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The phonic identity of the city urban soundscape for sustainable spaces

Reeman Mohammed Rehan *

Department of Architecture, Faculty of Engineering, Helwan University, Egypt

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Abstract The world is urbanizing rapidly, with more than half of the global population now living in cities. Improving urban environments for the well-being of the increasing number of urban citizens is becoming one of the most important challenges of the 21st century. Although city planners customarily have visions of a "good urban environment," those visions are usually limited to visual esthetics. The qualitative perspective of sound, which includes sonic diversity and acoustic ecology, is a neglected area of urban design.

Today, many cities have effective legislation that is aimed at reducing the negative effects of noise. Even though many cities may be perceived as very noisy, there are a number of effective practices that can be rather quickly implemented. The soundscape approach, which considers environmental sound as a resource, can be most effective when applied in the urban planning and design process. This paper aimed to apply the soundscape approach in the planning of urban spaces' redevelopment. It explores how the sound impact on the shaping of urban open spaces through international case studies. Then the paper suggests a strategy for including the urban soundscape in the planning process for one of the noisiest squares in Cairo, in order to create a quiet space amid the city's bustle. In this context, the paper concludes that, the concept of soundscape is an established theme in the acoustics environment and that there is a need for soundscaping techniques that are specifically adapted to the outdoor environment.

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Introduction

We are all, in general, largely unaware of the importance of sounds in relation to how we perceive the quality of a place and a good living environment. Whenever urban sound is on the agenda, the topic is primarily noise abatement and legislation to reduce noise.

The study of urban sound is increasingly becoming an established research field in many parts of the world. Many scientists and planners today argue for the need to make

* Address: w2Villa, 102 Street, 10 Dist., Gharb Somed, 6 October, Egypt. Mobile: +20 1064032713.
E-mail address: reeman_rehan@yahoo.com

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environmental acoustics a study program in which innovative design is used to bring out the positive aspects of sound in the urban environment.

This paper will focus on the importance of engaging in the soundscape of the city, emphasizing that the city should be enriched with natural sounds. Then the paper will prove that sound is an important part of people's experience of place and that it contributes to the definition of the phonic identity of the city.

The research problem

The sound environment in the modern cityscape is a growing problem. It is a serious threat to our health and impairs recreational possibilities. Traffic noise pollution in particular is a big environmental problem. City planners often have many innovative solutions for how to create a "good and sustainable urban environment." However, the dynamic sound perspectives in the urban environment, such as sonic diversity and acoustic ecology, are still very much neglected, especially in urban design. There is therefore an urgent need for better, more understandable representation of the sound environment. We will focus on the urban soundscape and its applications in urban design, especially in urban open spaces.

Research objectives

The aim of this paper was to view sounds as potential resources in urban planning and in the design of outdoor environments. Landscape architecture and planning could be developed and give way to conscious acoustic design and active sound management in order to produce the "right sound at the right place." These objectives could be achieved through the following:

- moving beyond just reducing noise levels and initiating innovative experiments of designing urban soundscapes that would create a calm environment and quiet spaces amid the city's bustle;
- describing acoustic phenomena in urban environments;
- determining the application of acoustic aspects of urban design;
- reducing unwanted noise in outdoor areas (streets, piazzas, open spaces, and nodes);
- managing the acoustic environment of cities through creation of sustainable solutions;
- enabling landscape planners to view sounds as a planning resource to increase awareness of soundscapes;
- enhancing our natural soundscape to create a pleasing soundscape.

Research methodology

Soundscape plays an important role in evaluating the quality of an environment. It is the life of a space that one experiences by listening. This paper explores the concept of the urban soundscape in urban open spaces from theoretical, analytical, and practical viewpoints, aiming for tranquility of spaces and sustainability.

This paper seeks to define the urban soundscape concept, its objectives, and how the phonic identity of a city helps to accentuate the characteristic properties of the area. Next, it analyzes how the concepts in international case studies were developed to optimize the soundscape for city sustainability. Then, it deduces a framework of the strategy of the urban soundscape planning process. This is followed by an applied study of one of the noisiest squares in Egypt and a questionnaire regarding the development of the visual image of Ramses square by noise reduction through the concept of urban soundscape and acoustical considerations.

Finally, this paper suggests a set of recommendations for developing urban open spaces from the perspective of soundscape and its application in urban planning and design.

Research hypothesis

The concept of the urban soundscape can positively impact the phonic identity of a city in order to add the tranquility of the city, because urban soundscape strategy has sustainable solutions for reducing noise. This paper assumes that the future soundscape of any city should be an important factor in guiding the planning process.

Urban soundscape as an approach to the phonic identity of the sustainable city

Definition of noise pollution

"We often refer to noise as 'unwanted sounds.' There are three different types of noise; unwanted sound, unmusical sound (defined as non-periodic vibration), and any loud sound." [1]

"Noise pollution is the source of most outdoor noise worldwide and is mainly caused by machines and transportation systems, motor vehicles, aircraft, and trains. Outdoor noise is summarized by the word environmental noise. Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas." [2] "The noise is indicative of patterns of unsustainable living and consumption." [3] (Fig. 1).

More aggressive control of the noises from cars is an important step in reducing noise at the level of urban design. For example, car-free urban districts, more common in



Fig. 1 Traffic is one of the main sources of noise pollution in cities. Ref.: González, A. (2014). What Does "Noise Pollution" Mean?, Journal of Environmental Protection ,Vol. 5, No. 4 August, 2014.

European cities, are one way to protect and celebrate the natural sounds present in cities.

> ''Urban planning and design often seeks to control noises, for example through land use planning aimed at keeping residential development out of noisy areas, design of structures (windows, building materials, interior room layout) to minimize noise, and other efforts to reduce the decibel levels of the noises around us.'' [3]

Definition of urban soundscape

''Soundscape is the subject of acoustic ecology and refers to both the natural acoustic environment consisting of natural sounds, including animal and sounds from trees, the sounds of water, weather, and environmental sounds created by humans through musical composition, sound design, and other human activities, including sounds of mechanical origin resulting from the use of industrial technology.'' [1] As ''soundscape can be defined as the totality of sound phenomena that lead to a perceptual, esthetic and representational comprehension of the sonic world.'' [4] ''Soundscape is thus an expression which focuses on the listener's experience of space'' [4] ''and it refers to the acoustic environment at a place, like a residential area or a city park, as perceived and understood by people, in context. It is the acoustic equivalent to 'landscape,' and includes all sound sources, wanted as well as unwanted.'' [5] ''The soundscape approach includes management of the elements of the acoustic environment that are of high quality and value to people, either through acoustic design or by management of the outdoor space, much in the same way that landscape design is applied to improve visual perception of the environment.'' [6] Soundscape ecology is the study of sound within a landscape and its effect on organisms.

> ''Sound forms an integral part of the urban environment, and there is a growing awareness that it should be considered at the same level of importance as visual aesthetics in the urban planning and design process.'' [7] And ''a natural soundscape is an essential aspect of livability and quality of life.'' [3]

Objectives of the urban soundscape

The main aim of the urban soundscape concept is to integrate sociological and esthetic aspects of the acoustic urban environment. The sub-objectives of the urban soundscape concept are as follows:

- To provide the listener with a sense of place.
- To find and protect quiet areas.
- ''To promote well-being, comfort, communication, enjoyment, excitement, happiness, harmony, liveliness, naturalness, relaxation, safety and well-being.'' [8]
- To enhance the visual image of cities.
- To reduce the urban heat island effect and improve air quality.
- ''To improve tranquility in city open spaces.'' [9]
- ''To promote activities such as walking and running [in order to] benefit mental health.'' [10]
- To play an important role in tourism, in order to bring enormous economic benefits.
- ''To create an attractive setting for economic investment.'' [10]

The phonic identity of the city

''Each city may have a rather unique acoustic profile, the composition of specific natural sounds, signals and noise.'' [1] Sounds are important for the intrinsic quality of a place. The quality of a soundscape is important for creating and preserving the identity of the city.

The phonic identity of the city depends on the landscape's acoustic characteristics, which are based on the shape, space, material, and furnishing.

> ''All locations can be expected to have a unique auditory identity. A landscape colors the sounds which travel within it; each location is thus unique. The landscape can be viewed as a gigantic reflector in the form of a resonance box or resonator in which sound is reflected.'' [4]

A soundmark is similar to a landmark and is an important component of the phonic identity of the city. ''It is used in soundscape studies to refer to a community sound which is unique, or possesses qualities which make it specially regarded or noticed by the people in that community. Soundmarks, therefore, are of cultural and historical significance and merit preservation and protection.'' [11]

''The sound signature of each community will be unique and different, of course, and is at least a part of what makes a place special and distinctive. Many of these sounds are human-made (and not all of them noise), and it is the unique blend of sounds that makes a unique signature.'' [3] For example, we can make comparisons between the Stockholm, New York, and Paris urban soundscapes to identify the phonic identity of each city. We can conclude that each city has a different phonic identity. This identity depends on the elements of each urban environment and the activities in each city, this leads us that there is a so-called sound branding of the city (Fig. 2). An example of a city's sound branding can be found in Istanbul's unique soundscape. Istanbul is a unique city in many ways, one of which is its loudness; the cries of hawkers, the shouts from cafes, markets and mosques and the noise from traffic on the roads and surrounding waterways.

> ''Acoustic design of the urban open space provides the opportunity to accentuate the characteristic properties of the area and to optimize the soundscape for psychological restoration.'' [12]

It is necessary to take sounds into account in the planning and design of a city. Every city might start by preparing a sound map, a kind of inventory of its aural assets. Each community, each place has its own soundscape, its own unique sound signature. Understanding this signature soundscape and monitoring how it changes over time should become a common planning practice.

Urban sound classification

''Urban sound classification is a method of describing the characteristic sounds and acoustic environments of cities. The method is intended to be used in urban analysis and thus in



Fig. 2 Stockholm, New York City and Paris urban soundscape. Ref.: T. Elmqvist, 2013, Designing the Urban Soundscape, http://www.thenatureofcities.com/2013/08/25/designing-the-urban-soundscape/, August, 2014.

the preparation of supporting documents for the planning process and it is an effective tool in planning and urban design.'' [13] This method indicates that sounds may be generated by natural acoustics or by human-made acoustics (see Table 1).

The natural acoustics

''Natural acoustics are sounds produced by natural sources in their normal soundscape, such as the sounds of any living organism.'' [14] The natural acoustics of locations, which include reflections of sound, should be considered in the process of landscape planning. ''Studying the natural sounds of cities is an increasingly important dimension of urban ecology.'' [3] This source of sound may be generated by the physical environment (geophony) or by organisms (biophony).

Geophony is the ''sound generated from water, wind, rain, or other natural physical processes.'' [15] For example; the sounds of water, ''since the sound of water in cities is soothing and therapeutic as well, it plays a powerful role in establishing the kind of quiet that is required; these paths should always connect up with the local pools. Rushing water can be used as an acoustic camouflage of traffic sounds. Paley Park in Manhattan is one such example. The original waterfalls still exist in many places and create seasonal water sounds. Because of this, the soundscape around these acoustic nodes can be regarded as a cultural heritage and thus important to preserve.'' [4] ''The sound from water fountains is an ideal instrument for attracting attention and masking traffic noise.'' [12]

Biophony is the ''sound generated from non-human organisms.'' [15] For example; the sounds of birds, the sounds of birds are important to soundscapes. Birds have been used as study organisms in much of the research concerning wildlife responses to human noise. ''Many cities, such as New York, have established a goal of minimum access to parks – say every resident able to reach a park or green space within a 5–10 min walk. Perhaps such targets could be expanded to include not just a park, but a quiet space,'' [3] through the use of the sound of birds or water in the urban soundscape at the level of urban design.

Human-made acoustics

Human-made acoustics are sounds generated from human activities (anthrophony). These types of sounds have a negative impact on the urban environment. They include

– *The sounds generated by road traffic*:

''Not all urban sounds are pleasant of course; many are not. Modern society is full of ubiquitous mechanical and engine sounds; cars and airplanes in particular, that serve to destroy and drown out the sounds of nature.'' [3]

– *The sounds generated by human activities*:

''The sounds generated by human activities can start out from the use of land; the expected activities at a site generally imply both specific behaviors and specific modes of hearing, for example conversation at cafes. Such behavior should be described in the planning process.'' [4]

''The assessment of the sound quality of an urban area depends on how long people have been living there, how they define the area in terms of dependency on the infrastructure, and how much they have been involved in the social life in the area.'' [16] see Table 1.

8. Urban soundscape as an important dimension of sustainable urban design

''During recent years, there has been a growing awareness that sound is an integral part of the urban environment and that it should be considered at the same level of

Table 1 Urban sound classification. Ref.: The author and Wang K., 2003, The esthetic Principles of Soundscape in Architectural Design and Built Environment, Texas A&M University, master. p. 23.

The natural acoustics	Geophony	Sound of water	Oceans, seas, rivers, streams, rain
		Sound of air	Wind
	Biophony	Sound of birds	Sparrow
		Sound of insects	Flies
Human made acoustics	Anthrophony	Sound and society	Town, urban, parks
		Mechanical sounds	Machines, aircraft, constructions...

importance as visual aesthetics in city planning and the urban design process.'' [17]

''The concept of sustainability relates to the design of sonic environments as the aesthetics; that is, the senses are important factors in the provision of sustainable habitats and welfare.'' [4]

''Urban sounds can be enjoyable for people in need of high complexity information. At the same time, urban planners need to respect those who do not find the high complexity of sounds as attractive.'' [1] ''The solution for this would be the creation of zones, with varying acoustical complexity. Complete silence is impossible to achieve, but much city noise can be masked and dimmed. Using natural sound sources in urban planning and design, such as water and vegetation, has proved to be effective for this purpose and pleasing for the general public. Green walls can reduce up to 40 dB of outdoor noise and vibration.'' [1]

The strategy based on the soundscape can be a good solution for designing quiet areas, considering not only the numerical constraints of legislation, but also the acoustic comfort of the place. It is important to the quality of life to achieve sustainability.

In terms of the soundscape, the question is how to plan for noise reduction through sound design using attention and/or acoustic masking. Noise reduction can be achieved by the following:

- *Planting*: (green walls, green roofs, green ground)

Increasing the area of green space in the city has the potential to contribute to the quietening of spaces below and the building itself, through attracting more birds into the center of the city. Climbers on walls can provide a habitat for birds, birds can also add to enhance the tranquility of an area, with the potential to enhance the natural soundscape. Greening walls can also reduce the reflection of sound.

- *Materials*:

''Creating acoustically softer surfaces will add to the tranquility of an area, thus having some impact on noise reduction. Where hard surfaces can practically be replaced with permeable/semi permeable surfaces or planting, this could also reduce surface water run-off.'' [9]

- *Water structure:*

The background of city noise is masked by the water structure. A good example of that is the sound of a waterfall. ''The waterfall is such an attractive natural figure as well as soundmark that many architects and urban designers want to take advantage of it.'' [13] The sound of water from fountains is also an important component of sonic outdoor spaces.

- *Noise barriers:*

''Barriers can be used to reduce the perceived impact of traffic noise. Well-designed noise barriers can be used creatively in urban open spaces. Many materials can be used including concrete, glass, metals, and mixes of recycled materials. There is scope for using barriers to contribute to the aesthetic qualities of the area.'' [9]

Barriers such as walls and buildings, these are as opposed to respectful distances. ''Walls and buildings are viewed as hard sound barriers which produce effects such as echoes and long reverberation time, while respectful distances are viewed as soft acoustic transitions between different forms of urban activities.'' [1]

Examples of urban soundscape

Paley Park, New York City

''The best example of a good urban soundscape is the use of water in Paley Park in New York City to mask certain sounds, like traffic. There is a spot on 53rd street in Midtown within the cultural district in New York and surrounded by high-rises, it's a little park that is just stuck between two big buildings to drown out the noise of the city and it's wonderful because it's like an oasis. There is a wall at the end of the park and it's got all the water, it's like a waterfall running down this wall, going down over this stone and there are trees. It's just a wonderful spot. That it's so popular because the water masks a lot of the city sounds. The urban designers increased the visual environment by audio environment through the use of plants because they have the ability to absorb sounds (Fig. 3). The park offers a quiet urban oasis in the midst of the bustling city by the careful use of falling water, airy trees, lightweight furniture and simple spatial organization.'' [1]

''The key to its success is a 20-foot (6.1 m) high waterfall spanning the entire back of the park. The waterfall creates a backdrop of gray noise to mask the sounds of the city. The park is surrounded by walls on three sides and is open to the street (with an ornamental gate) on the fourth side, facing the street. The walls are covered in ivy, and the overhead canopy formed by locust trees adds a degree of serenity to the park.'' [1]

– *Architectural features*

The park displays a unique blend of synthetic materials, textures, colors, and sounds. The wire mesh chairs and marble tables are light and do not detract from the surroundings. The park's ground surface is not terrazzo or concrete but features rough-hewn granite pavers which extend across the sidewalk to the street curb. The green of the ivy-covered side contrasts with colorful flowers and the white waterfall masks the noise from the street. See Fig. 4.

– *The phonic identity of the park:*

Paley Park creates a sense of quiet and privacy with walls that are covered with dense, soundproof material in the floor finishing and green ivy and 17 honey locust trees provide a thin overhead canopy. It is also very noisy – but the noise is white noise from the waterfall.

Catalunya Square, Barcelona

''Catalunya Square, Barcelona is a large square in central Barcelona that is generally considered to be both its city



Fig. 3 A small park between buildings in Midtown Manhattan (53rd St, and mentioned in the quote above), with a waterfall and a green wall. Green walls may reduce up to 40 dB of outdoor noise and vibration. Ref.: T. Elmqvist, 2013, Designing the Urban Soundscape, http://www.thenatureofcities.com/2013/08/25/designing-the-urban-soundscape/, August, 2014.



Fig. 4 Paley Park, Architectural features. Ref.: T. Elmqvist, 2013, Designing the Urban Soundscape, http://www.thenatureofcities.com/2013/08/25/designing-the-urban-soundscape/, August, 2014.

centre and the place where the old city. It is especially known for its fountains and statues, its proximity to some of Barcelona's most popular attractions." [18]

"The acoustic environment of the square depends on pigeons flapping and cooing; people walking; voices and children; the sounds of splashing water from the fountain. It is a loud place; full of sound, full of energy and vitality. All of the sounds present in this place made up its acoustic environment, and people's experience of this acoustic environment is the soundscape of the place. The enjoyment of this place is enhanced by its soundscape." [5] see Fig. 5.

Sheaf Square, Sheffield

"Sheaf Square provides interesting and enjoyable soundscapes. There are a number of water features (see Fig. 6) which vary considerably in terms of spectrum and dynamic process. It is very interesting to note that the steel barrier reduces noise from the busy road efficiently as shown in Fig. 7 and also, generates pleasant water sounds. It is a very successful soundscape element." [19] The design of soundscape in this urban open space is considered a dynamic process. These processes are not just solutions to reduce noise; they also contribute to the improvement of the visual image of the city.

Applied soundscape approach

"Water sound has been considered as one of the most important nature sounds in urban open space, which can be used to improve the tranquility of noisy environment. The analysis on soundscapes of waterscape can bridge the practical design of water features and soundscape quality, and the diversity of waterscapes can provide the opportunities to create tailor-made water sounds for the improvement of urban noisy environments with different sound sources and sound properties." [19]

The strategy of the urban soundscape planning process

From the previous study, we concluded that each community, each place has its own soundscape, its own unique sound signature. Understanding this signature soundscape and monitoring how it changes over time should become a common planning practice. We should plan and design to put the suitable soundscape in the suitable place through a set of steps according to the following strategy:

1. **Identify the parties involved in the development process**: urban planners and designers, planning authority, soundscape experts, the public.
2. w**Identify a case study area**: this step is to begin to record, inventory, and document the sounds, natural and human-made, that exist in the place, as well as whom are people involved? What are they doing? The use of area, and so forth.
3. **Formulation of soundscape objectives and planning methodology**: the main concern in this stage is to define a planning proposal that meets basic acoustic objectives. The goal will be to shape the acoustic environment in line with the intended use of the space, integrating the sound from local activities. This will imply creating different acoustic environments for different zones, from lively to quiet, from natural to more urban.
4. **Analysis of existing soundscape**: the measurements and questionnaire survey identify wanted and unwanted sounds (make a survey about the kinds of sounds that people enjoy or care about).



Fig. 5 Catalunya Square, Barcelona. Ref.: [11], LLC, 2014, Catalunya Square Photo, http://www.tripadvisor.co.uk/LocationPhotoDirectLink-g187497-d208598-i75898606-Catalunya_Square-Barcelona_Catalonia.html, August, 2014.



Fig. 6 The water features in Sheaf Square, Sheffield. Ref.: http://www.google earth .com August, 2014.

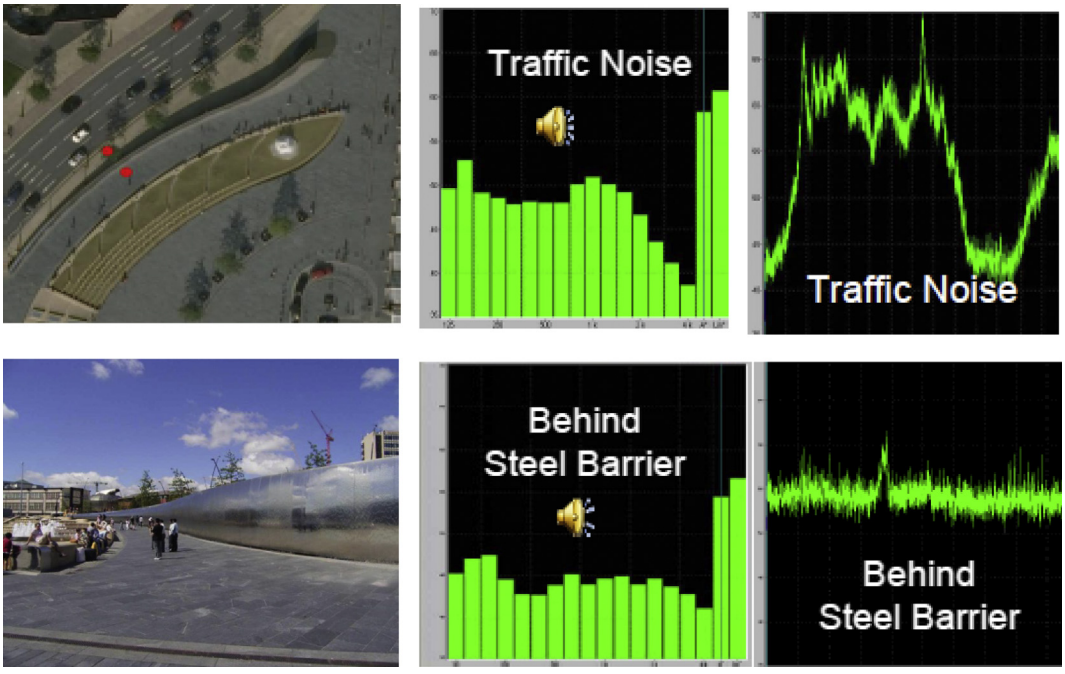


Fig. 7 Comparison between sound levels on the road side and behind the barrier, Sheaf Square. Ref.: http://www.google earth .com August, 2014. Kang J., Hao Y., 2013, Soundscape of waterscape and square on the Sheffield Gold Route, in Kang J., et al., 2013, Soundscape of European Cities and Landscapes, Oxford.

5. **Urban soundscape design**: this involves design tasks to develop the acoustic environment of urban spaces through planting, water structure, and noise barriers.
6. **Acoustic assessment of planning scenarios**: ensuring that the iconic sounds cannot be masked by unwanted sources. The objectives include specification of the wanted sounds in the place (e.g., moving water, nature, speech, music). See Fig. 8.

Case study of Ramses square, Cairo

In this section, we will apply the strategy of the urban soundscape planning process on some urban open spaces in Cairo. The urban soundscape design process depends on the previous strategy to reduce the noise, provide quieter spaces, and enhance sustainability of city spaces, notably for air quality, biodiversity, and climate change.

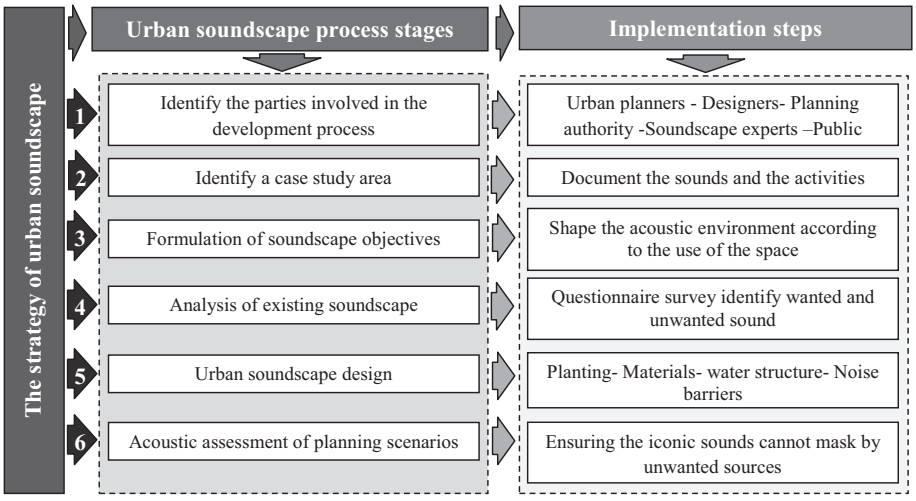


Fig. 8 The strategy of urban soundscape planning process. Ref.: The author.

Reasons for choosing Ramses square, Cairo

Ramses square is one of the most famous squares in downtown Cairo; it is an overcrowded and noisy place. It functions today as a point of intersection between different modes of transportation in the city.

Identify Ramses square

"Ramses square is the heart of the center of Cairo. The square is surrounding with the railway station building built in 1893 and the railway museum from 1932. To the west the tallest minaret of Cairo from el-Fath Mosque is dominating the whole area. To the south the vast space is enclosure by some historic buildings of the medieval town." [20] (Fig. 9).

Urban sound documentation of Ramses square

The square is dominated by noise from the traffic congestion on the streets that cut through Ramses square. There are multiple sources of sound including traffic congestion (because of micro-buses stopping everywhere), unwanted sound from trains in the railway station, the noise from the tram, hard pavement reflecting the sound of people walking, and noise from the shouting of peddlers. In addition, the sounds from the traffic congestion of 6 of October Bridge (Elevated Highway) that pass the square. There are no natural clear sounds due to the lake of trees (Fig. 10).

Use of the surrounding area of Ramses square

The main station with Islamic style, the area in front of this building is used as public and micro-bus barking and there is an exit to the underground metro station. There are also many areas for peddlers and green spaces. There are also some historic residential buildings with commercial shadow paths that overlook the square, El-Fath mosque (which dominates the square), a train exhibition, and the National Authority for the subway with Islamic style (Fig. 11).

Urban soundscape objectives

The urban soundscape of Ramses square can be improved to become quieter, more pleasant, and healthier if the planners and designers of this environment get involved. The main objectives are to develop the urban environment of Ramses square by creating a good urban soundscape and to distinguish the phonic identity of Ramses square by managing the sounds of the square and designing different sound zones. In each zone there should be a dominant sound and the creation of a soundmark that reflects traditional and cultural characteristics of Ramses square. The square will be unique and different according to its soundscape.

Analysis of existing soundscape

This section analyzes the soundscape of the square environment through the questionnaire survey. The questionnaire survey will evaluate the sound environment of the site. The questionnaire survey was administered to a select group of 25 people by way of face-to-face interviews. The questionnaire contained questions on the use of the area surrounding the square, quiet areas in the square and its surrounding area, and on important noise sources that should not be overlooked in the soundscape study. The questionnaire has been divided into the following:

1. General data about the interviewed people (in order to assess the sample's heterogeneity) and about mode and timing of attendance of the investigated area.
2. Annoyance assessment relative to several specific noise sources (voices, road traffic, and natural sources).
3. Sound evaluation: this section examines the soundscape evaluation in terms of three choices: annoying, neither favorite nor annoying, and favorite.
4. A description of the "soundmark" and most preferred sound.
5. The quality of the soundscape according to the following choices: pleasant, comfortable, disturbing, noisy, loud, natural.



Ramses Square-1960 beginning 20th centaury present situation

Fig. 9 Historic photos of Ramses square with different elements of urban design; green areas, fountain, Ramses 11. Ref.: Bott H., et al., 2009, Downtown Cairo-Ramses Square, Faculty of Architecture and urban planning, Stuttgart Uni., Germany, p. 56–57 and http://www.google earth.com.



Fig. 10 The acoustic environment of Ramses square. Ref.: Bott H., et al., 2009, IBID, p. 21–33.

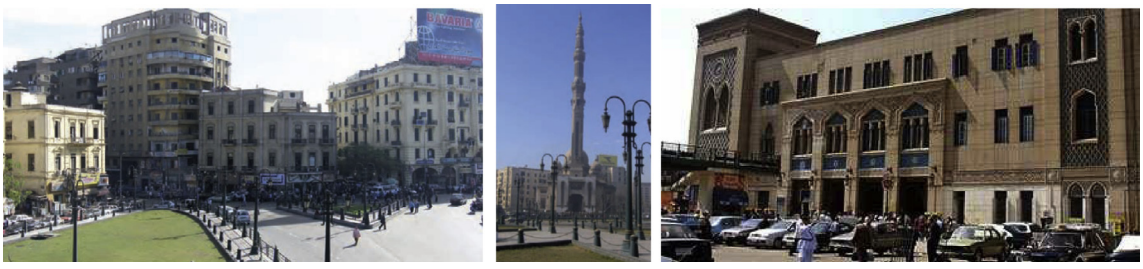


Fig. 11 Use of the surrounding area of Ramses square. Residential buildings. El-Fath Mosque. Ramses railway station. Ref.: Bott H., et al., 2009, IBID & http://www.google earth.com.

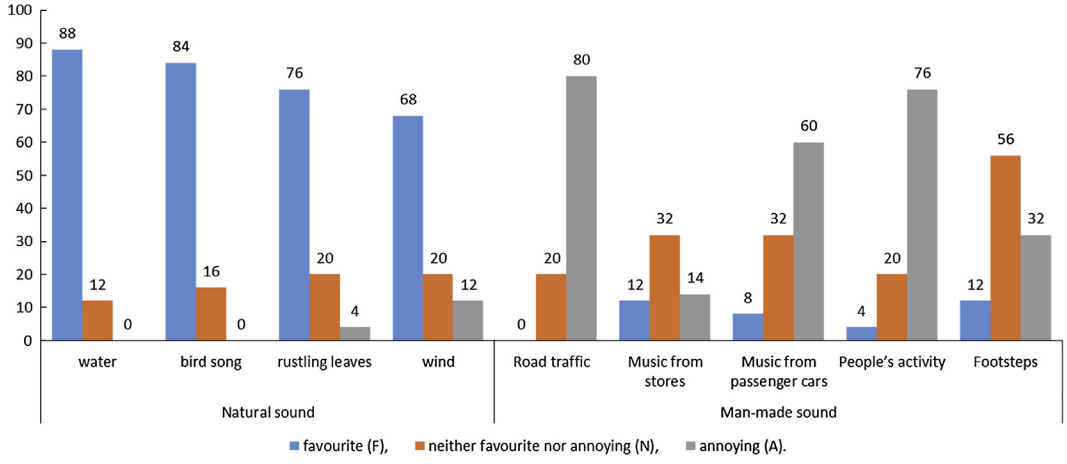


Fig. 12 Sound evaluation in Ramses square. Ref.: The author.

Discussion

In an analysis of the results of the questionnaire, it was found that people always mentioned the soundmarks (which are analogous to landmarks) as the first sounds they noticed. It can therefore be concluded that the soundscape identity of a designated space is important. There are reasons to believe that a more esthetically appealing soundscape will attract more users to the squares.

Interviewees were asked to classify three sounds as favorite (F), neither favorite nor annoying (N), and annoying (A). In terms of the soundscape, traffic noise was the main sound source at the site. Users' activities, such as footsteps and surrounding speech, were another source of sounds.

The results of the questionnaire revealed the importance of soundscape in the development of urban open spaces and in determining the identity of any city.

Fig. 12 shows the classification of a number of typical sounds in Ramses square. It can be seen that people had a very positive attitude toward natural sounds. More than 80% of the interviewees had favorable feelings about the water sounds and birdsong. In regard to human sounds such as surrounding speech, most people thought they were "neither favorite nor annoying." The most unpopular sounds were mechanical sounds such as construction sounds, music from cars, and music from shops.

The results of the questionnaire survey point to the fact that people feel annoyed because the overall sound level is high. In this case, it is important to reduce sound levels.

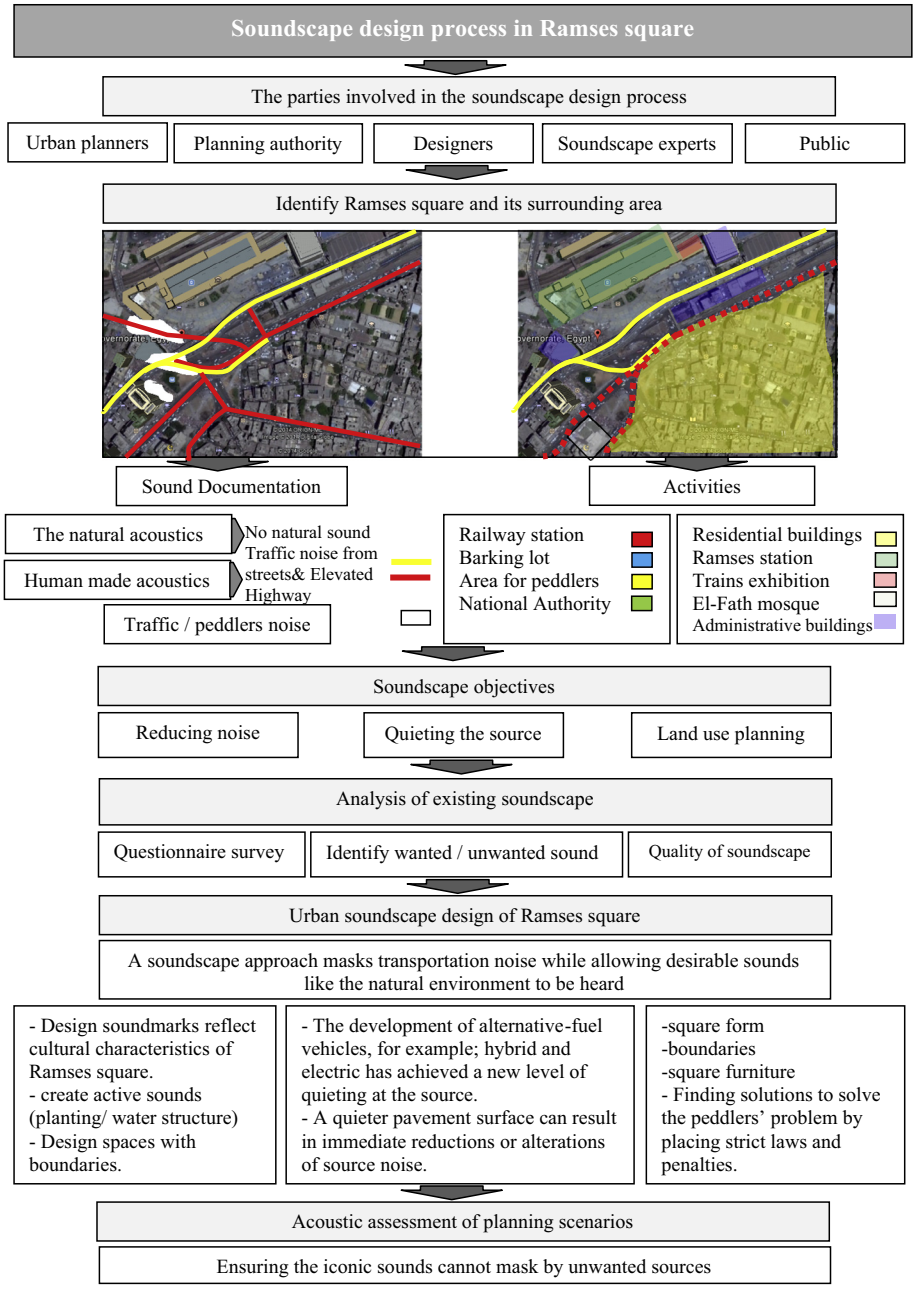


Fig. 13 Soundscape design process in Ramses square. Ref.: The author.



Fig. 14 Conceptual plan of Ramses square's urban soundscape. Ref.: The author.

The urban soundscape design of Ramses square

The concept involves designing for noise reduction through sound design using attention and/or acoustic masking. In order to improve the area surrounding the square according to the urban soundscape strategy, it needs adding noise protection and suggests new landscape's acoustic, which can be achieved by the following:

- *Planting*:
  - There is much room for planting and possibly for the greening of residential building walls that overlook Ramses square to make the square and its surrounding area feel quieter and to improve acoustic insulation.
  - Installing green roofs on the residential buildings that overlook the square, National Authority for the subway and Everest Hotel to reduce and reflect noise and improve the microclimate of the area.
  - Also, there is a need for more greening trees around El-fath Mosque to provide some shade and shelter. The choice of what to plant should be informed by historical associations.
  - As this is a very large space in front of the railway station, it may be possible to create a planted area where shade would provide a comfortable sheltered space for people and to attract birds and natural sounds into the site.
- *Materials*:
  - The surface of the pavement in the area is made of hard materials that reflect the sound of people walking and causes noise. It is important to replace the pavement with another material that can absorb sounds and reduce noise, such as a suitable stone block surface that maintains a historic association with the area.
- *Water structure*:
  - As the sounds of water are attractive to most people, it was suggested that the pre-existing fountain in the square should be re-activated.
  - Import natural sounds into the square such as fountains and flowing water as masking noises. The designed water feature should be in front of Ramses railway station to provide attentional masking sound, reducing the environmental noise. It should be designed as part of an interpretation of Islamic style and should serve to reduce noise.

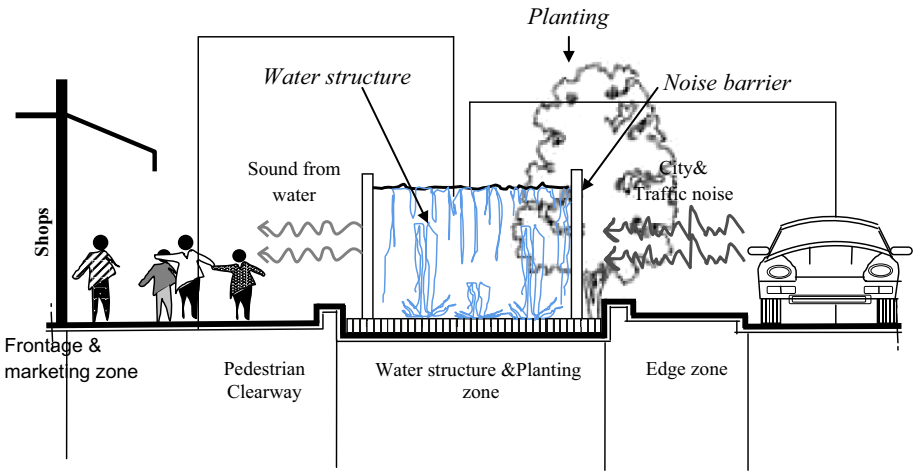


Fig. 15 Conceptual Section A_A (water structure and planting). Ref.: The author.

- The use of an extended water feature closer to the train exhibition should provide more attentional as an acoustic masking of the road traffic noise. It would also make some improvement to air quality by washing out pollutants.

- *Noise barriers*:
  - A noise barrier with suitably-designed openings for people arriving at the site should be used around the tram road to reduce the noise. It should be designed with an Islamic style to suit the architectural style of Ramses railway station.
  - The barrier should be engraved with information on Ramses railway station and Ramses monument. This would serve not only to reduce noise, but to enhance the visitor experience and increase the educational value of the site.
  - As there are many commercial shadow paths cause a lot of noise, the noise should be reduced through the use of higher, denser evergreen planting that attract birds into the center of the city, or a solid wall overgrown with climbers. This should be required on the front of shops.
  - A line of buildings that overlook the square is used as a noise barrier. Ideally, these buildings should not be used for residential purposes but rather for offices. If these buildings are used as dwellings, it is essential that the most exposed façade be well-insulated. The suggested strategy can be summarized in the following figures (see Figs. 13–15).

Recommendations For sustainable urban soundscape in Ramses square

- Sound needs to be put more squarely on the agenda of urban planning and design fields.
- Governments should make training courses for "urban sound planners" to reverse the negative trend of a deteriorating acoustic environment in urban areas.
- The acoustic design should be included in a more general approach to integrated management of urban design to enhance the sustainability of the city.
- The urban soundscape of any urban environment should be associated with the historical and cultural character of the place and the environmental and social aspects should be taken into account in the creation and design of the soundscape in an urban open space.
- Urban planning and design should involve more explicit zoning requirements for new constructions and urban environments which offer the planners and urban designers the possibility of designing soundscapes.
- Planners and urban designers need to take account of sounds in the planning and design processes of an urban environment through creation of solutions that are based on listening to the environment.
- The natural acoustics of the locations which include reflections of sound should be considered in the process of landscape planning. Adding greenery in well-arranged spaces may enhance the natural feeling of the environment and may also attract songbirds.
- Promoting the use of different materials, different types of plant species and other organisms to create a new type of sound environment – not just noise reduction and not just natural sounds, but the creation of a hybrid sound environment that is the signature of what is urban.
- Creating acoustically softer surfaces to add to the tranquility of an area, thus having some impact on noise reduction.
- -There should be protection against noise by means of embankments and green barriers.
- Reducing or masking noise sources. This strategy includes reducing automobile and bus noise through the use of electric buses and reducing car trips by increasing bicycle and pedestrian trips and alternate transportation modalities.
- Encouraging activities which generate unique sounds, reflecting natural, social, or cultural elements. These sounds do not necessarily need to mask the non-fitting sounds energetically; they could just attract attention, masking the non-fitting sounds perceptively.
- When designing the soundscape of an urban open space, it would be useful to consider soundmarks, which reflect an area's traditional and cultural characteristics.

Conclusion

Urban soundscape is an important part of the phonic identity of a city, as sounds are essential in creating a sense of place. Soundscape design can be considered a facet of urban design. The main idea of this paper was to focus on the acoustic development of urban open spaces as part of the urban planning process. The concept of soundscape in urban open spaces was addressed according to its definition, objectives, and classifications.

This paper suggested the framework of urban soundscape strategy that can be applied to identify cities through an analysis of some international case studies and applied this strategy on Ramses square, as it is one of the noisiest squares in Cairo. This applied study aims to develop the visual image of Ramses square according to its acoustical considerations. Consequently, a questionnaire for soundscape design has been established.

It has been shown that soundscape in urban open spaces is not just a noise-control issue and also not just an acoustic issue. A number of aspects need to be considered including acoustics, social characteristics of various sounds, social demographic characteristics of users, and environmental conditions.

This paper concluded that soundscape design will be a crucial part of the planning process for cities that are sustainable and pleasant places to live.

Conflict of Interest

The authors declare that no conflict of interest.

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