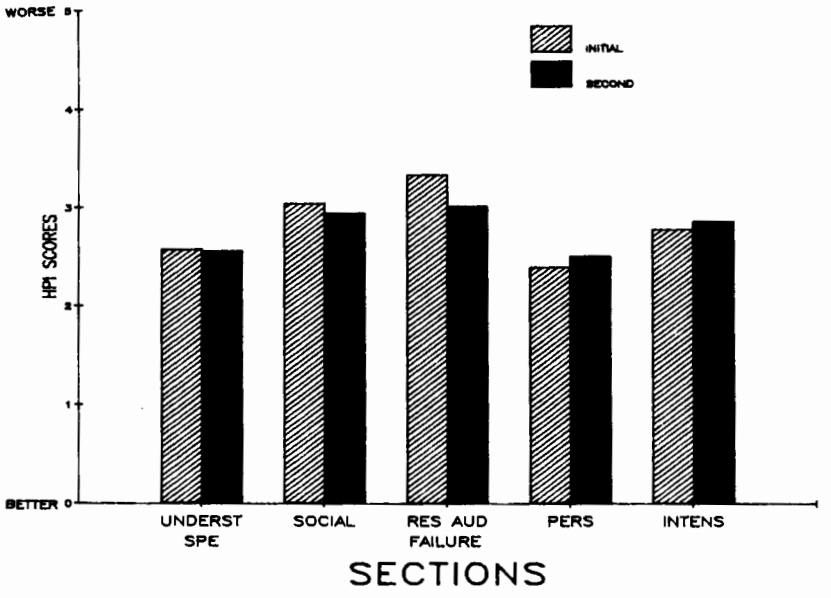

Figure 3. Mean section scores on the HPI, from 10 comparison subjects who do not use hearing aids, administered on two occasions six weeks apart. The section labels are Understanding Speech, Social, Response to Auditory Failure, Personal, and Intensity. A lower score indicates better performance.

DISCUSSION

Although statistically significant differences in HPI scores were demonstrated by the hearing aid users, the question remains whether the differences are clinically important. Owens and Fujikawa (1980) have suggested that examination of individual HPI data may be useful in evaluating hearing aid benefit. The pre- and post-amplification difference scores for the 10 hearing aid users were therefore inspected to see how many subjects demonstrated reduction in hearing handicap and to what degree. Table 1 contains the difference scores (pre-amplification minus post-amplification) for each of the five sections of the HPI for each subject.

Examination of Table 1 reveals a great deal of intersubject variability; however, for half of the group (Subjects 1, 4, 6, 7, 8) responses to questions about Intensity changed the most after hearing aid use. Subjects 4 and 10 responded much more positively to auditory failure with their hearing aids, while Subject 2 responded more negatively. Another large negative change

Table 1

Difference Scores (Pre-Amplification minus Post-Amplification) for Each of the Five Sections of the HPI for Each Hearing Aid Wearer

Subject	Understanding Speech	Social	Response to Auditory Failure	Personal	Intensity
1	0.83	0.19	-0.62	0.17	1.27
2	0.27	0.19	-2.19	-0.16	0.46
3	1.29	0.89	-0.44	0.60	0.90
4	0.49	0.42	1.07	0.83	1.08
5	0.41	0.00	-0.55	-0.17	0.21
6	0.87	0.55	0.50	0.67	2.04
7	0.81	0.73	0.50	1.33	1.72
8	0.41	-0.02	-0.77	0.66	1.46
9	-0.20	-0.24	-0.02	1.00	0.62
10	0.45	0.96	2.30	-1.33	1.09

was experienced in feelings toward hearing impairment (Personal) by Subject 10, despite her perception of improved response to failure. Subject 10 explained that, although she was more likely to use compensatory behaviors during a communication breakdown since acquiring her hearing aid, the awareness of the presence of the instrument by herself and others had intensified her bad feelings regarding her hearing loss.

For only one subject (Subject 5) was the HPI insensitive to hearing aid benefit, indicated by a lack of large change in any area. Subject 5 was also the least satisfied of all the hearing aid users. Her in-the-ear hearing aid was returned to the manufacturer for modifications on two occasions following completion of the investigation. Her initial hearing aid fitting was, therefore, the poorest among the 10 hearing aid users.

Understanding speech was the greatest measured benefit for Subject 3, while Personal feelings was the area of greatest benefit for Subject 9. Subject 3 was interested in pursuing amplification because of job-related communication difficulties and his high motivational level may account for his improvement in understanding speech. Subject 9 was very pleased with her hearing aid fitting from the cosmetic standpoint, possibly explaining her improvement in her feelings regarding her hearing loss even though improvement in the other sections was not dramatic.

Thus, group mean section scores may obscure individual differences in response to hearing aid use. When examined individually, 9 of the 10 hearing aid wearers experienced real change in at least one of four areas. For this group, there was little awareness of Social change (communication in groups). Demorest and Walden (1984) have shown significant change in HPI scores for the Social section before and after amplification with a time interval ranging from 90 days to 15 months. The lack of self-reported improvement in

group communicative settings demonstrated in the present study may therefore be related to the short time interval between administrations of the HPI.

For most of the group, the scores for the Social, Response to Auditory Failure, and Personal categories showed small amounts of positive or negative change which were obviously not clinically significant. Although 9 out of 10 subjects showed some degree of positive change for the Understanding Speech section, only four of these subjects demonstrated a change of more than half a step. On the other hand, all subjects showed positive changes for the Intensity section, with 7 out of 10 subjects demonstrating change of 0.90 or more. The Intensity section appears to be of primary importance when looking at aided versus unaided performance.

As Demorest and Walden (1984) have pointed out, it is important to demonstrate that a self-report procedure, such as the HPI, can detect change where it is reasonable to expect that change will occur. The results of the present investigation revealed important changes in hearing handicap for most of the hearing aid users for questions directly related to amplification (Intensity). What may be unexpected is the particular area that is sensitive to changes in a given individual.

The lack of statistically significant change for the aided group in the sections concerning Response to Auditory Failure and Personal feelings suggests that more intervention is necessary beyond providing individuals with amplification. Specific strategies may need to be discussed and practiced in the clinic to increase the number of compensatory behaviors utilized or to improve a client's feelings about his/her hearing loss.

The lack of change in the comparison group as shown in Figure 3 is also important and expected. These results substantiate previous work which has shown the test-retest reliability of the HPI to be high (Demorest & Walden, 1984) and support the contention that hearing aid use was an important factor in the change in HPI scores for the hearing aid wearers.

Pre- and post-amplification administration of the HPI may also prove useful with the dissatisfied hearing aid user. Analysis of the sections that do not reveal positive change, especially Intensity, may help to pinpoint specific sources of difficulty for these individuals. As shown in Table 1, most of the 10 subjects showed a relatively large reduction in hearing handicap for this section following the introduction of amplification. The Intensity section of the HPI may help to verify the goodness of fit of a particular hearing aid. This notion is supported by the data from Subject 5, who showed the smallest amount of change for the Intensity category and had a poorer hearing aid fitting than the other subjects, requiring major modifications to her aid.

Individual subject profiles can also be useful in planning a specific aural rehabilitation program. An example profile is shown in Figure 4. Figure 4 displays the scores on subscales of the Response to Auditory Failure section for Subject 2. This subject demonstrated small positive changes in all but the Response to Auditory Failure category in which his reported behavior dete-

riorated dramatically following the use of amplification. As is shown in Figure 4, after obtaining his hearing aid, this subject was less likely to inform others of his hearing loss or ask for repetition. This subject perhaps relied too heavily upon his hearing aid and refrained from using the compensatory behaviors he had utilized in the past. This hypothesis was confirmed through personal interview and subsequent counselling dealt with more realistic expectations regarding amplification.

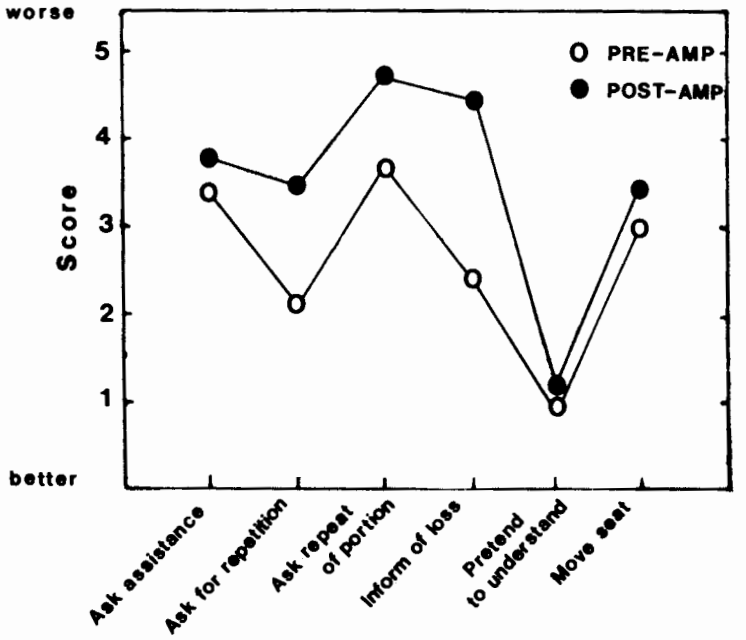

Figure 4. Mean scores on the subscales of the Response to Auditory Failure section of the HPI for Subject 2. The open symbols represent the scores before hearing aid use (pre-amp) and the filled symbols represent the scores after a hearing aid was dispensed (post-amp). A lower score indicates better performance.

Use of the HPI before and after dispensing a hearing aid appears effective in measuring reduction in hearing handicap and aiding in evaluating goodness of fit of the hearing aid. A question yet to be answered is whether changes in hearing handicap are maintained or enhanced over a period of time. In addition, the use of individual profiles obtained from the HPI may be valuable in planning aural rehabilitation.

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