

RESPONSE TO CHANGED DOSE OF ENVIRONMENTAL NOISE: DIVERSE RESULTS AND EXPLANATIONS IN THE LITERATURE

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Introduction Some surveys before and after step-changes in transport noise exposure suggest that human responses may change as a result of the increase/decrease in noise more than would be predicted from exposure-response curves derived under steady-state conditions. Further, such *over-reaction* may be more than a short-term effect. Interest in this phenomenon prompted the current authors to review the growing, but scattered, literature on human responses to change in noise. This paper contributes to the understanding of change by tabulating and summarising change studies to date along with five previous reviews of part of this literature on change. Various explanations for the phenomenon of a long-term overreaction to change provided by different authors are also listed.

Method A search was performed on literature (1980 to 2002) including *Psycinfo*, *Toxline*, *Embase*, *Medline* *SciSearch*, *Biosis*, and *Enviroline*. The search profile included keyword(s), in title and or abstract, related to *noise*, *change*, *sensitivity*, *annoyance* and *(over) reaction*. In addition, titles were selected from previous reviews of response to change (1,2,3,4,5) and Internoise proceedings (1985-2001) making use of the same keywords. This resulted in 137 references. A primary selection from these excluded studies where the noise source was not transport (road, air, rail), studies on specific groups or noise situations, or where there was no change in noise levels. This resulted in 76 references covering a broad range of change situations, contexts and results/conclusions. From these, some 38 papers, pertaining to 35 studies, provided enough information for a more detailed description and comparison. Outcome measures were restricted to dissatisfaction, annoyance, nuisance, and interference/disturbance or sleep indicators. Excluded were performance and laboratory studies, studies restricted to acoustic effects, and studies that provided not enough information or detail.

Selected Observations on the Literature A change in noise exposure may occur through different mechanisms and this could eventually prove an important variable in understanding response to change. Three types of change can be discerned. Type 1 is where the change results from a new (or eliminated) source, or change in intensity of the source. In this type, the noise emission of the source itself changes. Most Type 1 changes are experienced by groups of respondents in the same area. Type 2 is where the change results from some noise mitigation intervention. In this Type, there are no changes in the transportation source, nor in the noise emissions of the source. Type 3 is where an individual may move from one dwelling to another and the two dwellings have different transport noise exposures. At this stage, changes of this type are not of primary interest in our work.

A simple listing of *the nature of the responses to change* that have been observed in the various studies to date results in six categories of observation that are diverse, and conflicting. They include:

1. an increment or decrement in noise dose resulted in unexpectedly large changes (increase or decrease respectively) in noise response. This type of result is termed *over-reaction*
2. *as above*, but there was *evidence of adaptation* in this response in the *short-term* following the change
3. *as above*, but there was *no evidence of adaptation* in this response, even in the long-term following the change

4. increments or decrements in noise dose *did not* result in unexpectedly large changes in noise response (*no over-reaction*);
5. *consider-able reduction* in noise dose resulted in a *very small reduction in noise response*
6. noise response associated with the *expectation of change was greater* than the actual response when the change did occur.

On balance, the weight of the reviewed studies leans towards the existence of long-term over-reaction. There is no evidence for adaptation.

The explanations put forward in the literature for the frequent observation of over-reaction to change are also diverse. Again, a simple listing of these explanations, without commentary, yields: 1-They are *transient* effects only 2- they result from the *demand-response* of the repeated questioning of respondents 3- in a change situation respondents will have *negative attitudes* towards the source, or believe *misfeasance* on the part of authorities 4- respondents exhibit *coping* strategies, (*de*)*sensitisation* and eventually *habituation/adaptation* 5- observations explained by *adaptation theory*: After the change, respondents are still adapted to previous exposure levels 6-result from the existence of *measurement bias in steady-state* responses, caused by “*differential anchoring*” of the response scales at different levels of steady-state exposure 7- they are an artefact of *memory distortion* in those studies that relied on retrospective assessment of before-change conditions 8-can be explained by *anticipation* of the change 9-various notions that “change (decrease) sites” are somehow different in that it is only unusually high level situations that get treatment, and that people with high *noise sensitivity* will have already self-selected themselves out of these sites.(*selection hypothesis*).

Our initial conclusion is that most of these explanations are only partly supported by evidence, and in some cases not at all. There is still also no accepted view on the mechanism by which annoyance changes in response to a change in exposure. In particular, most explanations are usually post-hoc and the study designs have never been set up to test any of the explanations offered above.

Conclusions At this stage our work has consisted of assembling the various studies and reviews, of categorising them, and tabulating the nature of their observations and the explanations put forward. We would like to undertake a more detailed examination of the original studies, and the various explanations put forward for the different observations, to test for consistency of results when like studies are compared with like (at present, different Types of change are lumped together) and compatibilities and incompatibilities between observations in all of the studies and all of the “explanations” for the observations offered to date. However, mixed and sometimes conflicting evidence is due to differences in study design, outcome measures, method and differences in context, and the studies are hard to compare. A core problem is that in most studies, relevant contextual dimensions are either not, or insufficiently, measured, and that time frames in these longitudinal studies have been highly variable. A model is required of the nature, context and timing of a change situation to ensure adequate measurement and reporting for future research in this field.

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