
**Acoustics — Assessment of noise
annoyance by means of social and
socio-acoustic surveys**

*Acoustique — Évaluation de la gêne causée par le bruit au moyen
d'enquêtes sociales et d'enquêtes socio-acoustiques*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO/TS 15666:2003), which has been technically revised.

The main changes compared to the previous edition are as follows:

- A relaxation of the requirement to ask both the 5-point verbal scale and the 11-point numerical scale. Both questions can still be asked but guidance has been provided about the advantages and disadvantages of each scale to aid question choice in situations where only one question will be asked.
- Clarification regarding assumptions that the question covers a 24 h period (day, evening and night) and the indoor and outdoor home environment.
- Additional guidance has been added in [Clause 6](#) describing the conventional cut-offs to define “highly” annoyed” for the 5-point verbal scale and the 11-point numerical scale, to enable comparisons between different surveys and contexts.
- Updated references.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Many countries have already developed regulations concerning the acceptability of environmental noise exposure, while others are likely to do so in the future. Such regulations often take into account relationships between noise exposure and noise-induced annoyance.

Measurement of environmental noise has been standardized. For example, ISO 1996 (all parts) contains detailed specifications about basic quantities and procedures, about acquisition of (noise) data, and about the application of these data to set noise limits.

The intent of this document is to provide specifications for the assessment of noise annoyance by social and socio-acoustic surveys. When these specifications are met, the statistically relevant possibilities of comparing and pooling survey results will be increased, thus offering more and better quality information for use by environmental policy makers.

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Acoustics — Assessment of noise annoyance by means of social and socio-acoustic surveys

1 Scope

This document provides specifications for socio-acoustic surveys and social surveys which include questions on noise effects (referred to hereafter as “social surveys”). It includes questions to be asked, response scales, key aspects of conducting the survey, and reporting the results.

It is recognized that specific requirements and protocols of some social studies may not permit the use of some or all of the present specifications. This document in no way lessens the merit, value or validity of such research studies.

The scope of this document is restricted to surveys conducted to obtain information about noise annoyance “at home”. Surveys conducted to obtain information about noise annoyance in other situations, such as recreational areas, work environments and inside vehicles, are not included.

This document concerns only the questions on noise annoyance used in a social survey and the most important additional specifications needed to accomplish a high level of comparability with other studies. Other elements which are required to provide high-quality social surveys, but which are not specific for social surveys on noise (such as sampling methods), can be found in textbooks (see References [1] and [2]).

Conformity with the recommendations of this document does not guarantee the collection of accurate, precise or reliable information about the prevalence of noise-induced annoyance and/or its relationship to noise exposure. Other aspects of study design, as well as uncertainties of estimation and measurement of noise exposure, can influence the interpretability of survey findings to a great extent.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1996-1, *Acoustics — Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures*

ISO 1996-2, *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

**3.1
noise-induced annoyance**

one person's individual adverse reaction to noise

Note 1 to entry: The reaction may be referred to in various ways including, for example, dissatisfaction, bother, annoyance and disturbance due to noise (see References [3] and [4]).

Note 2 to entry: Community noise annoyance is the prevalence rate of this individual reaction in a community, as measured by the responses to questions specified in [Clause 4](#) and expressed in appropriate statistical terms.

**3.2
socio-acoustic survey**

social survey in which noise-induced annoyance is assessed and values of measured or calculated noise metrics are attributed to the respondents' home environment

Note 1 to entry: Many general social surveys of environmental factors including noise are not considered to be "socio-acoustic" surveys because they do not have associated (measured or modelled) noise data.

4 Specifications for wording and scaling of questions on annoyance

Two questions have been formulated: one question with a verbal rating scale; one with a numerical rating scale.

a) Question with verbal rating scale

Thinking about the last (12 months or so), when you are here at home, how much does noise from (noise source) bother, disturb or annoy you?

- Not at all
- Slightly
- Moderately
- Very
- Extremely

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b) Question with numerical rating scale, with introduction

Introduction:

This uses a 0-to-10 opinion scale for how much (source) noise bothers, disturbs or annoys you when you are here at home. If you are not at all annoyed choose 0; if you are extremely annoyed choose 10; if you are somewhere in between, choose a number between 0 and 10.

Question:

Thinking about the last (12 months or so), when you are here at home, what number from 0 to 10 best shows how much you are bothered, disturbed or annoyed by (source) noise?

NOTE 1 There is an implicit assumption that the verbal and numeric scales address annoyance over the whole 24 h period during the last (12 months or so), i.e. annoyance integrated over the day-time, evening and night-time periods.

NOTE 2 The terminology 'at home' covers inside the home or outdoors at home, for example in the garden or on the balcony (see References [5] and [6]). See also [A.7](#) and [A.8 d](#)).

The rationale for the specification and wording is presented in [Annex A](#). The most accurate translations into several other languages are presented in [Annex B](#).

5 Additional specifications for conducting social and socio-acoustic surveys when assessing noise annoyance

General specifications for conducting social surveys of any kind are found in numerous articles, papers and textbooks (see References [1] and [2]). This clause does not give a comprehensive overview of these general specifications. The focus in this clause is on additional specifications with respect to the design of the questionnaire when asking about noise annoyance. More information is given in Annex A.

- a) Each respondent may be asked both questions specified in Clause 4. More information is given in Annex A about the advantages and disadvantages of the verbal and numerical scales to aid choice of question, if only one question is to be used.
- b) The questions shall be placed early in the questionnaire, unless this conflicts with other survey objectives, and before other, more detailed, questions about noise have been asked. Respondents shall not be eliminated on the basis of some previous question about whether they “hear” the noise, nor on the basis of length of residence. There is too great an uncertainty that respondents may conflate low levels of annoyance with not hearing the sound of the evaluated source (Reference [8]). If it is necessary to determine whether some respondents do not hear the noise source, a question about the audibility of the noise should be asked separately later in the survey. If other questions on noise annoyance are more important for the survey’s purposes, the specified annoyance questions may be asked later (see References [7] and [8]).
- c) When asking a question about annoyance, do not imply that the noise should be present in the respondent’s situation at home. Ask, for instance, about “noise from aircraft” instead of “noise from the aircraft”.
- d) When both questions are used, if pre-tests indicate that the questions are perceived as repetitious, include appropriate instructions. An example is presented in Annex A.
- e) As discussed in Reference [8], the answer categories of the five-point verbal scale may be presented without numbers, in a vertical orientation that can visually depict their equal separation as follows:

| |
|------------|
| CARD QV1 |
| NOT AT ALL |
| SLIGHTLY |
| MODERATELY |
| VERY |
| EXTREMELY |

As discussed in Reference [8] the presentation for the numerical scale shall be as follows:

| | | | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|---|-----------|
| CARD QN | | | | | | | | | | |
| NOT AT ALL | | | | | | | | | | EXTREMELY |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

The chosen answer shall be marked clearly within one box.

- f) Prepare written instructions for interviewers. For telephone or personal interviews, the interviewers shall be provided with written instructions that
- instruct interviewers to ask questions exactly as written,
 - train interviewers to respond to “I don't understand” with methods that do not require paraphrasing the question,
 - urge respondents to choose between the offered answers, including those who respond “I don't know”,
 - request all respondents to answer these questions (new residents can be instructed to answer about only their recent period of residence and later excluded from some analyses) – for more details see Reference [8], and
 - if repetition is expected to be a problem, for some respondents provide interviewers with instructions as described in Reference [8].

6 Specifications for assessing the degree of annoyance

Results of the questions shall be given as the frequency or cumulative distributions of the individual annoyance scores, if available for each category of noise exposure, bearing in mind that it may be necessary to suppress values with low numbers (small samples) to preserve anonymity. Other (summarizing) statistics such as the mean or median annoyance score, or percentages of respondents who are annoyed to a certain degree, may be given.

“Defining highly annoyed”

The cut-offs used in individual countries or preferred by individual researchers to define the percentage of respondents who should be regarded to have at least a certain degree of annoyance, such as for example “highly annoyed” can vary, although such variations can impede cross-study comparisons. Over the past decades a science-based rationale has emerged to define “highly annoyed” as one of the following: (see NOTE 1, NOTE 2 and NOTE 3).

Consistent with what was originally proposed in Reference [9] “highly annoyed” is defined as the top 28 % for the 11-point numerical scale:

- Numerical values 8, 9, and 10 for the 11-point numerical scale (to be referred to as HA_N).

As specified in the extensive IC BEN Team 6 analysis (see Reference [8]) and consistent with Reference [9] “highly annoyed” can be defined on the 5-point verbal scale as:

- The top two verbal response categories for the 5-point verbal scale (i.e., very and extremely) (to be referred to as HA_V).

It should therefore be noted, that as defined above, the two scales do not use the same cut-offs to define “highly annoyed”.

New research from large-scale investigations (see References [7] and [10]) have found that comparisons between the two scales can be improved with the following weighting scheme, whereby:

- Defining “highly annoyed” as the top two verbal response categories on the 5-point verbal scale (i.e., very and extremely) with ‘extremely’ counted in full, and ‘very’ weighted by a factor 0,4 (to be referred to as HA_{VW}). This creates a greater mathematical similarity between this scale and studies that have reported high annoyance as the top 28 % on the 11-point numerical scale. A detailed analysis of the perceived annoyance intensity encompassed by the top two categories “very” and “extremely” on a scale from 0 % to 100 % is provided in Reference [8].

NOTE 1 The term “highly annoyed” in this context refers to the percentage of the survey respondents reporting to be highly bothered, disturbed or annoyed, following the wording of the question but the convention is to refer to this group as “highly annoyed” and not the literary “bothered, disturbed or annoyed”.

NOTE 2 The verbal scale is an ordinal scale so if converted to a numerical scale for statistical purposes there needs to be clear evidence that the step-difference between each category is perceived by the respondent to be equal. The analysis in Reference [8] supports the assumption of equidistance between the verbal categories in general, but this can be sensitive to study demographics. The procedure for constructing the verbal scale (see Reference [8]) attempts to space the verbal modifiers at equal intervals of annoyance intensity along the annoyance axis.

NOTE 3 When reporting percentage highly annoyed, it is important to clearly state which scoring has been used to support comparison and harmonisation of data. It is however recognised that users and countries can conventionally adopt other forms of scoring due to preference or historical need, which cannot be based on a need to report the prevalence of high annoyance.

7 Specifications for reporting core information from social and socio-acoustic surveys

In [Table 1](#), minimum specifications are presented for reporting core information from social and socio-acoustic surveys in scientific reports. This information is essential to judge whether comparisons with other surveys can be made. Further information can be found in Reference [11].

Table 1 — Minimum specifications for reporting core information from social and socio-acoustical surveys in scientific reports

| Topic area | Item | Topic | Required information |
|-------------------------------|------|------------------------------|--|
| Overall design | 1 | Survey date | Year and months of social survey |
| | 2 | Site location | Country and area/region of study sites |
| | 3 | Site selection | Any important, unusual characteristic of the study period or sites Map or description of study site locations relative to the noise source Rationale for site selection Site selection and exclusion criteria |
| | 4 | Site size | Number of study sites Number of dwellings by site |
| | 5 | Study purpose | State original study objective(s) State if respondents were aware of study objective(s) |
| Social survey sample | 6 | Sample selection | Population definition (i.e., is the sample drawn from a targeted area, local community, larger provincial/state, or representative of a national sample) Respondent sample selection method (probability, judgmental, etc.) Respondent exclusion criteria (age, gender, length of residence, etc.) |
| | 7 | Achieved sample | Number of respondents (sample size) Response rate Reasons for non-response |
| Social survey data collection | 8 | Survey methods | Method (face-to-face, telephone, online, mail.) |
| | 9 | Questionnaire wording | Exact wording of primary questionnaire items (including answer alternatives) and where appropriate, any valid skips |
| | 10 | Precision of sample estimate | Number of responses for main analyses, range of the average time taken to complete the survey per respondent. |