

# ANNOYANCE CAUSED BY DIFFERENT NOISE SPECTRA

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**Introduction** A-weighted sound pressure level is widely used to determine exposure limits. In addition this level is commonly found as an indicator of how annoying a noise can be. However, it is possible to get the same A-weighted level at the same point with a large number of noise spectra. If we think in social discomfort, the question emerging is the following:

*Does the spectral content of several noises having a particular A-weighted sound level cause similar degree of annoyance?*

In order to attempt to answer this question, an experiment was developed. It consisted in the airborne emission of five different constant and complex noises and the application of a survey intended to compare the induced annoyance.

**Method** Forty nine subjects between 15 and 19 years old were studied (23 female, 26 male). The subjects were located inside the test room in groups of five each. The experiment was conducted inside a recording studio at the Institute of Acoustics of the Univ. Austral de Chile, and it was monitored from the studio control room.

Previously to the tests, the five spectra were designed and recorded. They were created filtering wide band noise and the noises were labelled: “white noise”, “low noise” (500 Hz low-pass filter), “high noise” (high-pass above 5000 Hz), “medium noise” (band-pass filter centred on 2500 Hz), and “mix noise” (narrow bands in 100 Hz and 16 KHz).

The test was developed in two sessions covering in this way the total studied population. Both sessions were conducted during the morning, in order to minimize the temporal threshold shift possibilities.

Each one of the five spectra was emitted during 20 seconds at a sound pressure level of 81 dB(A) at the reception points (the positions were carefully determined). Each spectrum was followed by 10 seconds of silence. This time was given to fill out the survey form designed to quantify the degree of annoyance. In addition, the introductory explanation of the experiment and the instructions to answer the survey were played from an audio track of the same CD that had the test spectra.

The rank to classify the annoyance caused by each noise included the following six categories: agreeable, non-disturbing, a little annoying, annoying, very annoying, and intolerable. After the five exposures and their classification, a little fragment of each noise was repeated in the same order that were done previously, and the survey asked the subjects to select “the most annoying noise”. In addition, the investigation attempted to identify those individuals with aural deficiencies.

In the second test session, a different sequence of the test noises was used, intending to reduce the influence that the order could have on the annoyance.

The test spectra were played using a bi-amplified acoustic system Bose 302 and 802 (only one channel was used). The A-weighted sound pressure levels were monitored during the complete test using a Quest 2900 sound level meter with a ½-inch condenser microphone. The Leq (A), L<sub>10</sub> and L<sub>90</sub> were registered during 15 seconds out of the 20 seconds of duration of each noise.

The noise spectra at the receptor positions were digitally recorded using a DAT Tascam DA-P1 connected to the sound level meter output.

**Results** The highest Leq registered was 81,7 dB(A) while the lowest one was 80,4 dB(A). After an averaging process, the noises labelled “white”, “high”, and “mix” were found to have very similar degrees of annoyance. Those three noises were classified as “intolerable” by 12%, 16 % and 12 % out of the 49 subjects, respectively. The noise labelled “medium” was found to be less annoying than the ones mentioned above. The noise labelled “low” was chosen as the least annoying of the five spectra. There was no answer in the category “intolerable” for the “low” and “medium” noises.

With respect to the question “Which one is the most annoying noise”, the “mix” noise got most of the answers (35 %), followed by the “white” noise (31 %), and then the “high” noise (29 %). The “medium” noise registered only 2 % of the answers, while no one went for the “low” noise as the most annoying (the rest of the subjects did not choose any noise).

It can be observed that woman considered all the test noises more annoying when compared with the answers given by men.

**Conclusions** In the case of the population studied here, the type of noises used, and the experimental method applied, *equal A-weighted sound pressure levels are not necessarily corresponding to similar degrees of annoyance*. However, further studies with different types of noises and considering other types of populations or environments are required to give a correct answer to the question formulated in the introduction.

**Keywords:** A-weighted, A-network, dB(A), noise spectra, annoyance, exposure.

## References

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