Annoyance due to vehicle sounds is moderated by individual noise sensitivity

Wolfgang Ellermeier, Florian Kattner, Catherine Marquis-Favre

ANNOYANCE DUE TO VEHICLE SOUNDS IS MODERATED BY INDIVIDUAL NOISE SENSITIVITY

Wolfgang Ellermeier[1] Florian Kattner[1] Catherine Marquis-Favre[2]
[1] Institute of Psychology, Technical University of Darmstadt, Germany
[2] Univ Lyon, Ecole Nationale des Travaux Publics de l'Etat (ENTPE), France
ellermeier@psychologie.tu-darmstadt.de

ABSTRACT

In two experiments, a total of N=59 participants were exposed to short 5-s segments of pass-by recordings of motor vehicles presented at levels ranging from 50 to 70 dB(A). In Experiment 1, they had to perform a concurrent visual multiple-object tracking task. In Experiment 2, they just rated the annoyance due to sounds while picturing themselves trying to relax at home. After each experiment, the participants' individual noise sensitivity was assessed based on a 52-item questionnaire, LEF [1]. Both experiments yielded nearly linear annoyance functions as a function of SPL that were vertically offset when comparing the more noise-sensitive half of the sample with the less sensitive half, suggesting an additive effect of noise sensitivity on annoyance rather than a level-dependent interaction. Interestingly, though, the effect of noise sensitivity was statistically significant only in Experiment 1. Electrodermal recordings made while each sound was played showed transitory increases in skin-conductance the magnitude of which depended on sound level, but was only weakly related to noise sensitivity. Other trait measures akin to noise sensitivity, as measured by the ATQ questionnaire [2], namely 'discomfort' and 'high-intensity pleasure' were correlated with noise sensitivity proper, but not as discriminative in predicting annoyance ratings.

1. INTRODUCTION

The goal of the present research was to investigate the role of individual noise sensitivity in predicting noise annoyance . That was done by performing two experiments in which the dependency of both subjectively rated noise annoyance and objectively recorded skin conductance on noise sensitivity was assessed, essentially treating noise sensitivity as a moderator variable modulating the effect of noise level on perceived annoyance. A full report on this research will soon be available [3]; the present summary focuses on the role of noise sensitivity.

2. METHOD

Two experiments were performed, one in which (N=29) participants were exposed to vehicle pass-by recordings while performing a demanding visual-attention task (multiple-object tracking), and another one in which (N=30) participants were exposed to similar sounds while just being asked to relax. In both experiments, subsequent to the sound presentations, participants judged their perceived annoyance. Furthermore, skin-conductance responses were recorded while participants heard the sounds. At the end of the experiments they completed two questionnaires assessing their attitude to noise in general: a 52-item noise sensitivity scale [1] and a temperament questionnaire from personality research [2] containing a 'discomfort' scale (which is similar to environmental sensitivity) and a 'high-intensity pleasure' scale (reflecting the opposite).

3. RESULTS

In the following, results pertaining to the role of noise sensitivity are selected from either experiment. More results regarding psychophysiology or the effect of task load (resulting from the concurrent visual attention task) may be found in the full report [3].

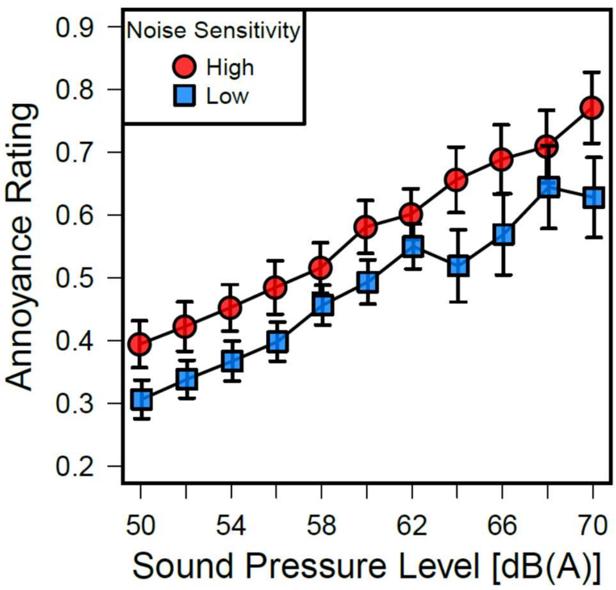

Figure 1. Effect of the sound pressure level of vehicle pass-by recordings on rated annoyance as a function of individual noise sensitivity (15 low, 15 high). Data from experiment 2.

Note, that first of all, the present laboratory experiment demonstrates the role of noise sensitivity (as assessed by a lengthy post-experimental questionnaire) in modulating the psychophysical relationship between sound pressure level of a given sound sample and its annoyance rating (see the results from Experiment 2 in Fig. 1).

Furthermore, we explored, whether questionnaire-based noise sensitivity had an effect on participants electrodermal responses to the same vehicle pass-by sounds. When contrasting level-dependent skin-conductance responses of participants exhibiting low (N=15, Fig. 2) vs. high noise sensitivity (N=14, Fig. 3, data from Experiment 1), we found slightly higher response peaks in the latter as well as a faster decay of the skin-conductance reaction (Fig. 3). While the level dependency of the skin-conductance reaction was statistically significant, the difference due to noise sensitivity (comparing Figures 2 and 3) was not.

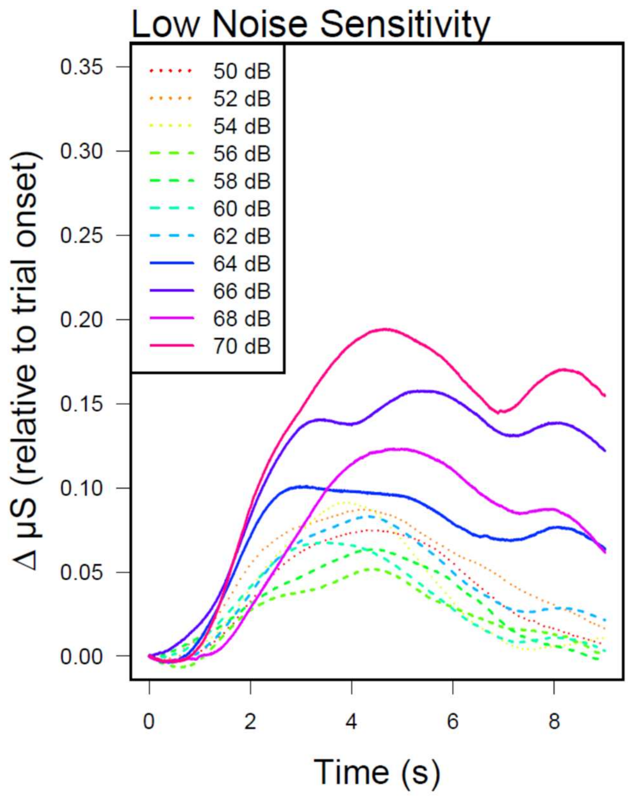

Figure 2. Average level-dependent skin-conductance reactions recorded while participants were exposed to motor vehicle pass-by sounds. Results of 15 low noise-sensitivity participants.

4. DISCUSSION

In two laboratory experiments, annoyance by sounds played back over headphones was found to be affected by the participants' questionnaire-assessed individual noise sensitivity. That effect turned out to be uniform across a wide range of sound levels, suggesting an 'additive', not an interactive effect of noise sensitivity on annoyance.

Furthermore, phasic skin conductance reactions recorded in response to the short traffic-noise excerpts showed a pronounced and statistically significant level dependency. Somewhat larger reactions were observed for highly noise-sensitive participants than for individuals exhibiting low noise sensitivity, however, this effect failed to reach statistical significance.

Assessing attitudes toward noise using a psychological 'temperament' scale (ATQ) revealed similar dependencies as had been observed for noise sensitivity, with 'discomfort' / increased sensitivity enhancing annoyance reactions and 'high-intensity pleasure' / sensation seeking attenuating them, but the effects were less pronounced, suggesting once more that specific noise-related attitudes and not some general 'increased environmental sensitivity' are at the root of noise sensitivity.

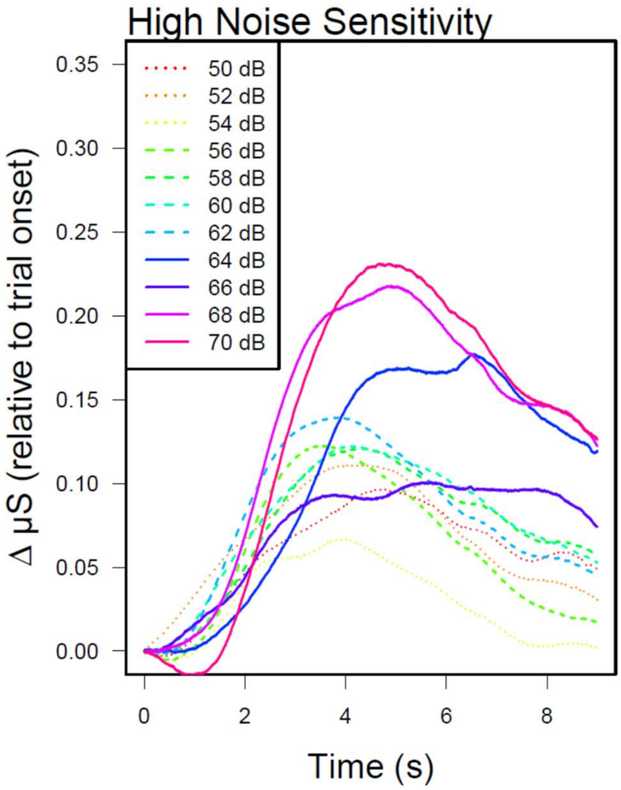

Figure 3. Skin-conductance responses as in Fig. 2. Here: Results of 14 participants exhibiting high noise sensitivity.

5. REFERENCES

[1] K. Zimmer & W. Ellermeier: "Konstruktion und Evaluation eines Fragebogens zur Erfassung der individuellen Lärmempfindlichkeit [Construction and evaluation of a questionnaire for measuring individual noise sensitivity]," *Diagnostica*, Vol. 44, pp. 11-20, 1998.

[2] D.E. Evans & M.K. Rothbart: "Developing a model for adult temperament," *Journal of Research in Personality*, Vol. 41, pp. 868-88, 2007.

[3] W. Ellermeier, F. Kattner, E. Klippenstein, M. Kreis & C. Marquis-Favre: "Short-term noise annoyance and electrodermal response as a function of sound pressure level, cognitive task load, and noise sensitivity," *Noise & Health* (in press).