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A NEW HEARING MEASUREMENT SCALE

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Introduction

This paper describes the rationale, content and field testing of a Scale, which is a questionnaire, for measuring hearing loss among people suffering occupational chronic acoustic trauma. The new Scale (Noble, 1969) has been created because existing methods do not provide the complete picture of hearing loss as we see it.

The first aspect of hearing loss is reduction in the ability to perceive speech. There may be two modes of speech hearing, participatory and non-participatory. One is conversation where the listener can influence the speaker's behaviour by altering his own. The other is, for example, where the listener is in an audience and cannot influence the behaviour of the speaker.

The second aspect of hearing loss is reduction of the functions of detection and location of sound. These functions are specifically auditory, unlike most speech perception which combines an auditory with a visual task. In location are the twin abilities of distance and direction perception of which the latter is probably the more important.

The third aspect of hearing loss, particularly in people with cochlear lesions like chronic acoustic trauma, is additional dysfunction - in contrast to reduced ability. One dysfunction is tinnitus and another is recruitment (perhaps giving rise to distortion of sound).

The Hearing Measurement Scale

It is clear that a multilateral approach is needed for the assessment of hearing loss as thus defined. Existing methods of hearing measurement can be used to measure individual aspects of

hearing loss but there is no unified method which covers the whole picture.

A questionnaire is the obvious design for a multilateral method of hearing loss assessment. This is not a novel idea: Silverman, Thurlow, Walsh and Davis (1948) and High, Fairbanks and Glorig (1964) devised questionnaires for measuring hearing loss. Both studies used subjects with predominantly conductive lesions and we are doubtful whether either instrument can be applied to people with sensori-neural defects. Blumenfeld, Bergman and Millner (1969) applied the questionnaire of High, Fairbanks and Glorig to people with presbyacusis. Their results show that the latter's questionnaire is an uncertain measure in such a population. Furthermore, neither of the previous questionnaires covers hearing loss as it has been described above. It was necessary, therefore, to devise a new instrument whose content reflected our concept of hearing loss and which was valid for those with chronic acoustic trauma.

The final form of the present questionnaire, entitled the Hearing Measurement Scale, comprises 42 scoring items plus several ancillary questions cast into seven sections. One section is on speech hearing, both participatory and non-participatory, covering face-to-face and group conversation, conversation at work, listening in an audience, listening to television, radio and film. A second section is on the detection of non-speech sounds, such as domestic noises (the tap running, the clock ticking). A third section is on the perception of direction and distance of speech and non-speech sounds. A fourth section is on distortion of speech and a fifth is on tinnitus and its effects.

There are a further two sections in the Hearing Measurement Scale: one on the emotional response to hearing loss, the other on personal opinion of the subject about his hearing. These two were included, along with certain items in the tinnitus section to measure hearing handicap, a function we define as the response of the sufferer to hearing loss.

The scoring of responses varies from item to item according to the importance of each item for the measurement of hearing loss. Judgements about relative importance were made by a group of five experts, first independently and then in conference. The Scale is designed for interview rather than paper-and-pencil use and the following examples illustrate the form of enquiry:

"Do you ever have any difficulty hearing in the conversation when you're with one other person when you're at home?"

Scoring on this item is five-point ranging from "never" to "always". Response categories are not read out to the subject. His response can be clarified by a follow-up question, such as:

"When you say (sometimes) do you mean half the time, most of the time, or rarely?"

At other times the questioning is more direct:

"Do you ever turn your head the wrong way when someone calls out to you?"

"Do you ever give the wrong answer to someone because you've misheard them?"

For the most part, however, the questions invite the subject to project into a series of standard, everyday events and circumstances and judge his capability in each.

Results Using the Scale

A reliability estimate of the Scale was made from a repeated application after six months in a group of 27 foundrymen aged 45 - 65 with between 15 and 40 years experience in the industry. The correlation coefficient between the two series of total Scale scores was .928 (Spearman) as against a correlation of .846 (Spearman) obtained from pure tone testing at 1 - 6 KHz in the same group after the same time interval. No significant change was observed in mean scale score or pure tone acuity between applications.

The reliability sample results provided evidence of the Scale's validity as a measure of hearing loss. The sample was made up of 13 moulders, 8 grinders and 6 chippers. These subsamples were of similar ages and had had similar years of employment in their various jobs. It was found that the mean Scale scores in each subsample were in accord with the mean noise immission levels (Robinson, 1968) derived from sound level measurements and exposure durations. The distribution of scores was significant below the .01 level of probability.

From the responses of the reliability sample and of a further sample of 46 foundrymen, the nature of hearing loss due to chronic acoustic trauma can be described. The principal finding is that

the term 'hearing loss', with its connotation of reduced ability to receive sound, is inapplicable to those with acoustic trauma. This condition is characterised by disorder of hearing, not loss of hearing. For the most part the sounds of the everyday world can be heard, the problem is lack of ability to organise these sensations.

In participatory speech hearing the presence of background sound, while an important feature, seems to have less effect than the size of the group engaged in the conversation. Lip-reading ability is a fairly common feature amongst these people, necessitated mainly by the working environment. It is probably that in conversation with one person, lip-reading is used to a considerable extent - particularly in noise. Lip-reading will be less effective when in a group because not every speaker will be in full view. With favourable acoustics and where visual cues are present (as in certain non-participatory speech situations like television viewing) little or no difficulty is experienced.

Disorganisation is exemplified again in the often gross inability to locate the direction of sound. Were this accompanied by loss of ability to detect signals, a greater awareness of impairment would be apparent. As was stated, however, such loss is not much in evidence. Another factor of importance is that the growing disorder is experienced by the working group and not by isolated individuals. Each man compensates increasingly for his fellows both in and out of work, and so knowledge of any handicap is held in abeyance.

The method of assessing the degree of hearing loss or hearing disorder as it would more properly be termed, is described in detail by Noble (1969). The procedure is to compare the responses of occupational groups with those of a group of people recognized as being disabled, namely, out-patients at a hearing aid clinic. These clinic patients have been selected on the basis of age and diagnosis to match, as well as possible, the industrial samples we have studied. Results so far show that of the 27 foundrymen refered to earlier, 12 had Scale scores greater than the 10th percentile of clinic scores. Of 12 weavers, three had scores in excess of this level. A study of a group of drop forgers is currently being conducted and the results of this will be presented to the symposium.

The aim of our work using the Scale is, first, to relate environmental measurement to the incidence of hearing disorder and secondly, to enlarge on the clinical picture of chronic acoustic trauma with especial note of whatever features are peculiar to different types of industrial population.

References

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