

# A REVIEW OF RECENT STUDIES ON LANDSCAPE INFLUENCE ON URBAN PARK SOUNDSCAPE

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**ABSTRACT**-Urban parks are considered to be the leisure space. Generally, the visual experience is always regarded as the dominating feature for the people to visit the park. It becomes less significant that people suffer the loss of opportunity in experiencing the sounds of parks. Issues related to soundscape and its preference in urban parks is yet to be explored much. In most cases, landscapes are designed whereas soundscapes are not designed. Based on 40 journal papers, this paper presents a critical review of recent studies on influence of landscape elements in urban park soundscape. The review focuses on the people's perception on urban park soundscape, temporal structure of urban park soundscape, evaluation of urban park soundscape and approaches for evaluating landscape influence on soundscape. To better clarify the mechanism behind the evaluation of landscape influence of urban park soundscape and recommendations of future research directions are also provided.

**KEYWORDS:** Soundscape, Urban park soundscape, Landscape, Urban parks

## INTRODUCTION

Urban parks are considered to be the leisure space. Generally, the visual experience is always regarded as the dominating feature for the people to visit the park. It becomes less significant that people suffer the loss of opportunity in experiencing the sounds of parks. Issues related to soundscape and its preference in urban parks is yet to be explored much. In most cases, landscapes are designed whereas soundscapes are not designed. Soundscape definition stated by ISO (International standard organization) is that acoustic environment as perceived or experienced and/or understood by a person or people, in context. In general soundscape is the combination of all sounds within a given location with an emphasis on the relation between individual's or society's perception (Schafer 1977). He explained the control of visual aesthetics in the present societies. This lets Schafer develop a series of hearing exercises, which was intended to create the sonic awareness among people through field studies. The study was done using the help of sound measurements, soundscape recordings and portraying various sound features. This interest directed him and few of his soundscape colleagues to invent few terms as

**Keynote:** Sounds that is continuously heard in the given location. This is also called background sound (the sound of the train in the railway station)

**Sound Signals:** Sounds that attracts attention of the people. This is also called foreground sound (eg: announcements in the railway stations about the train timings, for people to listen)

**Sound marks:** The sound which serves as a landmark for the particular place.

**Lo-fi:** The sounds cannot be heard properly due to masking of other sounds which acts as a disturbance

**High- fi:** Sounds can be clearly distinguished since there is only little masking by other sounds.

This paper therefore presents a critical review of recent studies on landscape influence of soundscape in urban parks. It starts with the background of urban soundscape, followed by the research methodology and an overall picture of the research progress. Selected papers are then discussed from four aspects as people's perception on urban park soundscape, temporal structure of urban park soundscape, evaluation of urban park soundscape and approaches for evaluating landscape influence on soundscape. Finally, the discussion section includes a summary of the findings from this study and recommendations for future related research.

## BACKGROUND OF URBAN PARK SOUNDSCAPE

Urban park soundscape gained its importance while in the process of understanding how urban parks attract more number of visitors. Good soundscape quality in parks cannot be provided without a systematic understanding of the complex relationships among different elements like sound, environment, and individuals (Tse & Kwan, 2013). The acoustic comfort evaluation plays an important role on user's acceptability of the urban park environment besides visual comfort evaluation of landscape. Acoustic preferences decide the likeliness towards the park environment.

There have been many researchers who categorizes various types of sounds inside the parks as natural, anthropogenic, mechanical. (Tse & Kwan, 2013) examined three conditions of parameters as acoustic comfort evaluation, acceptability of the environment and individual preference to stay in the park. They try to understand the interrelationship between three set of parameters using path analysis model.

## IMPORTANCE OF QUIET/TRANQUIL PLACES IN URBAN CONTEXT:

Booi & Berg, 2012 made a specific questionnaire in seeking answer for quietness in the urban environment. In response to that, a large group of respondents say they go outside to relax. Therefore, visiting quiet places or going outside actually meets a need for quietness in the urban. In the questionnaire survey conducted by (W. Yang & Kang, 2005) in two urban squares of

Sheffield, UK, when people were asked about where they want to go out to relax for a short period, many of the participants chose natural sounds. Quiet is not a core requirement for such acoustic preference in the outdoor acoustic environment. Core requirements include congruent soundscape and landscape, and dominant wanted sounds in a place over, and not masked by, unwanted sounds (Lex Brown, 2012).

There have been various efforts taken to protect such places. For e.g. a decade ago the Environmental noise Directive 2002/49/EC suggested the competent authority to implement a noise action plan which intended to protect the quiet areas. There have been various definitions of quiet areas as according to (Brown & Muhar, 2004), quiet are not the absence of sound, but the sound that have a specific character which forms the part of the society's culture. In addition to that the END defined the quiet areas specification as 55 dB  $L_{day}$  in Europe. It is observed that the possibilities for quiet recreation in urban environments can have a positive effect on the quality of life in the urban (Booi & Berg, 2012). (Pheasant & Horoshenkov, 2008) worked on the first ever evaluation of the tranquility of open spaces with respect to the characteristics of both acoustic and visual stimuli. They found that the maximum sound pressure level and the percentage of natural features present at a location were the key factors influencing tranquility.

### **INFLUENCE OF NATURAL AND MAN MADE LANDSCAPE FEATURES ON SOUNDSCAPE PERCEPTION**

Factors such as presence of trees, natural features and the tranquility, all contribute towards psychological perception by users, even in areas with higher sound limits than that define quiet areas. These factors cannot be neglected in soundscape assessment of urban parks according to (Brambilla, Gallo, Asdrubali, & D'Alessandro, 2013). (Gidlöf-Gunnarsson & Öhrström, 2007) put forward that the better availability to nearby green areas and their increased usage of such outdoor spaces are important for well-being and daily behavior as they reduce long-term noise annoyances and prevalence of stress-related psychosocial symptoms. Essential element of planning health promoting spaces shall include provision of easy access to nearby green areas, which can offer relief from environmental stress and opportunities for rest and relaxation. It is proved that good soundscape quality areas are those with highlighted natural sounds whereas low soundscape quality areas are those with technological sounds (Nilsson, 2007). Clearly natural features and landscape features have a significant part to play in improving the perception of soundscape. Through interviews, (Maffei, 2008) showed that natural sounds as birds twittering and the wind are the most expected sounds than sounds from road traffic and aircraft fly-overs which are considered to be most annoying.

### **WATER AS AN ACOUSTIC CAMOUFLAGE**

In an ecological waterscape, acoustic comfort is an important element associated with landscape experience. The water sounds such as streams and waves of lake sounds were selected as an effective natural sound to mask urban noises. The level of the water sounds should be similar to or not less than 3 dB below the level of urban noises (Jeon, Lee, You, & Kang, 2010). It is observed from various literatures that water elements as jets, fountains, running water etc. have some influence in the soundscape of an urban environment especially urban parks.

It has been noted that sounds from water features improve the urban soundscape in addition it mask the unwanted background noise in parks (Brown & Muhar 2004; Brown & Rutherford 1994; Perkins 1973). They can also be used to effectively mask other irritating sounds (Maffei, 2008). Booth in 1983 & Brown in 2003 suggested that rushing water can be used as an acoustic camouflage of traffic sounds. Axelsson Osten, Nilsson Mats E 2014, Mats E. Nilsson, et.al., (2010) experimented with fountain and proved that water sounds may have an indirect impact on soundscape quality by camouflaging the capability of hearing the road-traffic noise. They conducted a field experiment to explore whether water sounds from a fountain had a positive impact on soundscape quality in a downtown park. In total, 405 visitors were recruited to answer a questionnaire on how they perceived the park, including its acoustic environment. Meanwhile the fountain was turned on or off, at irregular hours. Water sounds from the fountain were not directly associated with ratings of soundscape quality. Rather, the predictors of soundscape quality were the variables "Road-traffic noise" and "Other natural sounds". The former had a negative and the latter a positive impact. However, water sounds may have had an indirect impact on soundscape quality by affecting the audibility of road-traffic and natural sounds.

Traffic noise reduction can be achieved by introduction of water oriented sound in urban open spaces. (Coensel, Vanwetswinkel, & Botteldooren, 2011) suggested that adding fountain sound with low temporal variability reduces the loudness of road traffic whereas, addition of bird sound enhanced soundscape pleasantness and eventfulness. The addition of latter was more effective in curbing traffic noise. They also agree with the results from laboratory studies that water sounds may mask road-traffic sounds, but that this is not simple and straight forward. Thus sound should be brought into the design scheme when introducing water features in urban open spaces, and their environmental impact must be thoroughly assessed empirically.

### **GREEN AS AN ACOUSTIC CAMOUFLAGE**

Despite the fact that water features influence the soundscape, the greeneries also help to influence soundscape. (Fang & Ling, 2005) suggested that tree belts help with noise reduction in open spaces and urban parks which decrease the stress on environmental noise for people. In addition, (Van Renterghem et al., 2014) proved through the experimental research that the effects of hedges, as a result, from a combination of physical noise reduction, influences people's perception. The acoustical affect produced by the hedges can be understood as a combination of physical noise reduction and their influences on perception. In a study that involved measurement of light vehicle noise reduction by hedges, thick dense hedges were found to provide only a small noise reduction at low speeds. Whereas, higher noise reductions were found to be associated with an increased ground effect. It is also proved that even the trunks could disperse sound with different time delays, in response to the environment (Zhang & Kang, 2007). (F. Yang, Bao, & Zhu, 2011) proved that viewing natural landscapes as vegetation, water and other natural elements generally creates a stronger positive health effect than viewing urban landscapes as concrete, buildings, and other man-made structures. This is proved by quantitative (EEG evaluation) and qualitative (the questionnaire survey) methods which indicate that landscape plants

can cause inflated levels of noise reduction and psychological noise reduction. This shows that the acoustic dynamics can be linked to vegetation structure, even on a micro scale.

### **A FRAMEWORK FOR IMPROVING URBAN SOUNDSCAPES**

Sound in public urban spaces is often considered in negative terms as both intrusive and undesirable – its referred to as noise! However, this issue is multi-faceted and goes much deeper than simply reducing levels. There are many positive aspects of a soundscape. In an attempt to progress thinking on positive soundscapes and move towards more practical planning approaches and decision making tools for soundscape assessment, this paper proposes an approach traditionally used in product development and manufacturing quality – The Kano Model. The approach is captured in the form of a broader framework which covers: the composition of a soundscape in objective terms; the factors affecting whether it might be perceived as positive; and how the Kano model for product development can be used as a means of understanding the range of applicability of approaches to create positive soundscapes (including several novel approaches which are the subject of other papers in this issue). It can be considered to be complementary with previous frameworks, some of which have concentrated on sound sources, others on the factors affecting perception or even as a model for understanding individual evaluation. In this case the motivation behind the framework is to help assess the likely impact of practical interventions on the positive aspects of a soundscape.

The framework proposes that the meaning of “positive” for a public space is quite different for three types of people, each with a different level of direct engagement with the soundscape: planners; serious listeners; users of the space. The first two are influenced by the soundscape itself, either in meeting legislation and reducing nuisance, or as an artistic or creative opportunity. However the third, arguably most important group of people, users of the space, are more concerned with the space itself and have their perception of it influenced by the soundscape, which is an inconvenient and highly complex intermediate step. This influence is largely determined by their activity e.g. reading, holding a conversation, shopping or sightseeing.

The paper discusses the further implementation of the framework, and how barriers to the wider application of the concept of positive soundscapes might be overcome. It shows how adapting an approach previously used in automotive sound quality can be adapted for urban soundscapes. It concludes with recommendations for taking the framework forward as a practical approach.

(Jennings & Cain, 2013).

### **PEOPLE’S PERCEPTION ON SOUNDSCAPE**

The acoustic environment is measured through sound level meter, whereas soundscape is measured through human perception which is considered to be one of the vital factors for the park visitors. Various studies were conducted based on the perception of people on soundscape in public places. Social and demographic factors of the users may play an important role in the soundscape evaluation. According to (Zhang & Kang, 2007) proved that soundscape evaluation is not only based on perceptual factors, but also cognitive factors, such as memory.

Besides (Ismail, 2014) analyzed the importance of the soundscape in the environment based on linguistic expressions through people’s memory and their experiences through open ended and closed ended questions. These linguistic expressions are used to describe sounds that help in the interaction between people and the surrounding environment. This study further explains how these environments shape people’s perception. (Booi & Berg, 2012) analyzed the factors that conclude the need for quietness. They explained it through the model showing the influence of demographic and socio-economic issues, health status, and daily activities and the noisiness in and around the home in the urban of Amsterdam. (Davies et al., 2013) identified three significant groups to describe soundscapes like sound source, sound descriptors and soundscape descriptors .

The survey in Europe showed that there is no significant difference among the different age groups in terms of subjective evaluation of a sound level (Zhang & Kang, 2007) whereas elderly and less healthy people are most often sensitive to noise according to (Booi & Berg, 2012) who also proved that there is a relation between need for quietness and the education level, in determining sound preference. According to them it is significant that highly educated people prefer a higher need for quietness. Kang further showed that “cultural background and long-term environmental experience are important aspects in determining soundscape by his research.

People have emotional reactions to the built environment, and the sonic environment is one of the major contributing factors of people’s experiences of places. It is useful for decision makers such as planners, architects, engineers and designers to understand the link between the soundscapes of built environments, and their resultant emotional reactions within users of those environments. This understanding can allow these decision makers to make better informed decisions about built environment design, and achieve the desired positive emotional responses from users.

(Cain, Jennings, & Poxon, 2013) try to understand and define the emotional dimensions of a soundscape, and then to explore how the resultant dimensional space could have a practical application in decision making. Through data generated through the Positive Soundscapes Project, a Principal Component Analysis was conducted to decompose descriptors of the urban soundscape into two independent emotional dimensions. Listening evaluations were then conducted to explore how perceptions of different types of urban soundscape could be plotted with the 2D emotional perceptual space, and to illustrate how (i) introducing design interventions can change the position of soundscapes within this space and (ii) how metrics such as dB(A) do not necessarily correlate with calmness and vibrancy scores. Through illustrative examples, we suggest how such a 2-D perceptual space might have a practical use in the planning process, primarily as a means for presenting users’ perceptions of soundscapes in a simple, visual, and easy to compare manner, and for setting targets for current and future soundscape design. We conclude with recommendations for further work required to fully develop these emotional dimensions and the 2-D perceptual space into a useful tool.



## APPROACHES FOR EVALUATING LANDSCAPE INFLUENCE ON SOUNDSCAPE OF URBAN PARKS

(Jeon, Hong, & Lee, 2013) worked on the series of gardens which are located in Seources as showed that users distinguish three categories on the sound sources as natural sounds, human sounds and traffic sounds based on sound walk approach. The approach for evaluating urban park soundscape includes qualitative and quantitative analysis. (Jeon & Hong, 2015) classified the categories of sound sources as human sounds, natural sounds and traffic sound based on hierarchical cluster analysis (HCA). Both discriminant function analysis (DFA) and artificial neural network (ANN) analysis were performed using various acoustic parameters to discern which of them best differentiate the soundscape classifications in urban parks. It was revealed that sounds caused by various human activities in parks play an important role to influence eventfulness of soundscape perception. Soundscape perceptions were also closely correlated with esthetic quality, simply urban and sense of enclosure of landscape.

## CONCLUSION

Cities are the main living environment for people. It consists of multiple sound sources as, natural sounds and artificial or man-made sounds. There have been various natural sounds as sounds from birds, sounds from the beach; sounds from branch of the trees etc. There have also been manmade sounds as mechanical sounds from vehicles, sounds from fountains, etc. Most of this soundscape either its natural or manmade, it defines the character of the urban and contributes to urban soundscape. Sound is an inseparable part of the living environment and livability of the urban. Soundscapes are always a changeable in course of time and can be observed from even macro level to the micro level which acts as an important component in adding tranquil places in the urban context. The soundscape approach considers the acoustic environment as a resource, focusing on sounds people want or prefer. The soundscape approach further development in urban parks are facilitated by distinguishing it, both conceptually and in measurement and management approaches, from environmental noise management. Soundscape design, planning, and management, based on soundscape concepts, augment environmental noise management approaches, expanding the scope of application of the tools of acoustic specialists in urban parks. The approach of soundscape considers the acoustic environment as a useful resource for engaging people in the park environment. In such case landscapes are the preferential sounds for a major choice of people in urban parks.

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