

Slovenian Standardised Noise Reaction Questions for Community Noise Surveys

Natalija Kranjec¹⁾, Truls Gjestland²⁾, Mitja Vrdelja¹⁾, Sonja Jeram¹⁾

¹⁾ National Institute of Public Health, Slovenia. sonja.jeram@nijz.si

²⁾ SINTEF DIGITAL, Norway

Summary

Two standardized annoyance reaction questions for community noise surveys and a corresponding verbal response scale has been translated into the Slovenian language according to ICBEN protocol. The modifiers for the verbal scale were selected through a web-based questionnaire. It is recommended that these questions and the corresponding response scales are included in all future social surveys on noise annoyance in Slovenia, so that new survey results can be readily compared with similar studies conducted elsewhere on the international scene.

PACS no. 43.50.Sr, 43.66.-x

1. Introduction

Data on community reaction to environmental noise are scarce in Slovenia. The national survey 'Health-related lifestyle' that has been conducted every four years since 2004 includes one question on noise in the environment: "How noisy do you find the environment where you live?" The answer offers four response options: very noisy moderately noisy a little noisy and not at all. The percentage of people that find their environment very noisy increased from 13.1% in 2004 to 18.9% in 2016 [1].

Another series of surveys that has been conducted since 1968 is the Slovenian Public Opinion Survey [2]. This study includes a question on noise disturbance: "How do the situations mentioned below harm or disturb you, or are they absent in your living or working environment." Noise is one of the situations that is listed. This survey has a 6-point response scale. The last survey from 2016 shows that 0.9% believe that noise in their environment can be life threatening and 6.8% believe it harms and disturbs them very much [2].

The questions used in these two studies do not follow the recommendations from ICBEN, and the results can therefore not be readily compared with surveys conducted elsewhere.

1.1. ICBEN recommendation

A number of different questions and response scales have been used for social surveys on noise annoyance, and the variety of options has made inter-survey comparisons very complicated. In 2001 The International Commission on Biological Effects of Noise (ICBEN), recom-

mended that two standardized questions with standardized response scales should be included in future surveys [3]. This would facilitate comparisons across surveys and across language borders. This recommendation has subsequently been translated into a number of different languages following a strict common protocol [4, 5, 6, 7]. The recommendation has also been adopted by the International Standardization Organization, ISO/TS 15666 [8].

Our research team decided to develop a Slovenian version of the ICBEN scale and standardized questions according to the specified protocol. It may not be feasible to change the questions in ongoing studies in Slovenia but we plan future epidemiological studies to better evaluate community annoyance caused by different environment noise sources. For that purpose, standardized questions that will allow for international comparisons will be used.

2. Method for construction of 5-point verbal scale

2.1. Forming a pool of test words

A list of 21 adverbs (modifiers) was selected to describe various degrees of annoyance in Slovenian language. Care was taken to cover the entire range from not annoyed at all to the most extreme annoyance. This was done by translating the list of 21 candidate response modifiers for English language used by Fields *et al.* (2001) in their original study.

2.2. Collecting data

An invitation for participation in the survey was sent in November 2017 to 217 employees (33 male, 184 female) from 9 regional units of the National Institute of Public Health. Participation in this survey did not demand any

Received 21 February 2018,
accepted 13 July 2018.

particular skill or previous noise experience. The only requirement was a general knowledge of the Slovenian language. For convenience sake we therefore recruited the participants among our colleagues at the National Institute of Public Health.

A large geographical spread of subjects was important in order to include all 7 main regional dialect groups in the country. This would compensate for possible regional dialect differences.

The survey was designed as a web-based questionnaire following the ICBEN protocol [3].

The subjects completed the questionnaire by performing the following tasks to evaluate the 21 modifiers.

Task 1: Intensity scoring

The subjects were asked to assign "an intensity score" to each modifier by putting a mark on a line representing the full range of annoyance. Each word was presented on a separate screen. These marks were subsequently transformed into a number in the range 0 – 100.

Task 2: Preferred modifier for a 5-point verbal scale

The zero-end point, "not at all" was pre-selected and the subjects were asked to choose a word representing the other end point (100%) from the remaining 20 modifiers. Then the word representing the mid-point of the scale (50%) was chosen, and finally the two words preferred for representing the 25% and the 75% positions of the scale.

At the end of the questionnaire questions on gender, age, native language, dialect group and education were presented.

2.3. Data analysis

In the data analysis only subjects' responses fulfilling the following criteria were included:

- Missing response to a maximum of three questions in the whole questionnaire, or
- fully completed Task 1 (Intensity scoring) of the questionnaire, or
- fully completed Task 2 (Preferred modifier for a 5-point verbal scale) of the questionnaire.

Subjects' responses were excluded if they have failed to follow the instructions of the questionnaire, or if they have completed the questionnaires in an obviously inconsistent manner.

From the approved responses, the following parameters were calculated according to the ICBEN protocol (3):

- Intensity score average (\bar{x}): the average value of the positions in which the subjects marked each of the 21 Slovenian modifiers on the 0-100 scale. From no annoyance at 0, to the most annoyance you can imagine at 100.
- Intensity score standard deviation (σ): the root mean square of the intensity scores. Large standard deviation indicates a lack of agreement between subjects of word's position.

- Difference from scale point intensity criterion for 5-point scale (Δ): the difference between the word's intensity score and the intensity criterion for that word's candidate scale point. For 5-point scale intensity criteria are 0 (point #1), 25 (point #2), 50 (point #3), 75 (point #4) and 100 (point #5).
- Scale point candidacy for 5-point scale (CAT #): The single scale point for which the word is candidate. Indicating the percent of the subjects who preferred this particular word to identify the category.
- Net preference score (NP%): Percent of subjects preferring the word for the word's candidate position decreased by the percentage preferring the word for other positions (CAT #). It may be negative if a word has been chosen for more than two positions.

2.4. Selection of modifiers

The best candidate word for each scale point on 5-point scale was chosen based on the net preference score, difference from scale point intensity and intensity score standard deviation. The lowest point was pre-determined. The selection proceeded in accordance to ICBEN Protocol [3], with gradual elimination of scale point candidate words, following 13 successive steps:

- Step 1: Net preference (NP) score $\geq 5\%$.
- Step 2: Unsigned difference from scale intensity $|\Delta| \leq 15$.
- Step 3: Net Preference score within 20 points of most popular remaining candidate word for the scale point.
- Step 4: Standard deviation within 15 points of smallest remaining modifiers' standard deviation.
- Step 5: Unsigned difference from scale intensity $|\Delta| \leq 10$.
- Step 6: Net preference score within 15 points of most popular remaining candidate word.
- Step 7: Standard deviation within 10 points of smallest remaining modifiers' standard deviation.
- Step 8: Unsigned difference from scale intensity $|\Delta| \leq 5$.
- Step 9: Net preference score within 10 points of most popular remaining candidate word.
- Step 10: Standard deviation within 5 points of smallest remaining modifiers' standard deviation.
- Step 12: Select highest remaining preference score.
- Step 13: Select lowest remaining standard deviation score.

3. Method for construction of two standardized annoyance reaction questions

The two standardized questions, one using a 5-point verbal scale and one using an 11-point numerical scale, specified by ICBEN protocol [3] and ISO/TS 15666 [8] were translated from original English version to Slovenian language by a professional translator and two researchers; one researcher from the field of environmental noise and one researcher from the public relation domain. Back translation into original language was performed by translator with no prior knowledge of the original content in order to assure the conceptual equivalent of questions.

4. Results

The list of 21 candidate response modifiers in Slovenian language with corresponding English modifiers from Fields *et al.* (2001) is presented in Table I.

Among the 217 invited subjects, 97 completed the questionnaire, giving a response rate of 44.7%. For the data analysis 79 subjects' responses were included.

The subjects were mainly women (76%), aged between 24 and 67 years. All except 2 (Croatian and Italian) are native Slovenian speakers. All seven Slovenian regional dialect groups were represented in the study panel, with the highest response in the Upper Carniolan (22.8%) and Styrian (22.8%) dialect groups.

4.1. Intensity score

Graphical display of the word intensity scoring results is given in Figure 1. The figure shows average intensity score and standard deviation. The modifiers are evenly spread out across the full range from minimum to maximum intensity. Numerical results of intensity scoring are presented in Table II and Table III.

4.2. Slovenian modifiers

Following the procedure specified in the methods, the preferred modifier for category #2 was "nekoliko" (selected after step 8), for category #3 the preferred modifier was "srednje" (selected after step 1), for category #4 the preferred modifier was "močno" (selected after step 3) and for category #5 the preferred modifier was "ekstremno" (selected after step 3).

4.3. Standardized annoyance reaction questions

The original English text for the question with a 5-point verbal response scale is as follows: 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?

The time frame, *12 months or so*, is meant to indicate a general response and are not referring to the exact 365 days preceding the survey.

The location for the assessment, *at home*, is not confined to inside the residence, but includes the residence and the immediate surroundings, for instance on a balcony or porch, in your own garden or on the street just outside your residence.

The impact of the noise, *bother, disturb or annoy*, is intended to include most negative reactions or feelings regarding that specific noise source.

We feel that these considerations are fully reflected in the following recommended Slovenian version of this question:

Če pomislite na zadnjih (12 mesecev ali podobno), ko ste doma, v kolikšni meri vas hrup (vir hrupa) jezi, moti ali vznemirja?

–Sploh ne? –Nekoliko? –Srednje? –Močno? –Ekstremno?

Table I. A list of 21 candidate response modifiers for original English version and corresponding translation of candidate response modifiers in Slovenian language. Underlined words are the preferred modifiers for the original English version of the 5-point verbal scale.

	English candidate response modifiers	Slovenian candidate response modifiers
1	not at all	sploh ne
2	insignificantly	neznatno
3	barely	komaj
4	hardly	zanemarljivo
5	a little	malo
6	slightly	rahlo
7	partially	delno
8	somewhat	nekoliko
9	fairly	dokaj
10	moderately	srednje
11	rather	precej
12	importantly	pomembno
13	considerably	občutno
14	substantially	znatno
15	significantly	bistveno
16	very	zelo
17	highly	izredno
18	strongly	močno
19	severely	resno
20	tremendously	izjemno
21	extremely	ekstremno

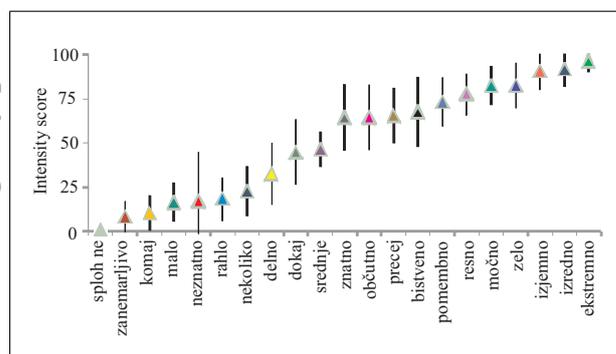


Figure 1. (Colour online) Intensity score for Slovenian modifiers (average and standard deviation).

A backwards translation from Slovenian to English, using the service offered by Google, gives an almost identical result as the original question.

The English text for the question with a numerical rating scale is as follows:

Introduction: This question 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), what number from 0 to 10 best shows how much you are bothered, disturbed or annoyed by (source) noise?

Table II. Data for choice of modifiers. n – number of responses; x – intensity score average; σ – intensity score standard deviation; Δ – difference from scale point intensity criterion for 5-point scale; NP # - Net preference score.

	n	x	σ	Δ #2	Δ #3	Δ #4	Δ #5	NP #2	NP #3	NP #4	NP #5
sploh ne	77	1.21	1.21	-23.79	-48.79	-73.79	-98.79	9.46	-9.46	-17.57	-17.57
zanemarljivo	78	8.26	8.57	-16.74	-41.74	-66.74	-91.74	-9.46	-1.35	1.35	-9.46
komaj	76	10.39	9.71	-14.61	-39.61	-64.61	-89.61	-22.94	-17.53	9.50	-25.71
malo	78	16.35	10.72	-8.65	-33.65	-58.65	-83.65	-16.04	-16.04	2.88	-2.88
neznatno	78	17.13	28.08	-7.87	-32.87	-57.87	-82.87	-4.05	-1.35	-1.35	-6.76
rahlo	77	18.48	12.40	-6.52	-31.52	-56.52	-81.52	-12.16	1.35	-1.35	-12.16
nekoliko	78	22.90	14.31	-2.10	-27.10	-52.10	-77.10	22.97	-22.97	-22.97	-22.97
delno	74	32.65	17.84	7.65	-17.35	-42.35	-67.35	8.11	-13.51	-16.22	-21.62
dokaj	75	44.83	18.35	19.83	-5.17	-30.17	-55.17	0.00	0.00	0.00	0.00
srednje	41	46.59	9.36	21.59	-3.41	-28.41	-53.41	1.35	-1.35	-1.35	-1.35
znatno	75	64.55	18.67	39.55	14.55	-10.45	-35.45	-6.72	-4.02	1.39	-4.09
občutno	75	64.63	18.27	39.63	14.63	-10.37	-35.37	-2.67	-2.67	0.04	-0.04
precej	76	65.62	15.40	40.62	15.62	-9.38	-34.38	0.00	0.00	0.00	0.00
bistveno	78	67.77	19.61	42.77	17.77	-7.23	-32.23	-52.63	-52.63	-52.63	52.63
pomembno	73	73.22	14.20	48.22	23.22	-1.78	-26.78	13.51	-24.32	-18.92	-29.73
resno	77	77.97	11.78	52.97	27.97	2.97	-22.03	-41.79	-41.79	33.89	-33.89
močno	78	82.55	10.82	57.55	32.55	7.55	-17.45	18.92	-18.92	-18.92	-18.92
zelo	78	82.85	12.81	57.85	32.85	7.85	-17.15	-64.86	64.86	-67.57	-67.57
izjemno	78	90.85	10.64	65.85	40.85	15.85	-9.15	-4.05	-4.05	1.35	-6.76
izredno	76	91.92	10.11	66.92	41.92	16.92	-8.08	-7.97	-5.26	-5.26	2.56
ekstremno	78	96.50	6.46	71.50	46.50	21.50	-3.50	-26.35	-26.35	-23.65	23.65

Table III. Scale point candidacy. CAT - the single scale point for which the word is candidate. Underlined words are the preferred modifiers for the Slovenian version of the 5-point verbal scale.

	CAT 2	CAT 3	CAT 4	CAT 5
sploh ne	1.35			
zanemarljivo				
komaj				
malo	18.92			
neznatno			1.35	1.32
rahlo	22.97			
nekoliko	21.62	2.70	5.41	
delno	13.51	4.05		
dokaj	14.86	4.05	2.70	
srednje	1.35	66.22		
znatno	1.35	1.35	4.05	
občutno		6.76	5.41	
precej	2.70	5.41	18.92	1.32
bistveno		4.05	5.41	
pomembno	1.35	2.70	2.70	
resno	1.35	1.35	5.26	
močno			37.84	3.95
zelo			9.46	6.58
izjemno		1.35	4.05	1.32
izredno			1.35	25.00
ekstremno				52.63

The recommended Slovenian version of this question is as follows:

Uvod: Sledi deset-stopenjska lestvica, s katero ocenite v kolikšni meri vas hrup (vir hrupa) jezi, moti, ali vznemirja, ko ste doma. Če vas sploh ne vznemirja, označite nič, če vas ekstremno vznemirja, pa označite deset. Če pa

vas vznemirja neke vmes, izberite številko med nič in deset.

Vprašanje: Če pomislite na zadnjih (12 mesecev ali podobno), katera številka med nič in deset najboljše odraža v kolikšni meri vas hrup (vir hrupa) jezi, moti ali vznemirja. This translation reflects the same considerations as discussed for the previous question.

5. Conclusion

Standard annoyance reaction questions for community noise surveys and 21 modifiers were translated from English into Slovenian language following the ICBEN protocol [3]. Modifiers for verbal scale were selected through a web-based questionnaire. Among 217 subjects that were invited to participate in the study, 79 fulfilled questionnaires that fitted our inclusion criteria and were used for data analysis. The selected modifiers suggested to be used in survey studies are: “sploh ne” (not at all), “nekoliko” (somewhat), “srednje” (moderately), “močno” (strongly), and “ekstremno” (extremely).

It is recommended that the two questions on noise annoyance and the corresponding response scales are included in all future noise annoyance surveys in Slovenia. This will allow Slovenia to contribute to the international pool of noise annoyance survey results, and will facilitate the comparison of Slovenian results with those from other parts of the world.

Acknowledgement

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 769627

References

- [1] CINDI: Z zdravjem povezan vedenjski slog 2017 (CINDI Health Monitor Survey 2017, in press). Ljubljana, 2018. Available from: <http://cindi-slovenija.net/>
- [2] N. Toš (Ed.): Vrednote v prehodu X. Slovensko javno mnenje 2010–2016 (Values in transition X. Slovenian Public Opinion Survey 2010–2016). Edition Echoraum, Wien; Univerza v Ljubljani, Fakulteta za družbene vede, IDV, CJMMK, Ljubljana; 2016.
- [3] J. M. Fields, R. G. de Jong, T. Gjestland, I. H. Flindell, R. Job, S. Kurra, P. Lercher, M. Vallet, T. Yano, R. Guski, U. Felscher-Suhr, R. Schumer: Standardized general-purpose noise reaction questions for community noise surveys: Research and a recommendation. *J. Sound Vib.* **242** (2001) 641–679.
- [4] A. Preis, T. Kaczmarek, H. Wojciechowska, J. Zera, J. M. Fields: Polish version of standardized noise reaction questions for community noise surveys. *Int. J. Occ. Med. And Env. Health* **16** (2003) 155–159.
- [5] T. Yano, H. Ma: Standardized noise annoyance scales in Chinese, Korean and Vietnamese. *J. Sound. Vib.* **277** (2004) 83–588.
- [6] P. Kvist, T. Holm Pedersen: Translation into Danish of the questions and modifiers for socio-acoustic surveys. *EuroNoise 2006*, Tampere, Finland, 2006.
- [7] T. Gjestland, A. Toma, L. Dragasanu, M. Deaconu, B. Oprea: Romanian Standardized Noise Reaction Questions for Community Noise Surveys. *Acta Acust united Ac* **103** (2017) 232-235.
- [8] ISO TS 15666 Technical specification: Acoustics – Assessment of noise annoyance by means of social and socio-acoustic surveys. 2003.

uncorrected galley proofs — for internal use only