

# RELATIONSHIPS BETWEEN RATING SCALES, QUESTION STEM WORDING, AND COMMUNITY RESPONSES TO RAILWAY NOISE

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**Introduction** A considerable number of reviews have been carried out to try to summarize dose-response relationships obtained from different surveys. Some problems have been pointed out in comparing the results of surveys using verbal scales with different numbers of categories. In 1997, ICBEN Team 6 agreed to construct two shared annoyance questions, one with a four-point or five-point verbal scale and one with a 0 to 10 point numeric scale. As a part of the international joint study, experiments were performed in Japan to determine the modifiers for four- and five-point verbal scales. The base descriptor, which is defined here as the part of the question stem that refers to the subjective impression of noise, was also considered in the joint study. The present paper discusses the relationships between the two verbal scales and the numeric scale, and those among the base descriptors by using the data obtained from social surveys on railway noise in Japan.

**Survey** Two series of social surveys on community responses to railway noise were carried out in Hokkaido and Kyushu, Japan. All of the houses surveyed were detached and faced the railways. In the first survey, conducted in 2001, two types of questionnaires were prepared in which a 0 to 10 point numeric scale was used in combination with either a four-point or a five-point verbal scale. The key questions concerned annoyance, activity disturbance and related effects caused by railway noise. The modifiers for the four- and five-point verbal scales are shown in Table 1 and the numeric scale is shown in Table 2. The total numbers of respondents for the questionnaires with four- and five-point scales were 490 and 467 respectively. Noise exposure to each house was calculated using data obtained with noise measurements. In the second survey, conducted in 2002, four types of questionnaires were prepared, each using one of the four Japanese base descriptors shown in Figure 3. The survey procedure was the same as that of the first survey and the numbers of respondents for each of the four types of questionnaires were between 397 and 408.

*Two verbal scales* Figure 1 shows the relationships between  $L_{Aeq(24)}$  and the extent of general noise annoyance. The rate of % highly annoyed is defined here as the ratio between the number of people who responded with the top category, “hijoni,” and the number of people exposed in a range of noise levels divided into five dB steps. No significant differences were found in the rate of % highly annoyed between the four-point and the five-point scales.

Table 1. Verbal scales

category	5-point scale	4-point scale
5	hijoni	-
4	daibu	hijoni
3	tasho	daibu
2	sorehodo...nai	sukoshi
1	mattaku...nai	mattaku...nai

Table 2. Numeric scale

0	1	2	3	4	5	6	7	8	9	10
mattaku...nai								hijoni		

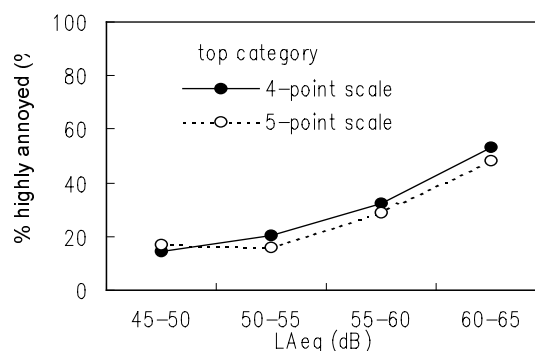


Figure 1. Comparison of dose-response relationships between the two verbal scales

Almost the same results were obtained for the activity disturbances.

**Verbal scales and numeric scale** Community responses to general noise annoyance were compared between the two verbal scales and the numeric scale as shown in Figure 2. It was found that the rates of % annoyed for the top category on the four- and five-point verbal scales (upper 20-25% of scales) lie between those for the top two numbers and top three numbers on the numeric scale (upper 18-27% of scale). It was also found that the rates of % annoyed for the top two categories on the four-point verbal scale (upper 50% of scale) were close to those for the top six numbers of the numeric scale (upper 55% of scale) and the rates of % annoyed for the top two categories on the five-point verbal scale (upper 40% of scale) were almost the same as those for the top five numbers of the numeric scale (upper 45% of scale). This means that the extent of noise annoyance rated on the four-point or five-point verbal scale corresponds with that rated on the 11-point numeric scale by percentages of scale steps.

**Base descriptors** Figure 3 compares the community responses to general noise annoyance among the four base descriptors. Although almost the same results were obtained for the four base descriptors, the response for the word "fukai" as the base descriptor was lower than that for the other descriptors at high noise exposure level. It may be hypothesized that the word "fukai" is stronger than the other words in subjective expression.

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**Keywords** community response to railway noise, rating scale, base descriptor

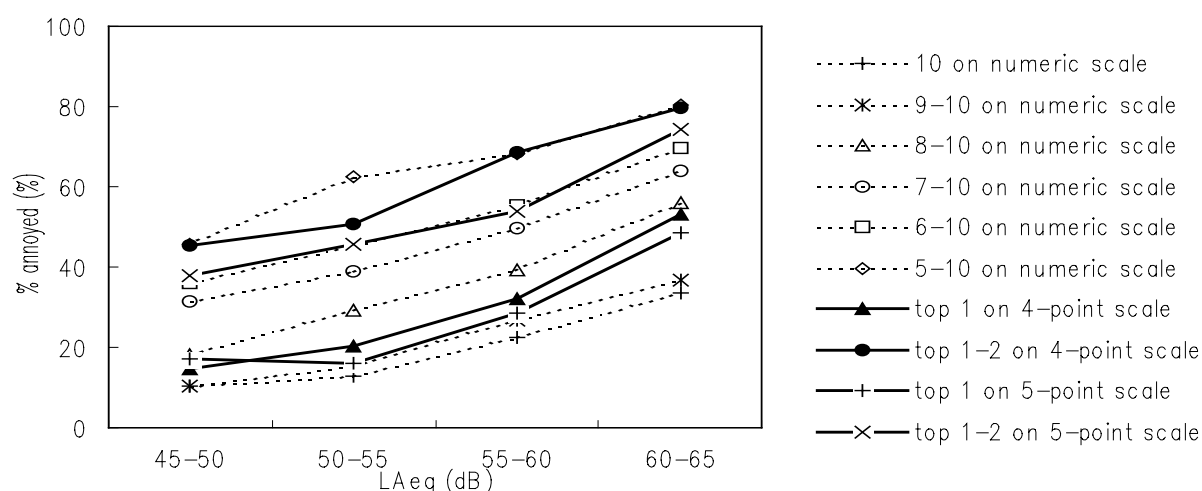


Figure 2. Comparison of dose-response relationships among the verbal scales and the numeric scale

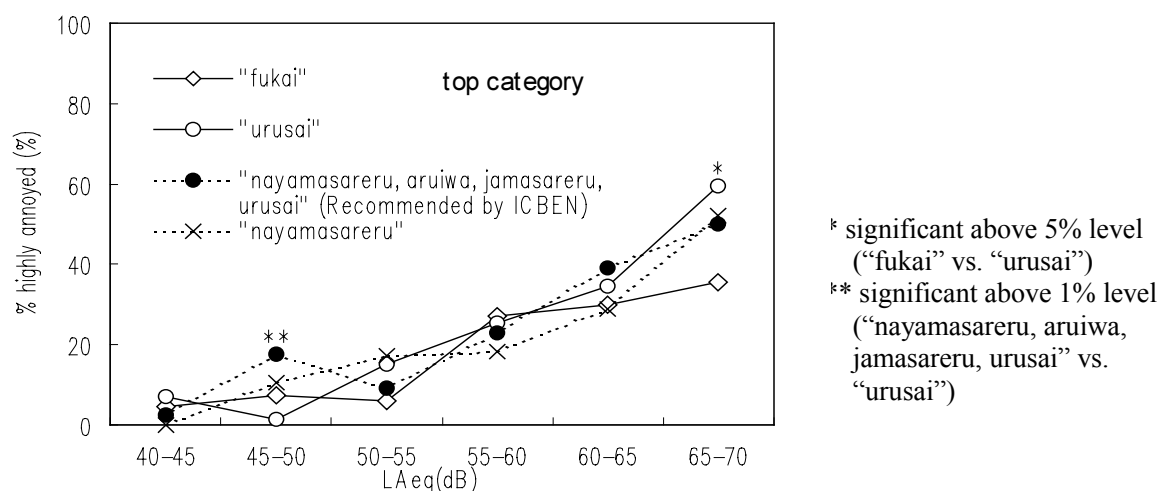


Figure 3. Comparison of dose-response relationships among the four base descriptors