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DEVELOPING A LINGUISTIC CORPORA-BASED SOUNDSCAPE QUESTIONNAIRE: ADDRESSING TRANSLATION CHALLENGES IN THE ISO STANDARD

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ABSTRACT

This study presents the development of a linguistic-acoustic questionnaire, created and administered as part of the PNRR RAISE (Robotics and AI for Socio-economic Empowerment) project, designed to validate and extend the results of the previous survey on the perceptual description of soundscapes in Italian port and backport areas conducted as part of the TRIPLO project.

This new questionnaire incorporates elements of the standard PD ISO-TS 12913-2:2018 (Method A), developed as part of the ISO 12913 series to establish international consensus and facilitate communication in soundscape research.

The ISO 12913 series promote an integrated approach to the acoustic environment, assessing all perceived sounds in their complexity.

Based on this, the questionnaire integrates the framework of the standard and its Italian translation drawn from recent literature to perform a comparison between adjectives derived from English and those identified through linguistic analyses of Italian corpora. By incorporating both established methodologies and linguistically grounded approaches, this study aims to further refine the descriptive framework for soundscape perception and explore the interplay between language and cultural context in evaluating acoustic environments. The results may offer valuable insights and be a good basis for the development of tools to enable comparative soundscape studies between languages.

Keywords: *corpus-driven approach, Italian language, acoustic linguistic survey, sound perception.*

1. INTRODUCTION

Research on soundscape perception has increasingly emphasized the role of language in describing acoustic environments. The ISO 12913 series [1] provide a recognized framework for soundscape assessment, promoting standardized attributes to enable cross-linguistic comparisons. However, one key difficulty in translating these descriptors across languages is preserving their perceptual nuances clearly and effectively. Initiatives such as the Soundscape Attributes Translation Project [2] have sought to ensure that ISO descriptor translations retain their meaning across cultural and linguistic contexts.

Our perspective challenges the translation-centric approach, arguing that capturing linguistic and cultural nuances requires starting from the language and its usage rather than adapting standardized terms.

Expanding on previous research [3,4] from the TRIPLO project [5] - which analyzed how Italian speakers describe port and backport soundscapes using corpus-derived linguistic descriptors - this study incorporates a new questionnaire developed under the PNRR RAISE project. The questionnaire compares standardized ISO descriptors with Italian adjectives selected through corpus analysis. We selected Italian adjectives from large linguistic corpora, analyzing them for frequent collocations with "suono" (*sound*) and "rumore" (*noise*) and refining them using statistical techniques such as frequency analysis, synonym normalization, and morphosyntactic annotation.

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This research contributes to ongoing efforts to adapt the ISO 12913-2:2018 (Method A) attributes to naturally occurring linguistic expressions in Italian soundscape perception, focusing on the value of starting from the language itself rather than relying solely on translations.

2. METHODOLOGY

The questionnaire investigates the perception of environmental sounds through a structured approach that combines standardized questions with items designed according to a linguistic perspective. It consists of several interconnected sections designed to gather specific insights into how individuals perceive and describe their acoustic surroundings.

The first section collects demographic and contextual information, asking respondents to provide details such as their birth year, education level, and a self-assessment of their hearing ability on a five-point scale. This initial data helps contextualize participants' responses about their background and personal auditory experiences.

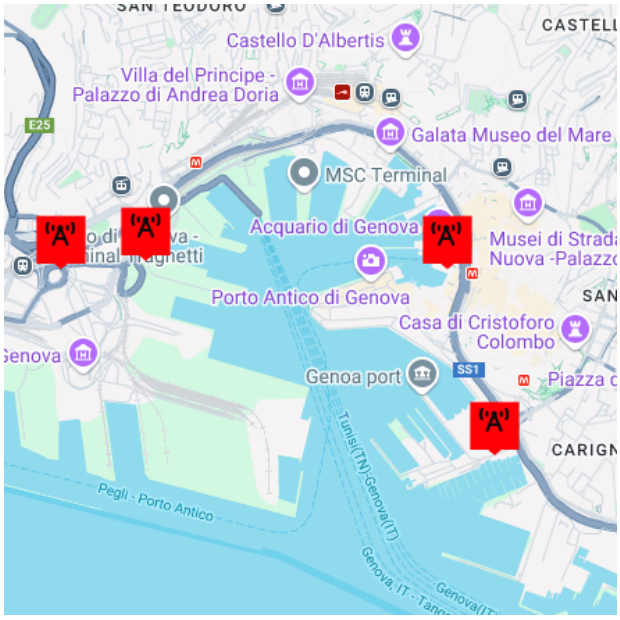

Figure 1. Positioning of sensors near the areas where questionnaires are administered.

The second section focuses on the evaluation of the acoustic environment. Participants describe their surroundings by indicating the perceived noise level, ranging from very quiet to very noisy, and selecting adjectives from a predefined list to characterize their current soundscape. To facilitate comparisons between the adjectives chosen by participants and those used in the ISO standard, they also respond to the standardized questions derived from the PD ISO-TS 12913-2:2018 framework (Method A), translated into Italian based on the study by Aletta et al. [6].

Interviewers conduct all sessions near an acoustic sensor that continuously records environmental noise parameters over 24 hours, allowing for the integration of objective measurements such as LAeq with subjective responses to analyze potential relationships between perceived and measured sound levels.

The questionnaire also includes an audio evaluation task, in which respondents listen to four pre-selected recordings and evaluate them using the same adjective selection process. In this section, among all the questions from Method A of the ISO framework, only the one related to the eight perceptual dimensions was retained, allowing for a comparison between the adjectives selected by participants in the previous question and those defined by the standard. This question includes a predefined set of adjectives representing the eight perceptual dimensions [7]: eventful, exciting, pleasant, calm, uneventful, monotonous, unpleasant, chaotic. The translation of these adjectives draws on existing literature regarding the use of this question in Italian [6,8].

Each respondent listens to four audio tracks, selected from eight, ensuring a balance between questionnaire length and diversity of auditory stimuli. The selection of these audio samples reflects the diverse acoustic environments found in port and hinterland areas. They include characteristic port sounds, such as the noise of loading and unloading operations, forklifts, and ship sirens, as well as natural and urban sounds, such as crickets, seagulls, traffic, and trains. The recordings were conducted on-site, with up to four sound level meters used to measure psychoacoustic parameters, while two digital recorders captured 16-bit audio at 44,100 Hz.

Finally, an optional section collects contextual data on participants' socio-economic profile to test whether noise perception - its disturbance or discomfort - varies with socio-economic well-being, assessed based on education level, residence area, job type (e.g., blue-collar, office worker), work environment (construction site, factory, office), perceived income (high/sufficient/low), and financial stability (monthly savings).

2.1 Methodological choices for adjective selection

The selection of adjectives, see the second section description and the audio evaluation task, was grounded in linguistic analysis using large-scale textual corpora, which

provided authentic examples of language use across various contexts, including journalistic articles, literary works, social media posts, and blogs.
We extracted texts containing the words "suono" (*sound*) and "rumore" (*noise*) from these corpora and subsequently processed them following standard corpus linguistics practices. That process involved tokenization, lemmatization, and morphosyntactic annotation to identify and extract adjectives associated with these terms. The analysis yielded a pool of 312 adjectives, subsequently applied in a linguistic-acoustic questionnaire to investigate how participants describe different auditory experiences.
This initial survey allowed us to collect contextual and auditory descriptions from 824 interviewers and provided the foundation for refining the adjective set used in the present study.

Figure 2. adjectives list presented in the questionnaire

By analyzing the results of that questionnaire, in fact, we identified a list of 55 adjectives that capture key soundscape characteristics along the scale from quiet to very noisy. These adjectives were all retained in the new questionnaire, ensuring continuity in the descriptive framework while refining the overall selection.

In addition to these 55 adjectives, we included those representing the eight perceptual dimensions defined by the ISO standard, as translated and validated for Italian within the Soundscape Attributes Translation Project [8].
Lastly, based again on the results of the first questionnaire, we retained all adjectives with a relevance score ≥ 0.05. This first questionnaire included two sections: in the first, participants described the soundscape of a road they selected; in the second, they listened to a series of audio recordings and described the sounds they heard. Based on these responses, we calculated relevance as the ratio between the frequency of each adjective and the most frequently used word in the two respective sections: "accettabile" (*acceptable*) (183 occurrences) in the first and "esterno" (*external*) (2,201 occurrences) in the second.
This selection process resulted in a final list of 154 adjectives that effectively capture participants' perceptions of their current environment and the audio stimuli they evaluated, ensuring a comprehensive yet concise set of descriptors.

3. CONCLUSIONS AND FUTURE DIRECTIONS

This study has developed a linguistic-acoustic questionnaire that integrates both standardized descriptors from the ISO 12913-2:2018 framework and context-specific adjectives derived from Italian corpora. By comparing these two sets of descriptors, we hope to assess the relevance of adjective in the context of Italian soundscape perception, with the aim of ensuring that the questionnaire will effectively capture the nuances of how individuals describe their acoustic environment.
At present, approximately 600 questionnaires have been completed, offering valuable data on how people perceive and characterize sounds in various port and hinterland areas. Although statistical analysis has not yet been conducted, this large dataset holds the potential to provide deeper insights into the factors influencing sound perception in these environments once the analysis is performed. As this research progresses, the findings could help refine the descriptive framework for soundscape perception and may support the application of the ISO standard across different linguistic and cultural contexts.
In conclusion, this study aims to contribute to the ongoing discourse on soundscape research by attempting to provide linguistically informed tools to better understand how individuals perceive and interpret their auditory environments.

4. ACKNOWLEDGMENTS

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