Reaction to combined sources of noise may depend on the respondents' interpretations of the questions.

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Abstract: Reported reaction to multiple sources of noise has proven difficult to explain. The unexpected results of assessment of total reaction to noise may not arise from inadequate integration within the subject nor from complexities of the perception of the noise. This abstract suggests that responses to questions regarding reaction to combined sources may reflect the subjects' interpretation of the relevant questions. Requests for reaction to the total noise load may be interpreted as requesting total reaction to all sources, or average reaction to all sources, or total or average reaction to the total noise environment possibly emphasizing quiet periods. The consequences of such interpretations by the subjects are not easily predicted. Finally, it should be noted that different subjects may interpret the same question in different ways in relation to these alternatives.

INTRODUCTION

Many residents are exposed to noise from more than one source, yet the impact of multiple sources of noise is poorly understood and essentially unregulated. One major measure of impact is reaction, typically (if not ideally: 1,2) measured as annoyance (3).

Reported reaction to multiple noise sources has proven difficult to understand, with no generally accepted method for adding raw or transformed reactions to individual noise sources to predict reaction to the combination of the sources (4) despite considerable effort (5, 6). The primary difficulty arises from the not uncommon finding that people report less reaction to the combined noise sources than they do to the most annoying noise source alone (7, 8). The implication that adding a noise to an existing (more annoying) noise could reduce the overall level of annoyance seems to be prima facie absurd.

METHODOLOGICAL ACCOUNTS

This has prompted the suggestion that these results are an artefact of methodological factors. For example:
1. The report of overall annoyance is often required at the beginning of the investigation, and so some noise sources and some effects of the noises may be neglected at this point but come to mind later as the interview progresses (9).
2. Subjects may disregard some noises in considering their overall reaction in order to focus on the more proximal or louder noises (9).
3. Subjects may not employ the same time interval for assessment of their reactions to each noise, depending on the time characteristics of the noises (9).
4. Subjects may not be able to perform the required task of providing an overall rating of annoyance (8).

However, it seems unlikely that any of the first three problems would result in the overall annoyance rating being less than that given for the dominant source except in the extraordinary event that the dominant noise source and its effects were among those overlooked. Rather than subjects not being able to perform the required task, possibly they can perform the required task but not with the questions, scales and instructions currently being offered.

POSSIBLE METHODOLOGICAL PROBLEMS WITH THE QUESTIONNAIRE

A simple two source example taken from the respondents point of view may illustrate the problem. Suppose that the respondent rates the aircraft noise as 8 on a 0-10 scale of annoyance, and rates the road noise as 6 on the same scale. Such a person's immediate response to rating the overall noise may be to call it a 14 (8 plus 6). However, this is clearly disallowed on a 0-10 scale. Even if the ratings are done in the other order with the overall rating first, the problem may still arise if the respondent has been forced by previous answers and the not unlikely (even if inexpressible) assumption of interval level measurement to
rate the second rated noise source too lowly compared with their real reaction. Thus the demands of the situation may disallow a simple additive model which may otherwise have been adopted. This may force the respondents to reinterpret the required ratings. Even in the absence of this problem respondents may interpret the questions in unexpected manners. These include:

1. The overall ratings may be taken to mean over all time, and thus include rating of annoyance when the noises are not present. The emphasis thus placed on the quiet times may reduce ratings of reaction.
2. Ratings of overall noise may be taken to mean average reaction to the various noises. As Berglund and Nilsson (10) pointed out averages fit some of the data.
3. Ratings of overall noise may be taken to reflect, or may emphasise in the respondents considerations, time when both or several noise sources are apparent at once. This may emphasise the relative rarity of such occasions.
4. Rating of the overall noise may emphasise to respondents the amount of time, overall, for which they are not at home, whereas rating one's annoyance with aircraft may be seen as presupposing hearing it.

Furthermore, any one of these possibilities may not account for the data because different subjects may make different interpretations, or may change the wording of the response scale as the interview proceeds.

POSSIBLE SOLUTIONS

The extent of impact of these methodological concerns may be determined through appropriate research, including:

1. Examination of the effect of the order of questions (overall rating first versus individual noise sources first).
2. Examination of the effect of allowing an open ended scale rather than one with an arbitrary end point (such as 10).
3. Examination of the effects of extensive, clear instructions as to the meaning of the rating of overall noise annoyance and the total task at hand.
4. The use of repeated ratings of the same noise event at various times during the interview in order to assess the reliability of the rating scale across the interview.
5. The use of master scaling techniques (11).

REFERENCES