An Application of the Scientific Approach To Hearing Aid Fitting

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A common intention of hearing aid fitting procedures is to select an electroacoustic system which will maximize a client's communicative abilities under everyday listening circumstances. Often implicit in this intention, although less commonly explicit and implemented, is that the hearing aid fitting is only a component of a larger hearing rehabilitation and utilization plan.

A hearing rehabilitation and utilization plan, although not to be specifically dealt with in this paper, encompasses among other things determination of hearing aid candidacy, consideration of client imput, assessment of communication handicap, counselling, development of a needs assessment design, implementation of intervention and monitoring of success, as well as hearing aid fitting per se. In other words, whether or not a client will ultimately benefit from an audiological consultation depends on factors other than the hearing aid. Nonetheless, it cannot be denied that the philosophy and methodology used to fit the aid often sets the stage for successful hearing rehabilitation and utilization, or failure.

Hearing aid fitting practice in this country has been dominated by a rationale and methodology proposed in 1946 by Carhart. The goal of this strategy is the determination of the best hearing aid fitting for a client, from among a limited sample of a vast array of electroacoustic variables, by making a variety of aided listener comparisons. Almost since it was proposed, this strategy has been regularly criticized in the literature for the inadequate reliability and validity of the electroacoustic and psychoacoustic measurements that it employs (Chial and Hayes, 1974; Millen, 1975). As a result of these inadequacies often only the least effective of a group of pre-selected hearing aids are removed from fitting consideration and only gross differences in hearing aid electroacoustic performance and related plumbing acoustics

can be used as the bases for determining the best hearing aid fitting.

In spite of these well known deficiencies, the use of this strategy persists. In 1972, Burney found 84.7 percent and in 1978, the ARA Committee on Hearing Aid Fitting Procedures identified 81.1 percent of the respective sample clinics using some form of the comparative strategy. There appears to be a paradox between the research literature and clinical practice which should be of immediate concern to anyone involved with hearing aid fitting. Of course, many audiologists have demonstrated concern over this paradox by producing endless modification of the psychoacoustic and electroacoustic measurements cited earlier as the genesis for the unreliability and invalidity of this fitting strategy. We can easily recognize efforts such as use of sentence length speech material, use of recorded rather than live voice presentation of speech, use of an ear simulator rather than the standard 2 cc acoustic coupler, use of an objective patient response, use of speech competition during aided speech testing and many more, as legitimate efforts to make the comparative strategy work. Indeed, a recent ARA Committee on Hearing Aid Fitting Procedures survey showed modifications like these in more common use. We must be realistically aware, however, that these kinds of modifications have not resolved the paradox and the prognosis for them accomplishing this feat is poor.

It is my contention that we have been unsuccessful in improving the inadequacies of the comparative strategy for good reason. We have been attempting to mend the reliability and validity of an approach which singularly defies the application of science in the clinic. The defiance relates to the specificity of the goals that each audiologist sets for the hearing aid fitting, the hypotheses generated to achieve the goals and tests of the hypotheses.

As you recall, the underlying goal of the comparative strategy is to determine the best hearing aid fitting for a client. This goal lacks specificity and is sufficiently vague so that each audiologist can subjectively define it differently. I suspect this definition is made in a way which will maximize achievement of the goal. Afterall, achievement is a psychologically and economically positive stroke. For example, an audiologist may choose to define "the best hearing aid fitting" as the one which produces the highest monosyllabic word score over a range of message-to-competition ratios. Concerns about reliability and validity aside, judicious pre-selection of aids and comparison of aided listener performance will likely result in the selection of an aid which will permit the audiologist to achieve the goal.

It should be noted, however, that how and why the goal was achieved is unclear. This is true because specific hypotheses and empirical tests of the hypotheses are conspicuously missing from the strategy. Indeed, specific hypotheses would be difficult to unambigously implement and be virtually untestable. In a like manner, the how and why of the goal not being achieved is not clear. The usual recourse is simply to add hearing aids to the comparison until the goal is achieved.

It appears, therefore, that the comoparative strategy is popular in clincial practice, because of convention and clinician inertia, but mostly because it has characteristics which virtually assure goal achievement. Among the most important of the characteristics are the following (1) goals of the strategy can be imprecise and vague, (2) hypotheses, when present, can be indefinite, (3) the goals can be very subjective and are often defined in ways which maximize chances of achieving the goals, (4) the strategy provides for no practical way of empirically testing the relationship(s) of goals and hypotheses to actual client performance (Figure 1.).

These characteristics, as well as the formidable inadequacies with regard to reliability and invalidity cited earlier, make application of a scientific approach to the comparative hearing aid fitting untenable. For this reason, the comparative strategy is not rigorous enough for the purposes of accountable and knowledgable hearing aid fitting and should be radically modified or abandoned altogether.

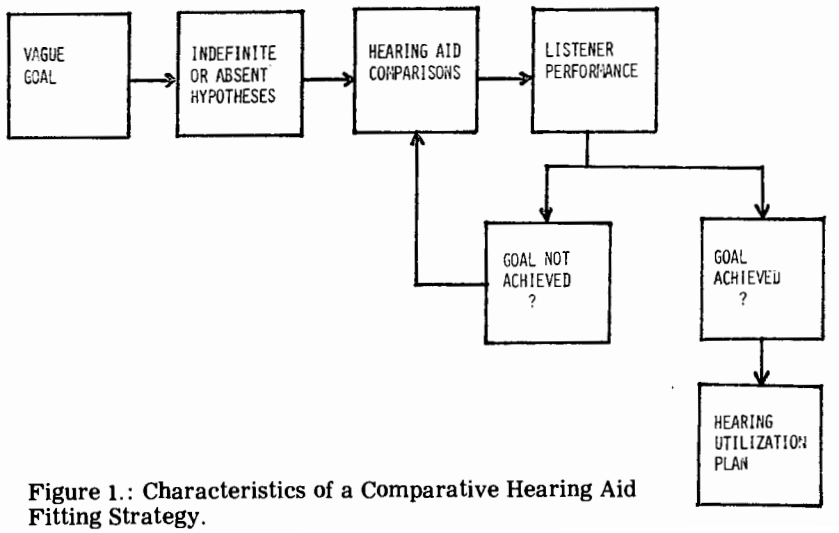

Figure 1.: Characteristics of a Comparative Hearing Aid Fitting Strategy.

A systematic application of the scientific method to hearing aid fitting is long overdue. The salient features of a scientific strategy for the fitting of hearing aids might include the following characteristics: (1) specification of as specific a goal as possible, (2) formulation of a hypothetical means for achieving the goal, (3) deduction of the consequences of the hypothetical means and consideration of current research results, (4) deduction and reasoning may lead to reformulation of the hypothetical means or revision of the goal, (5) empirical tests can be made relating the goals and hypothetical means to actual client performance, (6) specific revisions in hypotheses and goals can result from the empirical testing (Figure 2.).

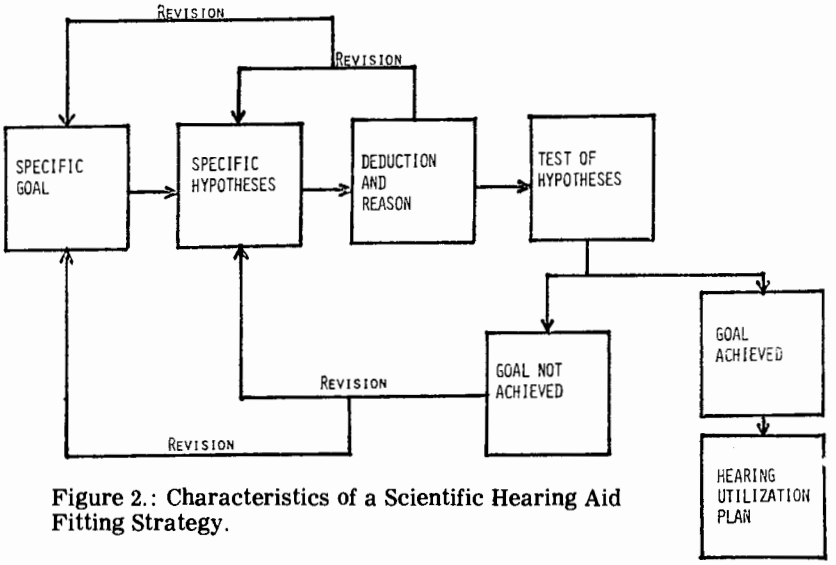

Figure 2.: Characteristics of a Scientific Hearing Aid Fitting Strategy.

A scenario of the application of this kind of fitting strategy may help to clarify the concept. An audiologist might choose selective amplification based on the speech spectrum as a goal for a client. The hypothetical means for establishing the gain, frequency response and SSPL required for selective amplification might include using formulae composed by the audiologist. Deduction and reasoning by the audiologist might include consideration of current research results. This process could result in a conclusion to test the formulae, modify the formulae or accept established formulae such as those proposed by Bryne and Tonnison (1976) or Berger, et. al. (1977). The selected formulae could then be applied and a prediction of the clients functional performance ascertained. The values derived from the formulae could then be matched with electroacoustic systems and a system dispensed to the client. Determination of the client's functional

performance with the amplification system and a comparison with the predicted functional performance would provide an empirical test of whether the formulae selected were adequate to meet the goal. If the goal is not met, systematic modifications in the formulae or a revision in the goal is indicated. If the goal is met, empirical evidence exists to argue for the use of the amplification system in the overall hearing rehabilitation and utilization plan.

Of course, there are many goals and hypotheses which could be made, tested, accepted, altered or discarded. Several goals might be formulated for a single client and decision packages constructed on which to make judgments as to the best utilization of hearing.

In summary, we are long overdue in implementing a scientific strategy for hearing aid fitting. The strategy is specific and rigorous enough to provide accountability for the decisions we make and flexible enough to allow us to quickly test or modify new hypotheses as they occur.

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