

Acoustic comfort evaluation in urban open public spaces

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Available online 25 September 2004

Abstract

This paper presents the results of an intensive questionnaire survey and objective measurements on soundscape, aiming at the evaluation of acoustic comfort in urban open public spaces. From summer 2001 to spring 2002, 9200 interviews were made for four seasons in 14 urban open public spaces across Europe. The results suggest that the subjective evaluation of the sound level generally relates well with the mean L_{eq} , especially when the sound level is below a certain level, which is 73 dBA on the basis of this study. However, considerable differences have been found between the subjective evaluation of the sound level and the acoustic comfort evaluation: people tend to show more tolerance in terms of acoustic comfort evaluation. The background sound level has been found to be an important index in evaluating soundscape in urban open public spaces – a lower background level tends to make people feel quieter. Analyses of individual sound elements show that the acoustic comfort evaluation is greatly affected by the sound source type – introducing a pleasant sound can considerably improve the acoustic comfort, even when its sound level is rather high. No significant difference was found among different age groups in terms of subjective evaluation of a sound level, whereas in terms of acoustic comfort, there were significant differences.

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Keywords: Urban open public spaces; Acoustic comfort; Soundscape

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1. Introduction

Numerous previous investigations regarding noise propagation and reduction in urban areas have been carried out [1,2], and various effects of community noise have also been studied [3,4]. A series of noise regulations has been established and many local authorities are actively making noise maps of their cities [5]. However, recent research has shown that reducing sound level does not necessarily lead to better acoustic comfort in urban areas [6–9].

Listening is one of the psychological functions through which people perceive the world. Hence, the evaluation of sound effects on people is primarily a subjective issue, rather than merely based on objective parameters. As people are the central core in today's planning and design approach, studying the relationships between acoustic sensitivity and the characteristics of people will help the design process.

Moreira and Bryan [10] suggested that individuals with high noise susceptibility might be personality types that show a great interest in and have sympathy with others, have a great awareness of their environment, and are likely to be intelligent and creative. To explain the considerable differences in tolerance between individuals when exposed to noise, the concept of noise sensitivity has been invoked – it is defined as a stable personality trait that captures attitudes towards a wide range of environmental noises [11,12].

For urban open public spaces, an important element of urban areas, it is vital to study the users' perception of sounds. A recent study based on the semantic differential analysis showed that relaxation, including comfort–discomfort, quiet–noisy, pleasant–unpleasant, natural–artificial, like–dislike and gentle–harsh, is a main factor for people's soundscape evaluation in urban open public spaces [13]. However, research in this aspect has been rather limited – most existing studies mainly dealt with relatively large urban or rural areas [14–18]. Moreover, many studies were laboratory-based [19–21]. For the soundscape in an urban environment, it would be more appropriate to carry out on-site surveys, given the difficulties in simulating the complex sound source situations, and the interactions between sound and other micro-climate and social/cultural factors.

In the research described in this paper, the acoustic comfort has been studied based on a large number of interviews in 14 urban open public spaces across Europe. The paper first describes the survey methodology. It then presents the results in terms of the evaluation of sound level and acoustic comfort, considering the overall soundscape and individual sounds. The effects of demographic factors as well as the relationship between acoustic comfort and overall physical comfort are also analysed.

2. Methodology

From summer 2001 to spring 2002, an intensive questionnaire survey and objective measurements on soundscapes were carried out for four seasons in 14 urban open public spaces of five European countries, namely Greece, Italy, UK, Germany and Switzerland. Seven cities, Alimos, Thessaloniki, Sesto San Giovanni, Sheffield,

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