

SOCIAL SURVEY ON COMMUNITY RESPONSE TO RAILWAY NOISE - COMPARISON OF RESPONSES OBTAINED WITH DIFFERENT ANNOYANCE SCALES

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1. INTRODUCTION

After Schultz [1] a considerable number of reviews on community response to noise have so far been carried out to compare dose-response relationships obtained from different noise sources and to investigate the effect of various factors on noise annoyance by using the data from different surveys [2,3]. In order precisely to compare the findings from different surveys, it is very important to know how the different subjective or objective scales are transformed to unified scales. A unified annoyance scale agreeable for many researchers is now highly required.

We constructed 4 to 7 point category scales in Japanese for noise annoyance based on the meanings of the descriptors assigned to the categories and investigated the effect of the different category scales on annoyance response by psycho-acoustic experiment [4]. The present paper discusses the effect of the four kinds of scale on annoyance response by using the data obtained from a social survey on community response to railway noise and compares the dose-response relationship between railway and road traffic noise obtained with the same scale.

2. METHOD

Social survey

A social survey on community response to railway noise was carried out by distribute-collect method in residential areas along railways in Kyushu, Japan, during the periods from May to June, September to October, 1994 and June, 1995. The selected houses were all detached houses and faced the railways. Four kinds of questionnaire were made, in which 4 to 7 point category scales as shown in Table 1 (the original is in Japanese) were used for the questions on annoyance caused by various environmental factors and the effects of railway noise. Respondents were randomly selected from the voters' list on

Table 1 Category scales used in the present survey

4-point scale	5-point scale	6-point scale	7-point scale
1. not at all annoyed	1. not at all annoyed	1. not at all annoyed	1. not at all annoyed
2. a little annoyed	2. a little annoyed	2. a little annoyed	2. a little annoyed
3. rather annoyed	3. annoyed	3. annoyed	3. somewhat annoyed
4. very annoyed	4. rather annoyed	4. rather annoyed	4. annoyed
	5. very annoyed	5. very annoyed	5. rather annoyed
		6. unbearably annoyed	6. very annoyed
			7. unbearably annoyed

a one person per family basis. Four kinds of questionnaire were allotted to the respondents in a consecutive order. The response sizes for the questionnaires with 4 to 7 point scales were 464, 462, 434 and 468, respectively. The total response rate was 80 %.

Noise measurement

At reference points besides the railways noise levels from various types of train were recorded with a sound level meter and a level recorder from morning to evening. The total energy level for every train type was calculated from the peak level and effective duration. $L_{eq(24)}$ was calculated by using the total energy levels for various train types and the number of trains shown in the time table of train. Distance reduction at points 5, 10, 20, 40 m apart from the reference points were also measured. Noise exposure to each house was estimated from $L_{eq(24)}$ at the reference point and the distance reduction.

3. COMPARISON OF DOSE-RESPONSE RELATIONSHIPS OBTAINED WITH DIFFERENT SCALES

The distribution patterns of responses for demographic variables and key variables for annoyance response such as sensitivity to noise and evaluation of natural environment are almost the same for different category scales. This means that annoyance responses obtained with different scales can precisely be compared. Figs. 1 to 3 show the relationships between $L_{eq(24)}$ and the extent of annoyance, % very annoyed, % rather annoyed and % annoyed, respectively. The rates of % very annoyed for 4-, 5-, 6- and 7-point scales are defined here as the rates of the numbers of people who responded to either of one, one, two and two categories from the top category, respectively, to the numbers of people exposed in a range of noise level divided in 5 dB step. The rates of % rather annoyed for 4-, 5-, 6- and 7-point scales are defined as those of people who responded to either of two, two, three and three categories from the top, respectively. The rates of % annoyed for 4-, 5-, 6- and 7-point scales are those of people who responded to either of two, three, four and four categories from the top, respectively.

Fig. 1 shows no systematic difference between the dose-response relationships for different annoyance scales, although the folded line for 4-point scale is a little higher than others. Applying chi square test to all combinations of pair of the rates in each noise level range, only two significant differences were found at 1 % level between 4-point and 7-

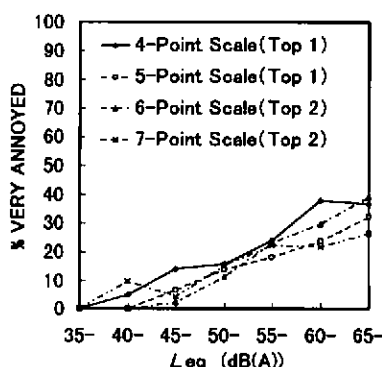


Fig. 1 % very annoyed

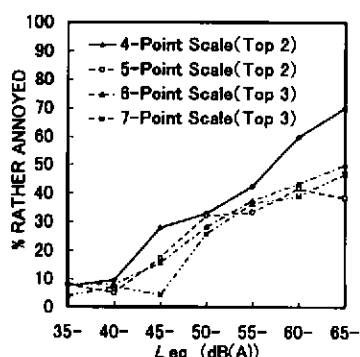


Fig. 2 % rather annoyed

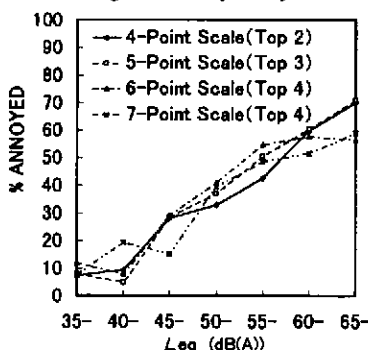


Fig. 3 % annoyed

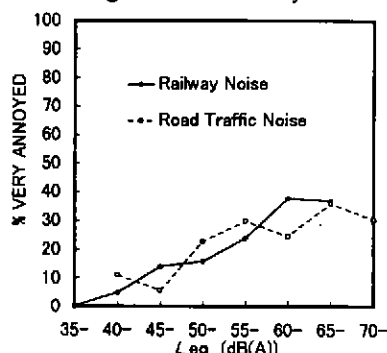


Fig. 4 Railway noise vs. Road traffic

point scales and at 5 % level between 4-point and 5-point scales in the range of 60 to 65 dB(A). In Fig. 3 no significant difference is found in dose-response relationships between four kinds of scale. On the other hand, in Fig. 2 the folded line for 4-point scale is systematically higher than the others particularly in higher noise level range. Applying chi square test to the plots in Fig. 2 as well as Figs. 1 and 3, significant differences were found at 1% level between 4-point scale and others in the range of 60-65 dB(A), at 5 % level between 4-point scale and others in 65-70 dB(A) and at 1 % level between 4-point scale and 7-point scale in 45-50 dB(A).

The agreement or difference in dose-response relationships seems to be attributed to the descriptors assigned to the categories just below the annoyance range. The descriptors just below the range are all "rather annoyed" in Fig. 1. In Fig. 3 they are all synonyms, "a little annoyed" or "somewhat annoyed". However, they are "a little annoyed" for 4-point scale and "annoyed" for the others in Fig. 2. This suggests that annoyance response is strongly affected by the descriptor just below the annoyance range.

such as % very annoyed and % rather annoyed and that people tend to respond not to the numbers but to the descriptors assigned to the categories. So the descriptors are very important in planning social surveys and in comparing annoyance responses obtained from different surveys.

4. COMPARISON OF DOSE-RESPONSE RELATIONSHIPS BETWEEN RAILWAY AND ROAD TRAFFIC NOISES

We have been carrying out social surveys on community response to road traffic noise in Kyushu district since 1993 by using the same method and the same 4-point annoyance scale as the railway survey. The sample size is 434. The distributions of responses for demographic and other key variables show similar patterns for both noise sources, although the distribution patterns of noise level are a little different. This suggests that the dose-response relationships for railway and road traffic noises are highly comparable.

Fig. 4 compares the dose-response relationships for railway and road traffic noises. No systematic difference is found between the noise sources, although a significant difference can be seen at 5 % level only in 60-65 dB(A). This is quite different from the findings shown by Fields et al. [2] and Moehler [3], where annoyance caused by railway noise is significantly less than road traffic noise. The difference between European studies and ours may be due to cultural/social factors or other factors. Further research is necessary to elucidate the cause.

5. SUMMARY

The present study is concluded as follows:

- 1) Annoyance response such as % very annoyed and % rather annoyed is strongly affected by the descriptors just below the annoyance ranges.
- 2) This suggest that people respond not to the numbers but to the descriptors assigned to the categories and that the descriptors are very important to make questionnaires and to compare the findings from different surveys.
- 3) There can be found no systematic difference in dose-response relationship between railway and road traffic noises, which were obtained from social surveys carried out with the same method in the same area. This finding is quite different from those from European studies.

References

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