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On the Meaning of Noise Annoyance Modifiers: A Fuzzy Set Theoretical Approach

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Summary
This paper reports on a fuzzy analysis of information gathered by many colleagues on the precise meaning of noise annoyance modifiers in 9 different languages. It is shown how fuzzy set theory can help us to construct a mathematical background for translating these modifiers between the languages concerned. A second goal of annoyance modifier research is to define labels to be used in noise annoyance surveys in order to obtain accurate and comparable results. Similarity measures used to compare fuzzy sets associated with verbal descriptors of annoyance levels indicate to what extent previously proposed labels [1] match between the languages considered. An ideal language from the fuzzy point of view where a continuous annoyance scale is exactly divided into n equal parts is translated to these natural languages and results in an alternative selection of labels that are better suited for fuzzy calculus. In general this selection of labels corresponds quite well with the set proposed in [1] which is rather surprising since the fuzzy set approach lacks most of the human input used in the ICBEN selection procedure.

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1. Introduction

Noise annoyance, although vague in concept, has been used as an indicator of the adverse effect of noise on man. A vast amount of knowledge has been gathered in social surveys using various types of questionnaires. Meta-analyses that were proposed to extract more general dosage response relations [2, 3] have been confronted with different annoyance scales both verbal and non-verbal. Verbal scales introduce the additional complication of language. Words used in surveys in different language regions do not necessarily match exactly to words in another language so no ”exact” translation is possible.

In 1993 the Community Response to Noise Team (Team 6) of the International Commission on the Biological Effects of Noise (ICBEN) therefore developed a program to facilitate comparisons between socio-acoustic surveys. Their work included a standardized research project that chose the labels for the answers to a 5-point verbal scale. The procedure started with selecting a pool of 21 modifiers (adverbs) of annoyance. These terms were then presented to a mixture of university students and employees of technical firms. The average age was about 35 years, but varied from 19 to 44 for different study sites. After providing some background information the subjects completed the questionnaire by performing the following four tasks to evaluate the 21 words:

Task 1: Subjects placed each word in one of nine groups ranked from “no annoyance” to “the most annoyance you can imagine.”

Task 2: Subjects indicated the intensity associated with each word by placing the word on its own 10-cm line that extended from “No/lowest degree of annoyance” to “Highest degree of annoyance.”

Task 3: Subjects selected one preferred word for each of the scale points by first choosing a word “that you would be most likely to use”’ for the “greatest amount of bother or annoyance you might feel” and then expressing a preference for the three words that should complete the remaining three points on a 5- point scale. (The lowest point was predetermined.)

Task 4: Same as 3 but for a 4-point preference question. For both the 4- and 5-point preference questions subjects were instructed to choose words that “people would normally use when talking”. Subjects were instructed to select words that were “equally spaced” between “not at all annoyed” and the previously chosen high annoyance word. The questionnaires were completed by 1 754 subjects at over 25 sites in 12 countries in nine languages

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