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SOME INDIVIDUAL FACTORS INFLUENCING AUDIOMETRIC PERFORMANCE

by

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Measures of individual audiometric thresholds may be influenced by the personalities of both tester, testee, and by the interaction between these two. These personality factors will attain varying importance according to the method of testing and the subject population involved.

The bias introduced by the tester is largely due to judgemental factors involved in his selection of a criterion for threshold designation. A number of studies have been made on the influence of the tester on the auditory threshold measures, but the results have been somewhat variable due, presumably, to the sample considered, and perhaps the particular technique used for threshold determination. The precise influence of the tester may only be effectively assessed by a careful repetitive experiment of the nature of that described by Delany (1970). It should entail a range of audiometricians making repeated threshold measures on a group of experienced subjects. Observer effects have been found in a wide range of psychological experiments and have been discussed recently by Rosenthal (1969).

The problem of the personality of the audiometrician may be eliminated in Békésy audiometry, provided that standard written instructions are issued to each subject, so eliminating differential encouragement from the testers. Personal variability in assessment of the results may be simply eliminated by the result cards being read by at least two independent observers, with a further check in the case of discrepant results.

With the development in recent years of the averaged evoked response technique (A.E.R.) which measures the average change in the electrical activity of the brain evoked by repeated auditory stimuli, it might have been hoped that the individual factors involved in auditory measures would be eliminated. Unfortunately, although this is an objective measure in that it requires no direct cooperation from the subject, it is not entirely free from variability. Interpretation of the records is often difficult and dependent very much on the judgement of the experimenter. Even tester bias is not eliminated in that an enthusiastic experimenter may encourage a high level of arousal in the subject, and Wilkinson et al (1966) have shown that the size of the $P_1 - N_1$ complex may be affected by the level of arousal of the subject. This complex is the main constituent of the waveform obtained in the averaged results, and may be measured to provide an indication of the response.

The audiometric threshold results obtained are more obviously influenced by the personality of the subject than that of the audiometrician. Russian studies, discussed by Gray (1964), have maintained that individuals with a "weak" nervous system have more

sensitive auditory thresholds than those with "strong" nervous systems. This has also been postulated by Eysenck (1967) who maintained that introverts should have a more sensitive threshold than extraverts, advancing a limited study by S.L. Smith (1968) in support of this. Subsequent studies, using forced choice techniques with 38 naval ratings at Cambridge (Stephens 1969), using both manual and Békésy audiometry on 70 suburban housewives in Teddington, and a study by Bryan et al in Salford on 178 members of the University staff have all failed to elicit any significant relationship between introversion and the threshold of hearing in normal hearing subjects. It thus seems unlikely that there is any important direct effect of introversion on the absolute auditory threshold, although learning factors in repeated threshold measures in which introverts show a greater learning effect than extraverts will undoubtedly influence the results of repeated auditory testing. Fig 1 shows the results of the learning effect found in a small study by the author on Békésy thresholds.

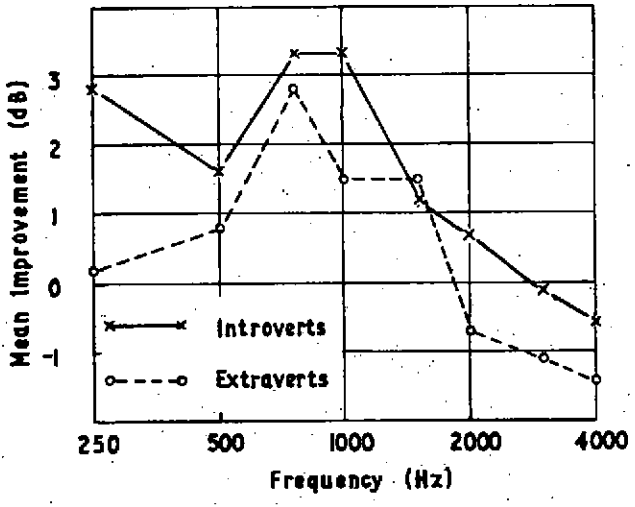

Fig.1 Learning effect in Békésy audiometry

The study by Stephens (1969), using signal detection techniques, separated the components of threshold variance into detection and judgemental factors. In 38 subjects it was found that neuroticism influenced the intertest judgemental variance, and that extraversion affected the detection variance. (In a further experiment on the variability of pure-tone thresholds in a background of 60 dB white noise, which is essentially a detection task, the mean variance for eight frequencies from 250 to 4000 Hz was significantly smaller in a group of introverts than in a comparable group of extraverts). Thus the neurotic extraverts exhibited the greatest overall variance and the stable introverts, the least. This study suggested that any improvement in auditory threshold reliability by the use of detection techniques would be confined to neurotic subjects.

In Békésy audiometry, the subject controls both the attenuation and amplification of the stimulus so that his personality might be expected to have a greater influence on the results than in manual audiometry in which he merely makes a simple yes-no decision. Shepherd and Goldstein (1968) have indeed shown the threshold excursion obtained with continuous Békésy stimuli to be related to the

anxiety, depression and defensiveness scores of the subject as assessed by the Minnesota multiphasic personality inventory (M.M.P.I.) This may be at least partially related to the reaction time of the subject, and both Reason (1968) and Russian workers have shown the auditory reaction time to be influenced by personality. In an unpublished study of the Békésy excursion in 13 experienced subjects under various conditions, analysis shows that any particular subject has a characteristic excursion size regardless of frequency and the presence or absence of background noise.

While there remain a few people who would question this, the general climate of opinion now favours the use of Békésy audiometry in large scale studies. It is thus most important to consider any differences which may occur between the thresholds obtained by manual techniques, and those obtained using Békésy audiometry. Burns and Hinchcliffe (1957), and many subsequent studies, have considered the differences found in relatively sophisticated subjects, but little consideration has been given to naive unsophisticates who constitute the majority of subjects in any survey. In recent unpublished work at NPL, Whittle has obtained such measures on a large group of naive suburban housewives, and the results show a significant difference between the findings obtained for neurotic extraverts and those for the other personality groups. In these hysterics, the threshold as measured by Békésy audiometry was relatively more sensitive than that measured by manual audiometry as compared with the results for the other groups. This difference disappeared on repeated testing and so serves to emphasise the importance of multiple Békésy determinations in order to obtain reliable results in such subjects. This difference between hysterics and dysthymics has also been found by Ingham (1963) in cross-masking studies in female subjects. Curiously he was unable to find the effect in male subjects.

Other auditory measures such as loudness estimates, auditory after-effects and discomfort thresholds have been shown to be influenced by personality factors, but as they do not enter into normal or projectural survey procedure, they will not be considered further at this point.

It might be expected that personality would influence the results obtained in evoked response studies particularly through its influence on the level of arousal of the subject. No systematic study has been made in this field, but subjective reports suggest that neurotics may, paradoxically, give the most consistent responses.

Certain of the results described above may assume a greater significance when one considers patients with pathological auditory mechanisms. One of the few personality studies on such subjects, that of Hinchcliffe (1965), has shown that both otosclerotics and patients suffering from Menière's disease are significantly more neurotic than normal subjects. Thus the degree of modification and sophistication of any experimental approach to be adopted must depend, partially at least, upon the nature of the population under consideration.

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