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"NOISE AND LOUDNESS EVALUATION".

PREDICTION OF NOISE ANNOYANCE - I. NOISE SUSCEPTIBILITY: EVIDENCE FROM FIELD STUDIES

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Introduction

It seems to be generally accepted that techniques are available which enable the community's response to noise to be predicted with high accuracy. Consider, for instance, the traffic noise study of Griffiths and Langdon (1). They found that their Traffic Noise Index (TNI) correlated with median dissatisfaction, of the noise, at a correlation of 0.88. This is a typical result obtained with the many measures of community noise response; an excellent review of which by Schultz (2) has recently appeared.

It is also unfortunately common ground that all measures of noise exposure are completely inadequate in predicting individual response to noise. In the case of the TNI study (1) when TNI was correlated with individual dissatisfaction, as distinct from median dissatisfaction, the correlation fell from 0.88 to 0.29. At such a low correlation it is completely impossible to predict whether an individual will be annoyed by a given level of noise or not. This result is typical of the inability of existing measures to deal with individual response to noise - see Bryan and Tempest (3).

If we are only concerned with predicting the annoyance of the community to noise than measures such as TNI, NNI, PndB, dB(A) etc. (2), to name only a few, are quite satisfactory. However, the individual, who is a member of the noise sensitive group of the community (which is 20 - 30% of the population), is unlikely to be appeased by being told that he should not be complaining about noise if the "average man" finds it acceptable. The trouble seems to be that the above noise measures tacitly assume that, firstly, the range in response of the population to noise is fairly narrow and, secondly, the population is homogeneous in its noise response. Bryan and Tempest (3) have argued that neither of these assumptions is correct and the concept of the "average man" may well be meaningless.

Their conclusions are based upon three considerations:

1) An examination of the more important UK field studies on community noise annoyance, which have been carried out in the last decade.
2) A laboratory study of individual annoyance by Moreira and Bryan (4).
3) The evidence from field studies which is the subject of this paper.

Strategy

The laboratory studies of Moreira and Bryan (4), show that there are

statistically significant and stable differences in the response of individuals to noise. They further found that these differences correlated with personality traits at a level equal to or better than that at which noise measures correlate with individual annoyance. They hypothesised that a "noise sensitive" individual 'might typically show a fair amount of empathy (interest in and sympathy with others), and to be intelligent and creative".

The field studies were carried out to see if the laboratory predictions had any reality in a typical noise annoyance situation. The techniques used to look for relationships between personality and noise annoyance are fairly crude. But at the time of the field study (and even now) there were no very useful guidelines.

The field studies

Four areas were chosen where there were existing noise nuisance problems and where attitudes towards the noise had had time to harden. In all cases the noises were considerably in excess of the recommended levels for that type of area, when the appropriate criterion was applied. In the case of the three industrial noises the BS4142 method (5) was applied and in the case of the aircraft noise the NNI method (6) was used. The table gives data on the four areas such as the type of noise, the recommended and actual noise levels, number of people interviewed and distribution of annoyance etc.

The type of interview varied somewhat from area to area. In area (1) the Minnesota Multiphasic Personality Inventory (MMPI) was applied to all six people whilst in areas (3) and (4) a questionnaire based upon the concept of "Excitability" (Barbenza, Bryan and Tempest (7) was used. In area (2), in the majority of cases, it was only possible to carry out a "doorstep survey" where the interviewee's reaction to the noise was ascertained. Tape recorded interviews were conducted on about 25% of the total number of people taking part in the studies (64 in all). All nine people subsequently classified as being "noise sensitive" were interviewed in this way. Such interviews were also carried out on several other people; people known to be unduly sensitive to noise. In these taped interviews the subjects were asked open ended questions about their own and others' reaction to noise, effect upon health, if they would move or had done so because of noise etc.

Results

Distribution of annoyance

In all four studies, the table shows that there is a wide range of reaction to the noise. Taking study (3) as an example, and where the actual noise level exceeds the recommended level by 10-20 dB, two subjects considered the noise to be "noticeable" although it did not bother them, whilst at the other end of the distribution another two considered it to be "unbearable". One of the latter two could not sleep because of the noise and expressed a desire to escape from it whilst the other said it "got on her nerves". Both of these are typical reactions of those who found the noises "very annoying" or "unbearable". Some 47% of the total rated the noises as being between "annoying" and "unbearable" (scored 6-10 on noise rating) whilst 17% (11 cases) were classified as being "noise sensitive" (see later). At the same time there were 36% (23 cases) of the total sample who could be considered as being "insensitive" to noise (scored 0-2 on the noise rating scale). This is quite remarkable as in the four studies the noises were 10-30 dB greater than they should be and vigorous community action and all subjects might have been expected

expected to have been affected by the noises. The appearance of two distinct groups "the noise sensitive" and the "imperturbles" is evident in both laboratory and field studies of noise annoyance (3).

Assessment of the "noise sensitive"

In all four studies the noises were of months or of years duration and so attitudes were hardened. It was not uncommon to meet the comments "I was bothered by the noise at first but not now" or "you have to live with it don't you" from those who scored 0-2 on the rating scale. Whilst those who scored 6-10 on this scale clearly did not adapt to the noise and had either tried to move to a quieter area or would be prepared to do so if they could not succeed in persuading their Local Authority to take action to have the nuisance abated.

A person was considered to be "noise sensitive" if they had a score of 6-10 on the rating scale and had some of the following characteristics: thought noise could affect health; would/had moved house because of noise; found noise oppressive and that it occupied their consciousness to the exclusion of nearly everything else; complained noise was getting on their nerves, was giving them headaches, causing depression; had initiated community action: considered themselves more sensitive than average to noise and frequently expressed a desire to physically attack those initiating the noise. They were usually articulate and above average intelligence for their area, clearly friendly, generous and sociable, very much aware of their environment and its deficiences (they were as likely to complain about the drains as about noise). They were active in the community, i.e. involved in voluntary social work (church, Oxfam, Shelter, etc) and very much aware of the needs of others. Very often they had a creative hobby such as painting, or writing. The labels "sensitive", "artistic", and "aesthetically inclined" could be attached to these "noise sensitive" individuals. The general agreement with the laboratory work of Moreira and Bryan (4) is quite remarkable.

Personality and noise sensitivity

The tape recorded interviews enable us, in broad terms, to indicate what type of person is likely to be "noise sensitive" and to predict how they will react in a noise annoyance situation. However quantitative information on the relationship between personality and noise sensitivity is obtained from an examination of the results of the MMPI profiles and the "Excitability" questionnaire.

MMPI Profiles These were available for eight subjects (six female, two male) of whom four were "noise sensitive" (two male, two female). The outstanding feature of the "noise sensitive" person's profile was that they had a high peak on the Interest (Mf) scale (which measures the tendancy towards masculinity or feminity of interest pattern). Those insensitive to noise, on the other hand, had low scores or even a dip on the same scale. The correlation between rating on the noise annoyance scale and the (Mf) score was +0.73 which is significant at the 5% level. Confirmatory evidence for a possible relationship between the (Mf) score and noise sensitivity comes from three different sources: a) There is a correlation of -0.36 (significant at 5-10% level) between the interest scale score of the MMPI profiles and noise sensitivity (slope m_s) for 24 of the subjects of Moreira and Bryans' laboratory study (4). b) Mackinnon found outstanding peaks on the (Mf) scale of the mean profiles of two groups of American male architects (84 in all) generally considered to be outstandingly creative (8). He comments that this pattern has been noted by other workers for different groups of creative males. Creativity is, of course, one of the traits which Moreira and Bryan

predicted the "noise sensitive" person should have (4). c) According to Dahlstrom and Welsh (9) the high (Mf) scoring males in the normal population were characterised, by their peers, as sensitive, prone to worry, idealistic and peaceable, sociable and curious, and has having general aesthetic interests. There are echoes here of the characteristics of the noise sensitive subjects of this field study - see above.

Excitability The "Excitability" concept (7) uses the MMPI scale of depression (D) as one pole of a scale and the traits of hysteria (Hy) or hypomania (Ma) as the other. A questionnaire was used in this study using 17, 13, and 13 questions respectively from each scale. The noise sensitive group mean (11 subjects) for the (Ma) score was significantly higher (p=1%) than that for remainder of the group (12 subjects) and at the 5% level compared with a control group mean of 10 subjects not involved in this study. For all 33 subjects who completed the "Excitability" questionnaire there was a correlation of +0.42 (p=1-2%) between (Ma) score and rating of annoyance of a specific noise. Whilst a modified form of the hypomania scale increased this correlation to +0.54 (p, better than 0.1%). However the complete MMPI hypomania score does not appear to correlate significantly with individual loudness or noise annoyance in laboratory studies.

Conclusions These field studies give good support to the evidence of Moreira and Bryan (4) that sensitivity to annoyance, by noise, is determined by personality differences. Additionally, the former work relates "noise sensitivity" to the (Mf) score on the MMPI profile and to a modified form of the hypomania (Ma) scale.

The field work very strongly indicates that there are two readily identifiable responses of (about half) the population to noise: The "imperturbable" group who adapt to noise and the "noise sensitive" group who are incapable of doing so.

Such personality factors must be taken into account if there is to be adequate prediction of noise annoyance.

TABLE

Study	Area	Level (dBA)		People		Annoyance Rating					
		Rec.	Actual	Total	Seen	0-2	4	6	8	10	N.S.
1.Earth dumping	Suburban*	55	69-75	12	6	2	2	1	1	-	2
2.Asphalt plant	Suburban	45	55	45	38	19	4	12	3	-	5
3.Cotton mill	Urban	45	55-65	19	15	2	4	5	2	2	3
4.Aircraft	Rural	20NNI	50NNI	?	5	-	1	3	-	1	1
TOTAL					64	23	11	21	6	3	11

N.S. = noise sensitive: Annoyance Rating;
0 = Quiet; 2 = Noticeable; 4 = Intrusive; 6 = Annoying;
8 = Very Annoying; 10 = Unbearable. *Daytime only.

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