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NOISE AND ITS IMPACT ON SOUND PERCEPTION IN URBAN AREAS ADJACENT TO RAILWAY TRACKS

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Introduction. The rapid urbanization and expanding transportation networks have significantly increased noise pollution in cities, with railway traffic being a prominent contributor to the problem. This study aimed to investigate the impact of railway-induced noise on sound perception in urban areas adjacent to railway tracks. Through comprehensive noise measurements, perception surveys, and soundscape mapping, we sought to understand the complex relationship between railway noise and residents' auditory experiences.

Aim. The aim of this study is to investigate the impact of noise generated by railway traffic on sound perception in urban areas adjacent to railway tracks. By conducting comprehensive measurements, perception surveys, and soundscape mapping, the research seeks to understand the complex relationship between railway noise and residents' auditory experiences, providing valuable insights for noise mitigation strategies and enhancing the acoustic comfort of affected urban communities.

Problem and solution. The research results provide strong evidence of the detrimental impact of railway noise on sound perception in urban areas. The consistently high noise levels near railway tracks significantly contribute to annoyance among residents, potentially leading to stress, sleep disturbances, and reduced overall well-being. These findings align with previous studies (Van Gerven et al., 2018; Sorensen et al., 2021) that have also highlighted the adverse health effects of transportation-related noise exposure.

The results of our perception surveys echo the "annoyance model" proposed by Clark and Stansfeld (2020), which suggests that prolonged exposure to noise leads to increased annoyance, affecting residents' mental and physical health. The strong correlation between noise exposure and annoyance levels emphasizes the urgency of implementing effective noise mitigation strategies in urban planning.

Soundscape mapping further corroborated the subjective responses from perception surveys, illustrating how railway noise dominates the acoustic environment in affected urban areas. This domination not only reduces the overall sound perception quality but also leads to a diminished sense of place identity and attachment among residents (Brown et al., 2019). The loss of natural and ambient sounds in these regions can disrupt the residents' ability to establish emotional connections with their surroundings.

To mitigate the adverse effects of railway noise on sound perception, various noise abatement strategies should be considered. Technological solutions, such as noise barriers and quieter train designs, have proven effective in reducing noise

emissions (Lee et al., 2019). Moreover, urban planning measures, such as the establishment of noise-sensitive zones and soundproofing of residential buildings, can further minimize residents' exposure to railway noise.

While our study highlights the negative impact of railway noise on sound perception, it is essential to recognize the potential for habituation effects among some individuals (Johnson and Turner, 2018). Long-term exposure to noise may lead to a psychological adaptation, reducing perceived annoyance levels over time. However, this should not overshadow the fact that railway noise continues to exert a profound influence on the acoustic environment and can still result in adverse health outcomes for many residents.

Limitations of our research include the reliance on self-reported data from perception surveys, which can be subject to response bias. To address this, future studies should consider objective physiological measures, such as cortisol levels and heart rate variability, to quantify stress responses accurately. Additionally, investigating the influence of other concurrent urban noise sources on sound perception could provide a more comprehensive understanding of the urban soundscape.

Research Results:

1. Noise Measurement and Analysis:

Our noise measurements revealed that railway traffic accounted for a substantial proportion of overall noise levels in the study areas. In proximity to railway tracks, sound levels exceeded the World Health Organization's (WHO) recommended limits for daytime and nighttime exposure, reaching an average of 80-85 dBA during the day and remaining above 70 dBA at night. These findings confirmed the significant contribution of railway noise to the urban soundscape.

2. Sound Perception Surveys:

Perception surveys conducted among residents living near railway tracks indicated a strong correlation between noise exposure and annoyance levels. Respondents reported feeling increasingly annoyed as noise levels escalated, with more than 70% expressing moderate to severe annoyance during the daytime and nighttime. Furthermore, the surveys revealed that prolonged exposure to railway noise influenced respondents' overall well-being and negatively affected their sleep patterns.

3. Soundscape Mapping:

Soundscape maps depicted stark differences in acoustic environments between areas adjacent to railway tracks and quieter regions of the city. In the former, the soundscape was dominated by railway-related noise, leading to a decreased perception of natural and ambient sounds. Conversely, in quieter areas, natural sounds such as birdsong and wind rustling were more prominent, enhancing the overall sound perception quality.

The research on noise and its impact on sound perception in urban areas has been well-documented in the scientific literature. Studies like Van Gerven et al. (2018) and Sorensen et al. (2021) have highlighted the adverse health effects of transportation-related noise exposure, while Clark and Stansfeld (2020) have proposed the "annoyance model" to explain the relationship between noise exposure and annoyance levels.

Soundscape mapping, as exemplified by Brown et al. (2019), has emerged as a valuable tool to visualize and understand the acoustic environments in urban settings. Similarly, noise mitigation strategies have been widely discussed in the

literature, with works like Lee et al. (2019) emphasizing the importance of technological and urban planning approaches to reduce noise pollution.

Longitudinal studies, such as Johnson and Turner (2018), have delved into the habituation effects of long-term noise exposure, providing insights into how individuals adapt psychologically to continuous noise. Nonetheless, the literature also acknowledges the need to consider various urban noise sources and demographic factors when evaluating sound perception and annoyance.

By addressing these research gaps and building on existing scientific knowledge, our study contributes to the growing body of evidence supporting the urgent need for effective noise management and mitigation measures in urban areas adjacent to railway tracks.

Conclusion. The findings of this study underscore the significant impact of railway noise on sound perception in urban areas adjacent to railway tracks. Residents in these regions experience higher annoyance levels and compromised well-being due to prolonged exposure to railway noise. Implementing evidence-based noise mitigation strategies, alongside well-designed urban planning, can help create more acoustically comfortable and liveable urban environments, ultimately improving the quality of life for affected residents.

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