Reducing road traffic noise
How to design effective interventions

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INTRODUCTION

More than 15% of the Swiss population feels annoyed by road traffic noise during the day (8% during the night) [1]. Thus, noise from road traffic is a serious environmental problem. Up to now, governmental noise abatement concentrated on technical and urban planning measures. The noise reduction potential of changing individual behavior has not yet been realized – not least because of missing theoretical and empirical foundations.

Overall aim:

- ✓ Identifying benefits and barriers of low-noise behaviors (in regard to road traffic noise)
- ✓ Based on these findings, developing propositions for intervention tools to reduce road traffic noise.

Overall research question:

- ✓ What can individuals do to avoid road traffic noise?
- ✓ What factors facilitate and inhibit low-noise behaviors?
- ✓ How can low-noise behavior be supported?

THREE-STEP PROCEDURE

Step 1: Developing a behavior change model

Aim: Developing a stage model framework for low-noise behavior in relation to road traffic noise.

Research Questions:
Which individual behaviors contribute to the reduction of road traffic noise?
Which predictors facilitate or inhibit the implementation of individual low-noise behaviors?

Procedure: Review of literature on continuum and stage models about behavior change (e.g., [2, 3, 4, 5]), adaptation of the theoretical implications to the context of road traffic noise by conducting 16 qualitative interviews with experts in noise prevention, traffic planners, retailers, motorcyclists, and car drivers.

Results: The proposed model framework (synthesis of theories on behavior change and contents identified in the interviews) is shown in Figure 1. Potential individual low-noise behaviors identified with help of the qualitative interviews are listed in Table I.

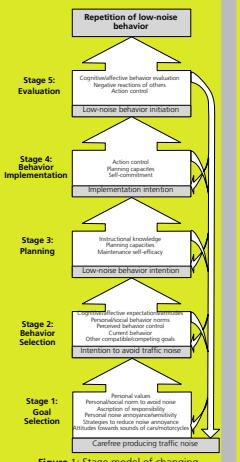

Figure 1: Stage model of changing noise-producing behavior in relation to road traffic

Table I: Overview of different low-noise behaviors to reduce road traffic noise identified in the qualitative interviews

Low-noise behaviors	Description
Investments	
Vehicle purchase	Choice to buy a low-noise vehicle
Purchase of tires	Choice to buy new low-noise tires
Tunning of the vehicle	Abdication to sound-tuning activities
Upkeep of the vehicle	Periodic maintenance of the vehicle, e.g. exchange of worn-down dampers
Routines	
Travel mode choice	Choice to use slow-traffic (by foot/bicycle) instead of motorized individual traffic (MIV)
Driving style*	Low-noise driving style (corresponding to the principles of Eco-Drive)
Carsharing	Use of car-sharing supply instead of owning a car (based on the assumption that there are less car rides when not owning a car)
Sound volume of the stereo	Abdication to listen to music in the car at high volumes

Note: *Application of a low-noise driving style was chosen as example for the further procedure.

Step 2: Identification of intervention points by means of quantitative tests

Aim: Identifying intervention points to foster the implementation of Eco-Drive.

Research Questions:
In which stage of the model is the majority of participants?
Which are relevant predictors explaining the transition variable of this stage?

Procedure: Non-representative online survey in the German speaking part of Switzerland (Oct 11 – Jan 12). From the 1684 participants 890 received the questions about their driving style (age *M*=31.03, *min*=19, *max*=80 years, 53% female).

Results: Surprisingly, a huge majority of participants (>80%) seem to be in the evaluation stage, as they report having performed Eco-Drive in the past and intending to use it in the future. Thus, interventions should support the maintenance of a correct application of Eco-Drive. Predictors explaining correct application (index) are reported in Table II. They can be subsumed within aspects of motivation, knowledge, routine building, and socio-demographic variables.

Table II. Linear regression analysis for correct application of Eco-Drive

Aspects of		*B*	*SE B*	*β*
	Constant	17,682	1,209	
Person	Gender (f vs. m)	1,235	,300	,154**
	Living location: village vs. small city	-,726	,368	-,075*
	Living location: village vs. large city	-,503	,347	-,056
	Vehicle class: small vs. middle	-,426	,322	-,050
	Vehicle class: small vs. luxury	-2,470	,995	-,090*
	Vehicle class: small vs. Van	-,679	,468	-,054
	Attended Eco-Drive lessons	,537	,376	,061
Motivation	Biospheric value orientation	,181	,182	,041
	Personal norm towards noise reduction	-,057	,138	-,019
	Ascription of responsiblity	,287	,123	,094*
	Attitude towards the sound of motocycles	-,302	,119	-,098*
	Personal norm to perform Eco-Drive	,399	,151	,127**
	Positive expectations	,487	,253	,095*
Knowledge	Knowledge/Information	,247	,127	,083*
	Self-Commitment	,163	,103	,064
	Assumptions about CO_2 savings	,134	,117	,055
	Assumptions about positive driving experience	,001	,134	,000
	Assumption that Eco-Drive harms the vehicle	-,278	,133	-,099*
Routine	Frequency of previous Eco-Drive use (self reported)	,407	,098	,161**

Notes: *B = unstandardized regression coefficient, SE B = standardized error of B, β = standardized coefficient, *p<.05, ** p<.01, R^2=.22, adjusted R^2= 20, N=636, forced entry method was used for calculations, missings were excluded listwise.*

Step 3: Developing intervention propositions

Aim: Developing ideas for key-messages, communication channels and multiplicators for intervention tools fostering the correct application of Eco-Drive.

Research Questions: How can the motivation, knowledge, and routine-building of car-drivers to perform Eco-Drive be fostered?

Procedure: Innovation-workshop using the brainstorming method (figure 3 illustrates a cluster of ideas generated during a brainstorming phase). Participants were Eco-drive instructors, a person of the Swiss umbrella association for Eco-Drive, a traffic psychologist, environmental psychologists with expertise in intervention design and a communication expert.

Results: A huge variety of ideas has been created and structured (cf. Table IV). Ideas are now evaluated on usability by the research team, and first prototypes are created (cf. Figure 4, which illustrates the idea of a sticker visualizing the ideal range of engine speed).

Table IV: Overview on different intervention measures identified

Measure

- Integration of Eco-Drive lessons within driving school
- Special Eco-Drive lessons
- Repetition of Eco-Drive lessons
- Feedback-device/App (fuel consumption, driving speed, engine speed)
- Better visualization of driving speed and engine speed
- Visualization/accustical feedback on the own noise emissions
- Indication of the ideal driving speed from one green light to the next
- DB-Meters on the roadside
- Instruction plate with principles of Eco-Drive on the roadside
- Prompts inside the car
- Oral information (e.g., by the police)
- Written information / knowledge transmission (Flyer)
- Contest/game (among co-workers)
- Eco-Drive Song (on the radio)
- Financial incentives (fuel prices, costs of driving lessons)
- Testimonials
- Shaping road space
- Pictures of people annoyed by noise
- Signalization of noise-sensitive areas (schools, hospitals, ...)

Figure 3: Example of a cluster of ideas as created during a brainstorming session

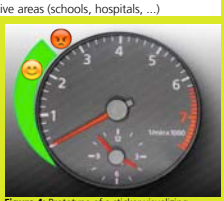

Figure 4: Prototype of a sticker visualizing the ideal range of engine speed (< 2500rpm for vehicles with gas engine)

DISCUSSION AND OUTLOOK

The three-step procedure chosen allowed for combining the advantages of theoretical and empirical foundation with experiences of practitioners in order to identify target behaviors, facilitating and inhibiting predictors, as well as potential intervention recommendations. However, the effectiveness of our recommendations has yet to be assessed. Therefore, prototypes of intervention tools will be presented to people of the target group in order to test their attractiveness and acceptability. We further plan to evaluate the efficacy of the tools in a field study.

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