Report of the ARA Committee on Hearing Aid Evaluation Procedures*

Mark Ross

University of Connecticut

Hearing aid evalutions is a vast topic and it behooves me to define what my limited objectives are in this paper. I don't think, for example, that we can adequately perform hearing aid evaluations, however we do it, if we do not incorporate an assessment of the communicative handicap imposed by the hearing loss, if we do include personal and perhaps family counselling, and if we do not routinely schedule a number of follow-up appointments so that we may be apprised of developing difficulties and be able to judge the efficacy of our efforts. Though these areas are, or should be, an integral component of hearing aid evaluations, they are outside the scope of my presently limited objectives. I shall be directing my attention specifically to the procedures we use in selecting one particular aid out of a formidable array of others for the use of one particular client.

Most of us, I expect, are somewhat familiar with the vast proliferation of literature which has developed on the topic since Carhart described his procedures in 1946. We must also be aware that in spite of all this literature, and just maybe, at least in part, because of it, we are not further ahead in reaching a professional consensus than we were at that time. Generally speaking, most clinics are still following roughly the same procedures developed during World War II, with, however, an increasing number of personal variations superimposed on the basic theme (Burney, 1972).

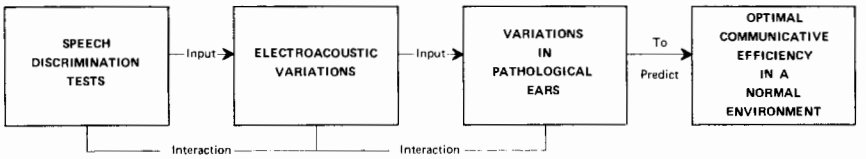

Figure 1. Model of Behavioral Hearing Aid Evaluation

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Our task in a conventional hearing aid evaluation is schematically depicted in Figure 1. By administering one more speech discrimination measures under a variety of possible test conditions, through a limited sample of a vast array of possible electroacoustic variations, to a client who exhibits a unique configuration of psychoacoustical capacities, we are supposed to predict which particular electroacoustic system will result in the optimal communicative efficiency under normal environmental conditions. Put this way, it is easy to get discouraged. The situation, however, is far from hopeless. I think we know a lot more than we realize; certainly we know more than we routinely put into practice.

Take our problem with speech discrimination tests. In one recent count (Northern and Hattler, 1974), 31 different types were reported in use, with no evident standardized method of presentation and scoring. Clinics and people appear to be "doing their own thing", with procedures apparently being dictated by convenience and inertia rather than the evidence. No matter what speech discrimination test we use in a hearing aid evaluation, we can increase its usefullness if we bear in mind the following, rather simple, points:

1. Recorded, rather than live-voice, presentations whenever possible. Audiologists seem to be incapable of just sitting in a control room while recorded lists are being played; there seems to be a need to "get into the act," and be "involved." I suggest that we learn to curb our impatience, and console ourselves with the thought of the increased reliability of our test results due to recorded presentations.

2. Routine administration of the speech discrimination tests in the presence of competing signals. I think that we are all aware that by administering our speech discrimination tests in the presence of a competing signal, we can increase the sensitivity and resolving power of our test material. A wider dispersion of scores is seen, which are presumably reflecting variations in electroacoustic dimensions not apparent when the tests are administered in quiet. We also increase the face-validity of the test situation, which, until something better comes along, is a benefit we shouldn't sneer at.

In this regard, I think one of Carhart's original procedures has potential which has never been fully explored. In it, discrimination in noise was tested by keeping the speech signal constant at a comfort setting, while the noise level was varied around the constant speech signal. The subject's task was to report when the noise level permitted the speech to be barely intelligible. It's a nice procedure. Subjects can be asked to assume a clearly defined strategy in which they report when the noise either just masks or just permits speech intelligibility, and variations between aids can be expressed as a Masking Level Difference (MLD). That is, some aids may be able to withstand higher levels of noise than others in

meeting the same intelligibility criteria; presumably any differences between aids reflect unique interactions between the external and different hearing aid characteristics. In spite of the many years intervening since this procedure was first described, I don't know of any research literature on the topic.

3. We should require written, rather than oral responses from clients as often as we can (Nelson and Chaiklin, 1970). Each time we take an oral response from a subject, we have intruded ourselves as still another variable in a situation which has enough of them as it is. Taking written responses is particularly important when tests are administered under competing noise conditions; I don't think any audiologist can guarantee error-free scores to a client's speech while listening to it under adverse acoustic conditions. Yet how many audiologists routinely do it just this way!

4. I see very little merit in equalizing the sensation level of speech tests across all the hearing aids being evaluated during a comparative procedure (Millin, 1975). We should rather, I think, administer our tests at the same hearing level for all the different aids, using at least one level which approximates average speech intensity, about 45 dB hearing level, and possibly two other levels as well, representing soft and loud speech. The performance/intensity function obtained with different aids can greatly assist our decision regarding a specific aid. In this regard, I would not consider the evaluation procedure to be complete until one is assured that moderately loud speech does not arrive at a client's ear at levels exceeding his threshold of discomfort.

5. The location of the typical loudspeaker arrangement should be questioned. Some time ago, during the affluent period in our society, clinics could afford to have two rather than one loudspeaker in our test rooms. Having them, we then arranged to locate them one on each side of the patient, who was instructed to face straight ahead. We all know how much research and new terms this arrangement generated. Now while it is true that occasionally speech does arrive at a patient's ear from one side or another, for the most part the hearing impaired listener is facing the person who is talking to him. Certainly this is what he tries to do, and this is what we instruct our client's to do during counselling and rehab sessions. What we should do, in my estimation, is locate the primary loudspeaker directly in front of a subject, with two other secondary speakers located directly to the right and left delivering two non-correlated competing signals. And if we only have two speakers, I suggest we seriously consider suspending the secondary speaker directly above the client's head—well attached, of course—which will place the client directly in the center of the cone of sound.

6. We have, as I mentioned earlier, a large number of speech discrimination tests to select from, and we seem to spend a lot of our time bemoaning the inadequacy of whatever tests we select. In addition to suggestions already made, we can increase the usefullness of some of our speech discrimination tests by using a procedure being developed by my colleague at the University of Connecticut, Ken Randolph. In addition to scoring a response right or wrong, he asks his clients for a confidence rating, that is whether they thought their answer was right or wrong. Some very interesting patterns emerge when one scores patient responses in this manner. For example, one can observe subjects who obtain similar objective discrimination scores across several aids, but whose confidence rating indicates that for some aids they did a lot of guessing, while for some others they were quite sure when they were and were not correct in a response. We can, with this method, increase the sensitivity of our scoring procedure with no additional investment in time and with the added bonus of increased insight into a patient's communication strategies.

7. One of the themes throughout the suggestions I've made so far deals with increasing the face-validity of the test situation. It follows from this that we should also include sentence material in hearing aid selections, of the type which requires comprehension of the intended message rather than the reproduction of the words themselves. As long as the task requires evaluation of the relative performance of an individual across different hearing aids, variations in the linguistic competencies among different people is not a confounding variable. Sentences have other advantages too, in that they can be mutilated by reverberation, filtering, interruption, etc., more realistically than words or nonsense syllables can. I am not suggesting eliminating analytic tests, since these can more effectively pinpoint discrimination problems and therapy objectives—just that we explicitly keep in mind our major goal, and this can best be assessed, it seems to me, with sentence intelligibility tests requiring message comprehension rather than word discrimination.

Finally, I think that the profession has to redefine its purpose in hearing aid evaluations in terms of selecting the most appropriate electroacoustic system for a particular individual rather than selection of Brand X over Brand Y. We have not really explored the potential of an electroacoustic method of hearing aid selection. Because of time limitations, I will not be able to analyze this topic in detail here, though I think this offers us more possibilities for progress than the traditional methods do. In an electroacoustic method of hearing aid selection, we are concerned with the pattern of sensation levels across frequency produced by the amplification device to an input contoured to approximate a speech signal. All behavioral measures, such as comfort, discomfort, stapedial

reflex thresholds, and all the electroacoustic outputs can be expressed on the same graph in terms of the SPL developed in a 2 cc coupler or, and maybe even preferably, we can measure these dimensions in the sound-field and obtain a more valid estimate of their status on the specific person (Pascoe, 1975).

In Figure 2 one can see hearing loss plotted on an SPL scale, with the supra-threshold judgements of comfort and discomfort expressed across frequency on the same scale. The sensation levels across frequency produced by two different inputs, are plotted on the same reference level; all behavioral and electroacoustic responses are expressed in terms of the sound-pressure developed in a 2 cc coupler.

In summary, it seems that much of the criticism of hearing aid evaluations is unfounded, reflecting not on the available information, but on our unwillingness to take advantage of it. Unfortunately, this has been an area which never received a long-term research committment by some facility, in which an integrated and sequential series of clinical projects could be undertaken, each one logically progressing from preceding ones. We have had, rather, a large number of discrete and isolated projects around the country, the main purpose for which appears to be meeting the requirements of higher academic degrees rather than the advancement of applied knowledge. Hopefully, the Academy of Rehabilitation Audiology, through its efforts, will improve this situation.

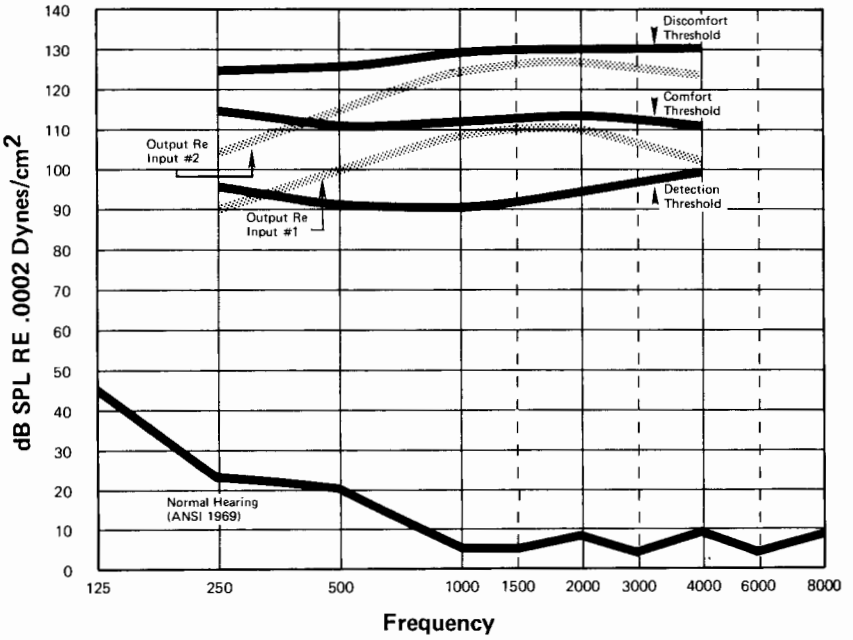

Figure 2. Behavioral measures plotted in terms of SPL

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