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Streetscape Design Elements Approach as a Tool for Urban Soundscape Enhancement A Perspective from Ahmed Oraby Square, Alexandria, Egypt

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1 ABSTRACT

Streetscape design is one of the disciplines that have an effective role in the quality of urban soundscape however, there is a noticeable absence of links between urban soundscape and streetscape design. This research aims to link urban soundscape with streetscape design by creating guideline for the process of enhancing and designing soundscape by employing streetscape design (elements). Therefore, enhancing designers' skills and focusing on enhancement process of open spaces within urban design. This study examines a preference level of urban soundscapes which has been designed based on (potentials of) streetscape design elements. First, a permutation process was applied to six streetscape design elements. Each streetscape element was connected to one acoustic component of the soundscape and with road traffic noise RTN as a major source of the noise, in order to formulate soundscape design proposals. Fourteen proposed situations of soundscape design have been chosen as sample for conducting the experiment. Each situation has been used to create two audios with two sound pressure levels SPL of RTN (73 and 66 dBA) to produce 28 audios representing proposed soundscapes. A total of twenty subjects took part in a laboratory experiment to evaluate preference levels of produced audios using a scale divided into ten levels (zero for the worst and ten for the best) and 3D created shoots were displayed simultaneously with every audio. Unlike previous studies, the results showed that the soundscape preference level of multi-sounds situations (situations have three acoustic components) gained a higher percentage than singular situations when road traffic noise level at 73 dBA. In contrast, in the case of low road traffic noise level (66 dBA) the preference level is higher in singular situations than in multi-sounds situations. Finally, a four stage guideline of urban soundscape design and enhancement, based on streetscape design elements is produced which enables examination of soundscape quality before design interventions and decisions.

Keywords: Sonic environment, Preference level, Design Guideline, Urban Soundscape, Streetscape Design

2 INTRODUCTION

The sound of the environment in urban spaces is one of the important aspects that affects quality of life and health. For example, noise has been associated with health diseases such as stress, cardiovascular disease, and sleeping disorders (Basner et al., 2014; WHO (2011). In addition, Cohen and Spacapan (1984) showed that noise influences social behaviour. Although sound has a negative effect on health, it also has a positive effect, for instance, nature sounds have been used by Alvarsson et al. (2010) and Annerstedt et al. (2013) as assisting approach in stress healing as well as in the rehabilitation process of patients Cerwén et al. (2016). Considering that the sound aspect has many possibilities in the design process, the sound approach is always neglected despite that. The focus is always directed to the visual aspects and when sound aspects have been considered the subject is always about the negative (passive) approach, most often about noise abetment. Urban designers and related disciplines have not fully recognised the importance of linking the two aspects. Thus, it is always about solving the noise problem and just excluding or masking the noise source while there is no attention given to enhancing the complete soundscape of a site. Streetscape plans design is one of the disciplines that have far/near-reaching effects, positive and negative, on the soundscape patterns. In present time, there is a noticed absence of linking the urban soundscape to the streetscape design. Considering that sound affects health, life pleasure, and has an environmental influence this is a problem. This research aims to create a guideline for the process of designing and enhancing urban soundscape with the use of streetscape design. The objectives are first, to enhance designers' skills and awareness in order to link soundscape to streetscape and secondly, to focus on the enhancement process of open spaces in urban design. In this research two types of methods have been used, analytical deduction and induction research process with an explanatory case study. This experimental method is the manner that has been used to apply a case study which was performed by a number of subjects to rate their preference level of soundscape proposals after enhancement of the site's soundscapes. According to this method, the following steps were taken: reviewing streetscape and soundscape design elements, features, and possible approaches to soundscape; analysing each of them; explaining suggested software for measurements and the modelling process. This was applied to a case study with previously analysed data regarding design enhancement of soundscape based on streetscape design elements. The results were analysed and followed by a discussion of derived design enhancement guideline/tool and the research concluded with a mention of further studies. The paper consists of two main parts: a literature review and a practical part aimed to derive a soundscape enhancement tool. The first part of the study includes literature on soundscape, streetscape, and previous studies; the second part consists of the practical case study of the selected area, results, discussion and conclusion.

3 SOUNDSCAPE OF URBAN ENVIRONMENT

In ISO (2014) standardisation of definitions, the acoustic environment is defined is the combination of all the acoustic resources, natural and artificial, within a given area as modified by the environment. Schafer (1977) defined soundscape as the environment of sounds, music, and noise that surrounds us. He noted that the soundscape is the sonic environment. According to Schafer (1977), the term “soundscape”, derived from “landscape”, designates those elements that shape a landscape from an acoustic perspective. Therefore, he recognised the main features of soundscape as keynote sounds, signals, and sound marks. According to him, keynote sounds are "those sounds which are heard frequently enough to form a background against which other sounds are perceived". Whereas, signals are any sound that can be listened to consciously as a conscious signal, such as bells, whistles, horns, and sirens. Finally, a sound mark is derived from a landmark and refers to a community sound that is unique or possesses qualities that make it regarded or noticed specially by the people in that community. The sound mark is what makes the soundscape of a place different from any other place in the world (Guzy, 2017). The design elements of the soundscape are relating the acoustical and visual elements. For example, water sounds are related to water features such as fountains, which are considered as a streetscape element as well. In a previous study by Jeon et al. (2011), six design elements of soundscape have been derived. These elements include water features, green spaces, people's activities, traffic, performances, and construction fields.

4 APPROACHES OF SOUNDSCAPE DESIGN IN URBAN ENVIRONMENT

In the past, when the topic of studies related to acoustics in urban design, it is always about noise abatement issues with the meaning of sound reduction (Ponten, E. 2009) which are considered as a passive approach of dealing with the soundscape. Even the early soundscape concept has been suggested as an approach to rethinking when evaluating the noise and its effects (Brooks et al., 2014). Starting from this point, many attempts were made to introduce pleasant sounds to acoustic environments polluted by urban noise in order to enhance the quality of the acoustic environment which is considered as an active approach to acoustic design. As a comprehensive approach to soundscape enhancement in the current study, both approaches, active and passive, are applied for the purpose of achieving the best preference level of proposed soundscapes. Some of the soundscape design elements have a double effect of noise reduction and the introduction of pleasant sounds, as Cerwéna et al. (2017) mentioned. For example, vegetation (trees e.g.) weaken sound waves by acting as noise screens, while also introducing pleasant sounds such as from birds.

5 PASSIVE APPROACH (QUANTITATIVE MANNER)

Referring to Praticò et al. (2013), two different aspects of decreasing noise pollution problems are mentioned. The first is the integrated planning aspect to transportation and land use and the second is a corrective approach through sound reduction techniques (e.g. vegetation, low-noise paving material, etc.) which is appropriate for the current study. Two techniques were used here for noise reduction: vegetation and low-noise ground material. The concept is that vegetation influences sound waves and weakens them by propagating them, thus well-planned use of vegetation can achieve useful road traffic noise reduction up to 6 to 7 dBA when inserted into a balanced design (HOSANNA, 2013). This can take multiple images and forms as vegetation can be implanted in different manners by means of trees, shrubs, and bushes, as well as green facades and such vegetation forms can be considered as noise barriers. The effect of vegetation screens to reduce noise varies depending on the type of their properties, while height is the most important determinant (HOSANNA, 2013). Noise screen materials vary. They can be wood or concrete, but vegetation is the most common use for low noise screening, which is up to around one meter high (Defrance et al., 2015)/ It is appropriate in urban environments where visibility above the screen is important (Cerwéna et al., 2017), inter alia for reasons of security and public space. Thus, in the present study vegetated facades, vegetated low-rise barriers (noise screens), trees in addition to cherubs have been used, depending on the design of each proposal. In terms of ground material, Praticò et al. (2013) showed that quiet asphalt pavement like rubberised asphalt, stone-matrix asphalt, and fine-graded surfaces can help reduce highway noise by 7 decibels (dB). Rubberised asphalt contains crumbs of recycled tires that provide some flexing in the road surface as tires pass over it, allowing the air a bit more time to be forced out at lower pressure (Careless, 2015). Therefore, rubberised asphalt was used in the case study as it was particularly appropriate and affordable.

6 ACTIVE APPROACH (QUALITATIVE MANNER)

Although, Rådsten Ekman (2015) said that the introduction of new sounds does not necessarily improve soundscape quality, Yang and Kang (2005) reported that the introduction of a pleasant sound such as water or music could considerably improve perceived acoustic comfort in urban spaces, even when the sound level was rather high. Progressively, water features in urban spaces became considered an essential element in the context of the soundscape. In a questionnaire survey conducted by Guastavino (2006), water sounds deserved the second-largest rank of favourable responses among natural sounds. A case study in the Peace Garden in Sheffield, UK has been conducted to investigate perceptions of urban soundscapes and sound preferences proved that soundscape quality in urban squares improved greatly by the introduction of water elements (Yang and Kang, 2005). It was found that the sound of water was evaluated as the favourite sound of approximately 80 % of interviewees. Another importance of water sound is the potential of masking noise such as construction, trains, or traffic (Brown and Rutherford, 1994). The degree to which water sounds successfully mask urban noises refers to the overall level of water sound which depends on the design and type of water features in urban spaces. Therefore, in a variety of road traffic noise levels it is requisite to identify the appropriate pressure levels of water sounds (You et al., 2010). Water features are classified into three groups: water structures, moving water structures, and fountains (Dewar, 1990).

In terms of vegetation, the sound of vegetation can enhance the soundscape quality of urban situations which can be described as the rustling of leaves in the wind, the sound of rain on tree leaves, or the singing of the birds they attract (Cerwéna et al., 2017). Axelsson et al. (2010). The sounds of nature like birdsong are generally perceived as pleasant. Birds sound rated as the most favourable in an international sound preference survey conducted and published by Schafer (1977). Cerwéna et al. (2017) mentioned that conditions to attract songbirds can be achieved by considering aspects such as dense and varied vegetation with many layers. Specific species of dense trees like oak, mulberry, and eastern white pine are known to attract songbirds (Exploring Birds). Among the ten most attractive trees for songbirds the oak tree is a very popular tree for use in Egyptian streets (Zayed, 2020). There are ten types of birds in the world known for their pleasant signing (Bravo Animals, 2021) and the two types known in Egypt are the song thrush and the house sparrow (Bird list Worldwide, 2001). Furthermore, the sound of wind garnered the largest proportion of favourable responses among the natural sounds in surveys carried out by Guastavino (2006). Poplars, bamboo, and beech are species of trees that are known to produce stronger sounds in the wind than others (Cerwéna et al., 2016; DeGroot, 2015; Yang et al., 2016). The poplar tree is one of the common trees used in Egypt's streets (Zayed, 2020) and has been used as a producer of leaves sounds. Human activities are considered an effective component of urban soundscape because they communicate through sound. "Activities striking is the construction of zones that attract certain human activities that influence the soundscape" according to Cerwéna et al., (2017) who concludes with different examples of activities that encourage everyday social activities, such as a kiosk, a cafe, or a seat. In general, previous research identified that technological sounds are perceived as annoying, whereas natural sounds are perceived as pleasant (Axelsson et al., 2010). The sounds of human beings' were somewhere in between (Cerwéna, 2017). In the International Sound Preference Survey conducted by Schafer (1994) for testing how people are liking or disliking sounds by sound category, natural sounds of birds, wind, and water won as the most pleasant sound; music, and human sound came after them. although it was also found that the attitudes and perceptions of human sounds varied depending on loudness, social context, and phase of treatment (Cerwéna et al., 2016).

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Auditory masking is defined as an effect that occurs when one sound (masker) is introduced with the intention to reduce the impact or shift the focus from another sound (target). There are two kinds of auditory masking, energetic and informational masking (Cerwéna et al., 2017). For the current study, energetic masking will be used which happens when the masker sound is literally covering the target sound energetically with the introduction of a masker sound. Most commonly, there is an 8–10 dBA difference in sound pressure levels between the masker and the target (Brown and Rutherford, 1994).

7 METHOD

This research is a qualitative research with a quantitative dimension. Two types of methods have been used, analytical deduction and induction research process with an explanatory case study.

7.1 Site Selection

The area that has been chosen is Ahmed Orabi square in the Al-manshya district in Alexandria city. It is located between two main horizontal streets, Omar lofty street forms the north and Salah Salem street forms the south boundary, and two parallel streets run from east and west as shown in figure 1. The area is considered a mixed used, where commercial use dominates on the ground floor whereas residential use is occupying the other floors of the buildings.

In general, Ahmed Orabi square is rich with acoustic sources caused by the mixed uses. Vendors' cheers, drivers' cheers, walking and talking of people and the tram, railway, road traffic are the main sources of noise. The selected part of the square has significant problems and potential. On one hand, street vendors occupy the sidewalk and more than two car lanes along the street. On the other hand, a wide area of sidewalk in the square's streets enables variety of uses in addition to gathering of people because of the existing of the ATM, CIB bank branch the and settled vendors. The site has been selected for significant reasons, firstly to enable dealing with problems and potentials of the crowded soundscape and secondly to create a significant transformation of the urban soundscape throw streetscape elements to enhance the site's soundscape. Finally, the purpose of paying attention to and raising awareness of streetscape design is an effective approach to enhance and design the site's soundscape. Ahmed Orabi square is a symmetric square, thus it could be divided into four similar parts. The experiment implemented on the north-eastern part, is a sample of the other four parts.

Fig. 1: To the right, selected Site of Ahmed Orabi square in the middle of Al-manshya Al-Kobra quarter, Al-Gomrok district, Alexandria city, and to the left, the two horizontal streets (Omar Lotfy and Salah Salem Street) and the two parallel vertical streets on both sides of Ahmed Orabi square. Source: Researchers, 2020.

7.2 Variables

The wide sidewalk which is four meters wide enables a variety of uses and activities, so that different types of vegetation, water features and spaces for activities have been inserted as design proposals. Based on the potential problems were analysed. Three categories of six streetscape design elements related to three categories of acoustic sources that have a significant effect in soundscape preference and quality have been inserted into the design proposals as variables. Two categories represent the natural sound sources and the third category represents human sounds as shown in table 1. Firstly, the water category includes two types of water features which are street fountains connected to drop water sound in addition to the natural waterfall sound connected to falling water. Secondly, the vegetation category includes two types of trees, the poplar tree which is connected to songbirds (thrush and sparrow especially). Whereas, the second component is the oak tree connected to sounds of moving leaves. Finally, the category of people's activities includes sounds of vendors' cheers which maintain the area sound mark but inside small kiosks. The second component is street seats connected to people's talks. Streetscape elements named with reference to sources name are drop water (D), falling water (F), songbirds (B), sound of leaves (L), people's talking voices (T) and vendors' cheers (C).

Acoustic categories	**Water sound**	**Vegetation**	**Peoples' Activity**
Streetscape Design Elements	**Streets' small fountain** (Drop water sound)	**Poplars trees** (Birds singing)	**Kiosks** (vendors' cheer voices)
	Natural Waterfall (water fall sound)	**Oak trees** (leaves sounds)	**Seats** (talks voices)

Table1: Variables of soundscape represented in three acoustic categories, each category corresponding to two streetscape design elements which connected to two types of acoustic categories. Source: Researchers, 2020.

7.3 Procedure

7.3.1 Acoustical Modelling

After applying permutations of six previous streetscape elements, fourteen situations have been chosen as samples of soundscape proposals (situations). Two types of proposed acoustic scenes have been created, multiple and singular sounds situations to end up with eight multiple-sound situations and six singular situations. Firstly, each one of the eight multiple-sound situations consists of three acoustic components (represented in streetscape elements as acoustic sources) mentioned above. whereas singular situations consist of one from each category. The multiple situations are named as D + C+ B, D + T+ L, D + C + L, D + T + B, F+ C + B, F+ T + L, F + C+ L and F + T+B. Singular situations consist of only one acoustic component and they arenamed as D, F, B, L, T and C. All Fourteen situations are created with two sound pressure levels (SPL) of RTN which are considered as the main source of noise: firstly, in the existing condition which is 73 dBA and secondly after applying rubberised asphalt (which reduces the SPL to 66 dBA) to test the reduction effect on the preference level. This results in twenty-eight proposed situations to test.

Introducing positive sounds and reducing levels of unwanted sounds have to be conducted as comprehensive approaches to soundscape design. Therefore, in the present study vegetated façades, vegetated low barriers, and trees in addition to cherubs were used as noise reduction techniques. Each of these techniques can reduce the overall traffic noise up to 4 dB on average and up to 6 to 7 in balanced combination of these solutions. In conclusion, SPL of RTN became 68 dBA and 61 dBA in the silent asphalt case. In general, signal-to-noise ratio (SNR) between the road traffic noise and natural sounds (water, birds and leaves) is -3 dBA or the same of RTN. In the current study the energetic masking technique was used. Water sounds and vegetation sounds were considered as a masker for reducing RTN effect (target). Therefore, sounds of birds and leaves and water sounds were set with extra 10 dBA in both levels of RTN. So that birds singing, rustling sounds, falling water and dropping water would be 78 dBA and 71dBA in the silent asphalt case. Finally, peoples' activity category which includes street vendors' cheers and people talking were set as the real site values, which are 77 dBA and 60 dBA respectively.

For data collecting, five minutes' record of RTN, vendors' cheer and people's talks have been recorded from the site and with 1 meter distance from the sound source as a sample. The two water features and birds singing (thrush and sparrow) in addition to leaves sounds were downloaded from the Sound Snap (2008) online library as one-minute audio for each. Fifteen seconds have been extracted from records and audios in order to produce audios which represent the proposed soundscape for each situation. The time of fifteen seconds was chosen to prevent boredom and loss of focus in the parallel aspect of commercial advertisements.

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7.3.2 Visual Modelling

For visualisation of acoustic scenes proposals, a whole 3D model was created for the selected part as shown in figure 2. A reference street view point was fixed in all shoots in order to avoid influence of different view angles. In total, fourteen 3D shoots were created. Each shoot was displayed simultaneously for the two RTN levels. An oval fountain rectangular shape of downpour simulated the natural waterfall. Both were distributed in a balanced way five times along the street and with dimensions of 1.5-meter length. For the vegetation elements, 3D blocks of poplars, intensive oak trees, vegetated barriers and cherubs were downloaded from Turbo Squid website (2021).Vegetated barriers, were one-meter high. A kiosk model was created with 1*1.8*2 dimensions. Finally, two models were created for two types of seats; the first was two single seats against each other and second type was one long seat.

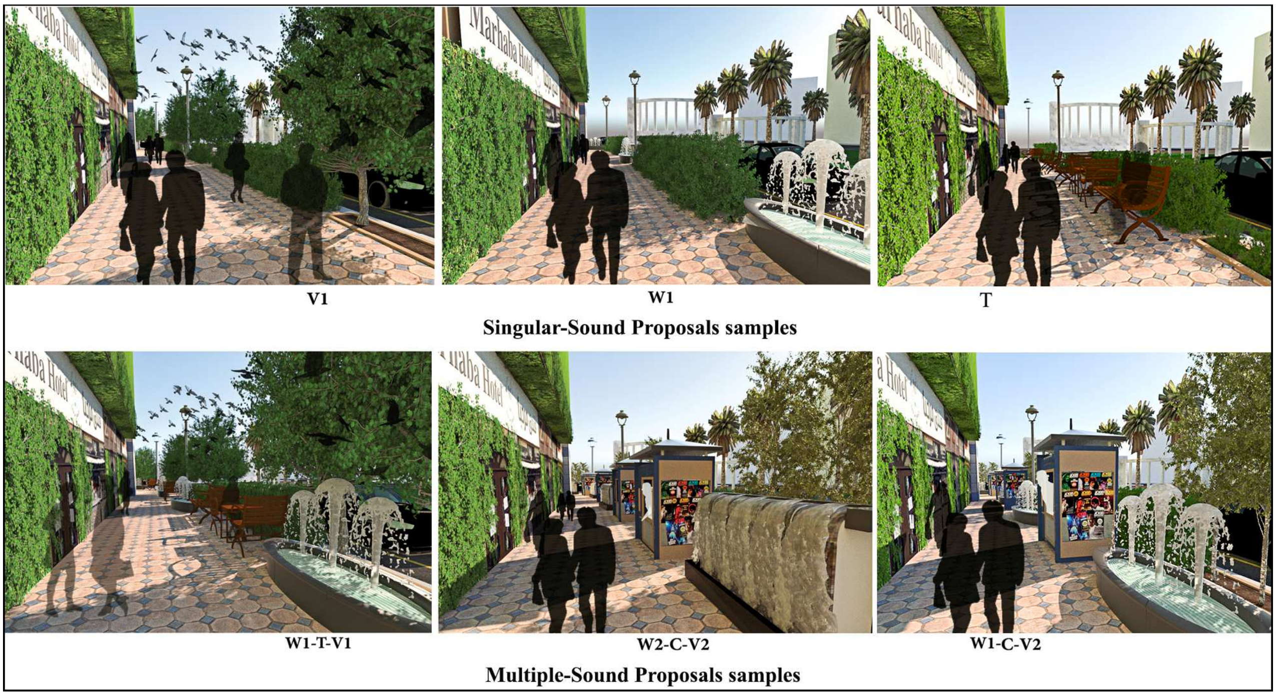

Fig. 2: Samples of visual modelling of acoustic proposals, first type above is the singular-sound proposals samples (V1: Poplars trees with Birds singing, W1: streets' small fountain with drop water sound and T: seats with peoples' talking voices whereas, second type down is the multiple-sound proposals samples (W1-T-V1: streets' small fountain, seats, and Poplars trees, W2-C-V2: natural Waterfall item, kiosks, and Oak trees W1-C-V2: streets' small fountain, kiosks, and Oak trees) Source: Researchers, 2020.

7.3.3 Used Software

Four different programs have been used in the complete process. The first is the Voice Recorder Pro application for recording the existing sounds. The second is the NIOSH application as a professional sound levels meter. The third is the Adobe Audition program for sounds extracting, editing and mixing to produce the proposed audios. Finally, 3D max for 3D modelling and rendering were used in addition to Adobe Photoshop CS6 for postproduction of displayed shoots.

7.3.4 Laboratory Experiment

The main purpose of a laboratory experiment is to validate the proposed stages by experts (subject from the urban design field) for linking soundscape preference with streetscape design in order to extract an independent soundscape design and enhancement tool. Therefore, the guideline could be used for soundscape enhancement based on people (non-experts) preferences. In this experiment the preference level of urban soundscape where it was designed based on design elements of streetscape was examined. A ten-minutes video has been created as a presentation manner of the twenty-eight proposed audios and 3D shoots have also been created. Fifteen seconds of each scene and five seconds as transition time between them were used to answer the evaluation of each.

As shown in figure 3, the laboratory experiment was conducted in a computer lab of the engineering faculty at Alexandria university. PC computers with HP Compaq Elite 8000 small form factor desktop and Dell 17" inch DVI-D VGA flat panel monitor were used in addition to beats headphones model STN13 for displaying the created video for each participant. Subjects were required to assess each audio throw a preference scale with numbers from zero to ten (with zero to the worst and ten to the best) in an evaluation handout. Before the video was started, a two-minutes quick brief about the experiment was presented explaining the assessment manner for participants. A total of twenty-five subjects (17 females and 8 males) were chosen with categories of participants of fresh-graduates, under graduated (students), designers in the academic field and in practice.

Fig. 3: Samples of participants while they were conducted the Laboratory Experiment in computer labs of Alexandria Faculty of Engineering by using PC computers and headset to the left Menna (students of Pharose University) and Mo'men (freshly graduated students of PUA) also to the middle Mohamed and Osama with the same rank , to the left , Isra'a and Riham (demonstrators in Architecture department of PUA). Source: Researchers, 2020.

8 RESULTS

Fig. 4: Laboratory experiment's results of soundscapes proposals which implemented in two sound pressure levels of road traffic noise RTN (77 dBA and 66 dBA), orange chart represent the experiment with the high level of RTN (77 dBA) whereas blue chart represent the experiment of the low level of RTN (66 dBA), concluding singular and multiple situations of proposals and starting with the multiple situations in both RTN levels. Source: Researchers, 2020

As shown in figure 4, the two charts explain the preference levels of 28 audios which represent soundscape proposals that have been evaluated by participants twice, first with 73 dBA and second with 66 dBA. In

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general, the score of preference level in the first case was around 8 whereas the second case was around 9, the rest of the scores ranged between 8.7 as maximum value and 3.3 as minimum value in both cases.

For the first chart (where RTN was set at 73 dB), the best preference of an acoustical scene of the 14 soundscape proposals is when only the birds singing was used (singular case of birds singing); a close value was for the combination of drop water, people's talks and birds singing scenes, whereas the lowest score was for falling water, people's talks and leaves sounds as a combined situation.

For the scenes which include the people's talks who sat on the pavement's side in combination with drop water sound and bird singing produced the best preference at all, followed by the combination of drop water and leaves sounds. A close score followed closely for the singular case of people's talks. The lowest score was for the mixing between falling water and leaves sounds. Conversely, for the scenes which include the vendors' cheer of the kiosks, the best evaluation has been rated in the condition of drop water and leaves rustling, followed by the fall water and birds' songs condition, as opposed to people's talks scenes. In contrast, the least rating was for the combination of fall water and rustling sound, with the same value for the single sound of vendors' cheer. As for the single sounds for each drop water, fall water, vendors' cheer, people talks, birds' songs and leaves rustling, the bird's songs have been rated as the best and the fall water as the lowest, with close score for vendors' cheer.

In the second chart (where T.N. was set 63 dBA), the best preference rated of the 14 audios was acquired by the singular case of the drop water sound and, with a similar level also by the singular case of bird singing. The composition between fall water and leaves rustling in the presence of people's talks rated the lowest. In cases of people's talks sound, the case which include people's talks alone is rated the highest, followed by the composition of drop water and rustling sound, in contrast to the case of fall water and the rustling which rated lowest. Alternatively, in the first chart, in the presence of vendors' cheers the combination of drop water and birds' songs was represented as the best proposal for that type of activities sound, whereas in the separate case of cheers, it ranks before the last which is obtained for the omposition of falling water and leaves sound. For the singular cases, the best preference has been evaluated for the drop water case, followed by the birds singing with almost one score lower, whereas the vendors' cheer ranked the lowest as a separated case.

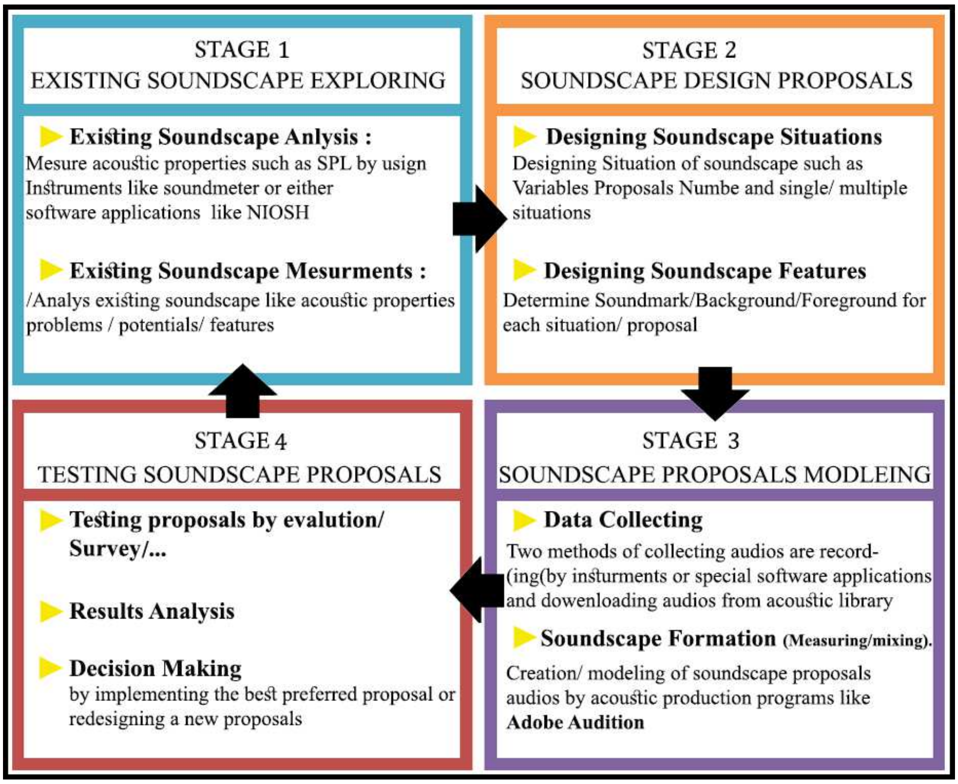

Fig. 5: Four Stages Soundscape design tool based on streetscape design elements with each step under every stage and as a looping process in order to enable the variety of proposals and solutions. Source: Researchers, 2020.

The laboratory experiment validated stages have been proposed for the current case study, so that we could extract a general guideline with four stages (as shown in figure 5): existing soundscape analysis, soundscape design proposals, testing soundscape proposals and soundscape design proposals modelling. The guide line stages represent a loop process, so that we can repeat the process until reaching the required evaluation/ assessment for a specific area with a specific soundscape.

9 DISCUSSION

The main purpose of this study is to extract an independent guideline for soundscape design and enhancement based on streetscape design in order to link soundscape and streetscape design, (through a laboratory experiment conducted to validate the steps/stages of the guideline that would be extracted). The laboratory experiment validates the stages of the guideline extracted from the experiment, so that it could be used in similar environments with the same variables, adjusting the variables or even adding new variables related to the contexts/conditions and create unlimited numbers of proposals with the purpose of finding the most appropriate soundscape design. Unexpectedly, the results show that where traffic noise is 73 dBA, high levels of a preference have been achieved with multiple mixture of sounds situations/ scenes (the case of 3 sounds together: people talk, drop water and bird singing) unlike the singular sounds which rate with less preference, as opposed to previous researches. The situations where the traffic noise is 66 dBA, the higher percentage of preference evaluations were in favour of singular situations (such as the drop water alone).

10 CONCLUSION

This paper was based on an experiment of an existing case study for the enhancement of soundscape quality in the urban environment. A new guideline was proposed as a tool for soundscape design and enhancement for urban designers. In the experiment analysis, four comprehensive stages of soundscape design were extracted. As a tool, the soundscape guideline is based on an organised analysis and previous studies of acoustic design and enhancement. Stages were generated in collaboration with the practical case study. This was considered as an asset to ensure its validity and usability in urban design. The tool enables designers to adjust, enhance or even design the soundscape scenes and test them before implementing any interventions in order to select the best design and solution. The present study did not aim to extract constant parameters of soundscape design to deal with acoustic environment, but instead it was to highlight that it is possible to take a number of procedures (or stages) related to acoustic aspects. These procedures prove that they contribute to form the individuality and identity of the environment like any other design interventions.

The urban environment is never growing and developing all its components, such as mobility patterns (transportation methods), types of activities or lifestyle and improvement projects at the same pace. Therefore, the need for studies, researches and knowledge about soundscape, alternative approaches and requirements for their implementation is likely to increase. Thus, the need to improve understanding of the acoustic discipline of the urban environment will persist. The requirements for dealing with the acoustic environment will differ from one urban context to another. For instance, the commercial context (like the current case study) varies from residential or historical contexts. Hence, these other contexts are also in need to study and research their acoustic requirements in addition to applying this knowledge during actual progress.

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