

Methods for Data Collection on Annoyance Moderators

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Outline



- Socio-acoustic surveys
- Audio-Visual listening test
- Mini surveys
- Soundscape measurements
- Modelling





Socio-acoustic surveys

• The "correct" method





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Socio-acoustic survey according to ISO 15 666



Thinking about the last year or so, when you are here at home, how much does noise from road traffic bother, disturb, or annoy you?

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



- In total 30 questions (demographic, residence, moderators...)
- 6,761 completed questionnaires



Calculation of noise levels - L_{den}



- L_{den} (yearly average) at the most exposed façade for each respondent
- Nord2000 calculation method taking into account:
 - Ground surface types, including the road surface
 - Traffic intensity, composition and speed
 - Height of receiver (respondents)
 - Wind and weather
 - Screens/buildings
 - Terrain shape







Dose-response curves - Motorways



Outline

Audio-visual listening tests

- Visibility of traffic
- Greenery

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Listening tests

Traffic Greenery, Positions Туре Screen % Visible, % 1. Town Hall Square Major road 100 0 No 2. Gentofte 80 Motorway 17 Glass 3. Ishøj Motorway 100 63 No 4. Lyngby 1 100 Motorway 67 No 5. Hørsholm 1 50 Motorway 77 No 6. H.C.A. Boulevard Major road 100 57 No 7. Holte Major road 100 78 No 8. Buddinge Motorway 0 22 Steel 9. Hørsholm 2 Motorway 0 100 No 10. Lyngby 2 Motorway 0 59 Wood

4. Lyngby 1

5. Hørsholm 1

6. H.C.A. Boulevard

7. Holte

8. Buddinge

9. Hørsholm 2

Field: Video and noise recordings

Lab: Audio-visual listening test - 24 assessors

- The 24 listeners were ordinary persons (non-expert listeners) from SenseLabs group of "consumers".
- Videos of the traffic were presented with stereo sound
- Same road noise without characteristics for all videos
- L_{Aeq} = 45, 50, 55,... 75 dB

Two questions (attributes)

Annoyance

Rate how annoying you perceive the sound

Annoyance: The sound is irritating and/or bothering

The sound fits the video

Very bad - Bad – Neutral - Good – Very good

Rate how much you think the sound fits

The sound fits: Look at the video. Does the sound fit to what you see and the activities you could imagine at this place

Annoyance. Dose-response curves for all positions

Visual effect

Three factor model

Conclusions

- We have found dose response curves with a high degree of explanation of the annoyance response (R²>0.95).
- There is a significant influence of the visual impact
- The influence of Greenery and Visible Traffic is significant, but opposite findings in the literature.
- The hypothesis is that this is caused by disappointed expectations from what is seen on the videos.
- If audio-visual listening tests are used for this purpose it is important that they are realistic and give an in-depth understanding of the full context.

Mini surveys

- Visibility of traffic
- Trust to authorities
- Communication expectations alignment

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Mini survey plans

- Original plan: Find locations for surveys before and after a change
- Timeframe of the project was limited
- New survey layout: Assessing changes that had already happened.
- Due to the Corona virus the survey had to be changed from an interview combined with paper surveys to an online survey

Mini survey area

- A7 motorway in Hamburg, Germany
- 100,000 vehicles per day
- Enlargement of the motorway
- Three coverings (tunnels) of the motorway
- Noise level reduction next to the former motorway of more than 20 decibels

Mini survey area

Selection for postal distribution (red) – tunnel and barriers (grey)

Tunnel finished 3 years before survey

Mini survey area

Selection for postal distribution (red) – tunnel and barriers (grey)

Online questionnaire - 24 questions with subitems - 160 valid responses

Flyer with a link to an online questionnaire

Online questionnaire

- Living conditions, 10 questions
- Motorway A7 and the covering, 10 questions
- Private data (age, gender, tenancy), 4 questions

Noise data and respondents

Noise levels

- Noise data from the A7 covering planning process.
- Both noise with and without covering were calculated.

Respondents

- No information on exact locations (German R rules)
- Streets were grouped by similar
- e each are on noise levels per respondent the Uncertainty on noise versure were summarized in dependency of • For each are

Annoyance

Expectations to reduced noise

Expectations: Greenery

Very -

View blocked

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Quality of information

The annoyance is lower when...(trends)

- Expectations to lower noise levels are met
- Expectations to greenery are met
- View to the motorway is blocked
- Quality of information is good

Conclusions on the method used

• PRO:

The flyers and online questionnaire is a cheap tool
=> Bigger number of respondents affordable

• Contra:

• We don't have the exact addresses Face to face interviews: More reliable data

• Conclusion:

- We can see trends, but no solid numbers for modelling
- Usable method but more respondents needed
- The addresses of the respondents should be known, for correct calculations of noise levels,

Soundscape measurements

- Visibility of traffic
- Greenery

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Why soundscape measurements?

Annoyance:

An emotional and attitudinal reaction

from a person exposed to noise in a given context.¹

Soundscape measurements

ISO Draft 12913-2 Acoustics — Soundscape — Part 2: Data collection and reporting.

"The soundscape provides a holistic approach to the acoustic environment"

FAMOS

1. Sound walks

2. Acoustic measurements / computations

3. Interviews

Sound walks

• The assessed attributes are defined in the questionnaire

FAMO

a CEDR project

- 18 ordinary persons (non-experts) rated the same six soundscapes at different times to get representative averages
- Noise measurements were made at the same positions and times

Online assessment with Ideal profile method – IPM

Annoyance: The sound is irritating and/or bothering

14 Attributes

The attributes were defined in the questionnaire

Soundscape measurements

Positions	Туре	Traffic Visible	Greenery	L _{Aeq} dB	L _{A50} dB	L _{A95} dB
1. HCA Boulevard	Major road	100 %	47 %	71	70	65
2. Rådhuspladsen	Major road	100 %	3 %	66	66	59
3. Studiestræde	Minor street	100 %	0 %	60	54	48
4. Larslejstræde	Minor street	100 %	11 %	60	57	52
5. Kongens Have pos. a	Park	50 %	100 %	55	52	46
6. Kongens Have pos. b	Park	0 %	100 %	52	52	47

Principal Component Analysis

Attributes

Soundscape index

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Dose-response curve

Annoyance —— Logistic fit – – – Miedema road

Three factor model for the effect of moderators

	Coefficients	P-value	Lower 95%	Upper 95%
Intercept	-7,16	0,07	-15,61	1,28
LAeq, dB	0,13	0,09	-0,05	0,30
Green %	-0,37	0,66	-3,44	2,70
Visible %	-0,71	0,57	-5,26	3,85

Not significant

Conclusions

- Soundscape measurements may be a useful tool for investigating the annoyance from traffic noise and the effect of non-acoustic variables
- There shall be sufficient and independent variation in the variables under investigation in the chosen measuring positions.
- Four times as many measuring positions as the number of variables of interest.
- The noise level of the traffic: level range of 15-20 dB or more among posisions
- At least 20 persons (e.g. in groups of 5-7 persons) shall make the assessments.

Modelling

- The "Annoyance equivalent noise level shift", L_{eas}, of moderators
- Interaction between moderators

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Purpose of modelling

- Establish models for the effect of moderators in various context and use case situations.
- Describe the models in practical terms,
 - which use cases they are applicable for
 - which context variables to control or specify as input
- Get output estimates of the moderator effect with a specified uncertainty

Data input

- Raw data from two major Danish socio-acoustic surveys (made available for modelling in this project by permission from the Danish Road Directorate)
- Excellent quality
 - Methodology according to ISO 15 666 standard
 - High number of participants
 - Questions on relevant moderators
 - Good data quality

Study	Year	Number of	Total	
Noise annoyance from motorways and urban roads	2014	Motorways: 3446	Urban roads: 3315	6761
Noise reducing pavements (Copenhagen dataset)	2007 and 2008	Before: 1330	After: 1540	2870

A total of 6316 respondents

Method

TECHNOLOG

Examples of dose-response curves from model

Road visual Annoyance L_{den} [dB] Not visible ——Logistic Not visible
Visible ——Logistic Visible

Access to a quiet side

Yes

—Logistic Yes

No ——Logistic No

Model: Annoyance equivalent noise level shifts, L_{eas}

- Orientation of outdoor areas: 10 dB (8.4-11.8 dB)
- Access to a quiet side: 10 dB (8.0-11.8 dB)
- Motorway visible: 4 dB (2-6 dB)
- Acceptance of road noise: 20 dB (19.1-21.6 dB)

Conclusions

- The model can quantify the annoyance and the effect of moderators
- The model can quantify the relative importance of the moderators when more moderators are in play at the same time
- The models confirms the findings in the literature study to a large extent
- The results are representative for Denmark and probably for other northern European countries

Outlook – take home messages

- More data are needed for a more representative model
- Future socio-acoustic surveys should include (standardized) questions on relevant moderators
- Uniform questionnaires are highly recommendable to facilitate data aggregation of surveys

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Thanks for listening! Do you have any comments or questions?

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