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"NOISE AND LOUDNESS EVALUATION".

Some Possible Correlates of Loudness

F McRobert

Department of Electrical Engineering, University of Salford.

Introduction

In a previous study of loudness and personality involving 15 observers (Barbenza et al 1970) individual loudness functions were obtained which exhibited some degree of correspondence to a measure of 'excitability' derived from the individuals personality profile, obtained using the Minnesota Multiphasic Personality Inventory (MMPI) in its individual form (Hathaway and McKinley 1951). The study went on to conclude that inter-individual differences in loudness slope were, in the main, psychological in origin.

Further data is available, relating loudness slope to various subjective and personality measures. Stephens (1972) has reported significant correlation of loudness slope with test anxiety, as measured on the Alpert-Haber scale (1960), and Feason (1968) has found significant correlation between loudness slope and the spiral after-effect, which he defines as a measure of 'receptivity". He links "receptivity - non receptivity" to "extroversion - introversion". However, no significant correlation has been found linking loudness slope with introversion (Stephens 1970).

Moreira and Bryan (1972) have also shown significant correlation between loudness slope and annoyance to noise. Since correlation of annoyance with both excitability and Welsh anxiety index (Dahlstrom and Welsh 1965) was not significantin that study, it was felt desirable to investigate more fully the relationship between loudness slope and various personality measures derived from the MMPI. This represents a preliminary report of some of the findings.

Method

Relative loudness estimation was carried out by a group of naive subjects. In this procedure, each observer is asked to judge how many times louder is the second of two tones than the first. The first tone presented was always that of lower intensity. Each pair of tones was repeated until a decision was reached by the subject.

For each individual the binaural auditory threshold at 1000 Hz was first determined employing a Peters SPD-5 audiometer with TDH-39 headphones set in MX-41/AR cushions. The binaural loudness discomfort level at this frequency was also obtained at the same sitting. This was determined to the nearest 5 dB, employing a method of limits. All loudness estimations were carried out binaurally under free-field conditions (1). Twenty-one pairs of tones were employed, the sound pressure levels being (in dB re 2 x 10^{-5} N/m^2).

30-40, 40-50, 50-60, 60-70, 70-80, 80-90,
30-50, 40-60, 50-70, 60-80, 70-90,
30-60, 40-70, 50-80, 60-90,
30-70, 40-80, 50-90,
30-80, 40-90,
30-90.

The tones were of 1-sec duration with a 1-sec interval between tones. Frequent calibration of the sound pressure levels at the observer's ear position was carried out throughout the study.

After completion of the loudness estimations, the subjects threshold at 1000 Hz was redetermined.

Finally, two questionnaires were administered to the subjects. These were

(a) the Minnesota Multiphasic Personality Inventory (MMPI) in its individual form (Hathaway and McKinley, 1951)
(b) the Eysenck Personality Inventory (EPI) form B (1968).

Subjects

The group comprised of 71 volunteers from the University population. 22 were females, aged 19-39 years (mean age 25 years) and 49 males, aged 19-57 (mean age 33 years).

Results

The transformation y = log (observer's estimate) was applied to all the loudness judgements. A regression line was fitted to each individuals data, thus providing the individual loudness slopes. These ranged from 0.010 to 0.055 (mean 0.025) and compare favourably with those of Barbenza et al (1970), who found slopes ranging from 0.012 to 0.070 (mean 0.025). In fact, 14 of the 15 observers in that study had slopes in the range 0.012 to 0.037.

Correlation coefficients of the slopes with auditory threshold (mean of the two determinations, these not being significantly different) and various personality measures are shown in Table 1. Only one of the correlations, that with excitability, approaches significance (at the 10% level).

Table 1 Correlation Coefficients (N = 71)

	Loudness slope at 1000 Hz
Threshold at 1000 Hz	-0.06
Introversion	0.08
Neuroticism	-0.05
Excitability	0.23*
Welsh anxiety index	-0.16
Masculinity/Femininity	-0.06

*Rank order correlation: significant at 10% level

Discussion

The results indicate that use of either the EPI or the MMPI is very limited in assessing how a person will judge loudness.

The most significant correlation, is that with excitability, and since this is only at the 10% probability level not much support is provided for the general claim of correspondence put forward in the study of Barbenza et al (1970).

The failure of the slope to correlate with both introversion and neuroticism as derived from the EPI confirms earlier findings of Stephens (1970) who employed the Heron 2-part personality scale (1956). He also tested his observers individually, both studies thus accentuating any differences in behaviour. The findings reported here provide further evidence against the hypothesis put forward by Hood (1968), that a possible correlation might exist between loudness slope and auditory threshold. The range of mean auditory threshold in this study was from -4.8 to 21.2 dB re ISO zero (group mean 5.0 dB re ISO zero). Such lack of correlation has been found earlier (Stephens 1970) in 12 normal hearing individuals. A surprising lack of correlation was found between slope and the Welsh anxiety index, as derived from the MMPI; although, as mentioned earlier, it had failed to predict noise annoyance with much success (Moreira and Bryan, 1972). A negative correlation (albeit not so small) was expected since both the idea of restricted excitability and anxiety index are derived in much the same manner from the profiles and we have already seen a positive, albeit low, correlation of slope with excitability.

It has been suggested that a person susceptible to annoyance by noise might typically show a fair amount of empathy and be intelligent and creative (Moreira and Bryan 1972). Since they have also demonstrated significant correlation of slope and annoyance from noise, it might be argued that people with high slopes would exhibit similar traits. MacKinnon (1962) has shown, in his study of creativity among architects, that such creative individuals demonstrate high scores on the masculinity/femininity scale (Mf score) of the MMPI and hence it was thought desirable to inspect such scores in this study. The mean score was only slightly higher and not significantly different from normal (T value of 58.6). It was not surprising therefore to find the correlation with slope was low and insignificant. However it appears that the group is not homogeneous in respect of Mf scores, the males having a mean T-score of 64.2 and the females 46.4. Further investigation along these lines is in progress.

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(1) The sound insulated room was not fully anechoic. However at 1000 Hz, the wall treatment was highly absorbent.