Article

NOISE & VIBRATION WORLDWIDE

Evaluation of the soundscapes through the cafe terraces before and after the COVID-19 lockdown in coastal cities in Algeria

Noise & Vibration Worldwide
2022, Vol. 53(7-8) 377–389

DOI: 10.1177/09574565221114660
journals.sagepub.com/home/nvw
SAGE

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Abstract

This paper aimed to examine the impact of the COVID-19 lockdown in Algeria on the soundscapes' components throughout the cafe terraces in coastal cities. The methodology is based on a laboratory qualitative approach established and divided into two stages. And the monitoring of sound recordings through twenty-one cafe terraces inside the coastal city of Azzaba in Algeria was conducted before and after the lockdown of whole the country due to the COVID-19 pandemic. Using the McNemar's test on the first stage, results suggest that the lockdown measures in Algeria affect the soundscape components of the cafe terraces, specifically the predominance of the anthrophonical sounds over the natural sound components. The predominance of traffic sounds on the soundscapes after the lockdown period does not reflect an increase in noise level, whereas the soundscapes through the cafe terraces during the two periods were similar, and showed as less noisy by the semantic difference analysis evaluation, of the second stage. The factors of the principal component analysis suggest that the soundscapes of the cafe terraces reflect the main patterns of the acoustics design in the public spaces, such as functions (relaxation and communication), space-time for the two factors of the soundscapes of the period before the lockdown, and by relaxation, space and time for the three factors of those of the period after lockdown. Otherwise, the Marginal Homogeneity Test shows that there are significant differences in the assessment of the soundscapes of the cafe terraces during the two periods, which were only associated to the functions. Findings suggest that additional long-term research is needed to preserve and improve the cultural soundscapes among the urban spaces to ensure the acoustic comfort of the occupants and preserve their health.

Keywords

Pandemic, health crisis, soundscape, public space, sound recording, survey

Introduction

The soundscape is an acoustic composition resulting from a combination of natural and/or urban sounds,[1,2] where its creation is mainly based on a mixture of different sounds, such as biophony, geophony, and anthrophony.[3–6] It is considered a relatively complex and multidisciplinary approach for the evaluation of the sound environments of architectural and urban spaces.[7] In urban environments, soundscape represents an important environmental reference for the quality of life of city inhabitants,[8] that can preserve their health,[9] and their well-being.[10–12]

The majority of daily activities in the urban environments are practiced on the street level, which includes public, semi-public, and private spaces.[13] Urban open spaces are generally defined as publicly accessible open places designed and built for human activity and enjoyment,[14] they are considered among the important elements of cities, and represent the main places for outdoor activities.[15] Activity-based environments are strongly associated with the sound's effect,[16] along with other sensory impressions which contribute to the perceived quality of the environment and influence the human experience of place.[17] This sound experience refers to the human perception's soundscape of the acoustic environment, where the soundscape is considered a perceptual construct, and its approach focuses closely on the customers' experience

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within the acoustic environment inside public places.[18] In this context, an important set of literature can be found about studies on urban soundscapes through public open spaces,[19,20] such as urban parks,[21–24] and urban green spaces.[25] Despite the above, there is a lack of studies that analyze and evaluate the soundscapes of cafe terraces in North Africa, which creates an unresolved scientific problem.

At the urban level, the importance of the cafe terrace is to recreate the context of the street and to allow its occupants to reproduce the street's behavior.[26] The cafe terrace has an essential function in North African cultures as a place for collective gathering or individual relaxation, where the occupant can meet and play board games while having a light meal. This leads to creating a soundscape identity, which is a part of the cultural heritage of these spaces since the soundscape paradigm can recognize the environmental, social, and cultural meanings and significance of communities.[27]

In this context, several researchers consider that the soundscape is a construct of human perception that is influenced by the socio-cultural background,[28] where it can represent part of the cultural heritage,[29,30] and it can also represent an important part of the phonic identity of spaces, as sounds are essential to create a sense of belonging.[31] In contrast, the current urban strategy of Algeria is outdated in terms of preserving the cultural heritage of the soundscape, [9] due to rapid, strong, and poorly managed urbanization that leads to radical and progressive changes in luminous and thermal atmospheres, in addition to urban soundscapes.[32] With rapid urbanization and the development of transport vehicles, traffic noise can also become a critical problem.[33] Therefore, preservation[34] and improvement of the noise environment are considered essential means to improve the quality of the urban environment and reflect the city's characteristics.[35,36]

In 2020, the health situation's response to the COVID-19 pandemic required control of individual behavior through a period of collective containment.[37] In response to this pandemic, lockdown became the generic term for the global restrictions imposed on physical mobility and socioeconomic activity.[38] In addition, the emergence of COVID-19 and the absence of suitable medications, during the lockdown period, require physical distancing as preventive measures to contain and reduce the spread of the virus.[39] Hence, COVID-19 has currently become an unprecedented challenge for all facets of human endeavor.[40] At the urban level, the crisis of COVID-19 has attracted the attention of several researchers,[41,42,43–45] because it poses a challenge at all levels of the built environment to find a solution that can reduce the impacts of this epidemic.[46] On the other hand, during the lockdown period, the noise level may decrease due to the reduction of road movements[47] and human groupings, which can be attributed to changes in the soundscape of public spaces. Within this framework, the main objective of this paper is to explore one of the ambiguous scientific tracks that is: the study of the COVID-19 lockdown effects on the soundscapes of cafe terraces, through the evaluation and analysis of the cafe terraces soundscapes of the coastal city of Azzaba, Algeria, in the periods before and after the lockdown.

Methodology

In this study, two surveys were conducted in the laboratory, in two stages, after the realization of several short-term in-situ sound recordings that were done before and after the lockdown in the different cafe terraces available in the city of Azzaba, to examine the effect of COVID-19 lockdown on the soundscapes of the cafe terraces in the city, and to compare the perceptions of the customers of these places regarding the soundscapes during the two periods, before and after the lockdown. Azzaba is a coastal city located in the mercury zone in the northeastern part of Algeria in the Skikda province, Figure 1(a). It is considered a more or less developed urban center,[48] inhabited by more than 60,000 inhabitants. The main economic resources of the region of Azzaba are mining and agriculture,[49] knowing that the majority of the region is occupied by agricultural activity. It is characterized by an open society and mixed cultures, but it maintains its customs, such as the use of cafe terraces as an essential place for the daily gathering between groups or an individual relaxation place, where the customer can experience a meeting and play board games. This study was carried out in the 21 cafe terraces of the city, presented in Figure 1(b).

Materials and Data Collection

In the field, a series of binaural sound recordings[50,51] of 60 s was conducted at fixed points through the selected 21 cafe terraces for the investigation to assess and identify their soundscapes. This spatial audio recording technique is considered the most useful compared to the monaural, stereo, array, and ambisonic techniques which offer the possibility of recreating the spatial characteristics of the studied sound environment.[52,53] The sound recordings were done by using a sound recorder "Zoom H4", coupled with a "Soundman OKM II Classic" binaural in-ear microphone. As several previous studies had used soundtracks of 30-s to perform a short-term assessment of soundscapes,[54] the 60-s recording applicated in this study for each station is considered applicable as well. Soundtrack recordings were taken in August 2019 (before the lockdown) and August 2020 (after the lockdown).

In the laboratory, the identification of soundscapes was performed after two evaluations, in two different stages, for the same soundtracks recorded in "WAV" format. Since the recorded soundtracks last longer than 10 s, the extreme sound events characterizing the last seconds of the recorded soundtracks were avoided, because the evaluation of the soundscape is strongly related to the sound events of the

last moments.[55] With the participation of two different groups of 50 architecture students for each stage, the evaluation of the soundtracks was carried out with the use of audio restitution using headphones "Sony the MDR-ZX660AP", applying the same sound output level for all the soundtracks. This method has been applied and validated by several previous recent studies.[32,9]

To verify the impact of the lockdown measures in Algeria due to the social measures COVID-19 on the soundscape compositions of the cafe terraces, we started at the first stage of the expertise which was based on the use of a survey presented in the study of Liu et al. (2018),[56] Table 1. Where, the identification of soundscapes in this stage was based mainly on the analysis of the three soundscape components which are biophony, geophony, and anthrophony.[57,58] The second stage of this research was based on the comparison between the evaluation of the Semantic difference analysis of the soundscapes before and after the COVID-19 lockdown, based on the survey used in the study of Kang and Zhang (2010),[59] Table 2. The two questionnaires presented in Tables 1 and 2 were translated by the participation of a group of architects, sociologists, and psychologists so that both groups of participating students could correctly understand the different attributes and indices related to the soundscape.

Participants

In this study, the participants for the two surveys were architecture students with age categories ranging from 18 to 30 years. They were grouped into two groups of 50 participants, corresponding to each survey (each stage). The first group was composed of 74% females and 26% males, with an average age category of 23 years ±3.22. While the second group was formed of 66% females and 34% males, with an average age of 22 years ±2.57. All the participants declared that they did not have hearing problems.

Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences (IBM-SPSS) software. In the first stage (questionnaire 1), descriptive analysis and non-parametric tests were carried out in order to compare the components of the soundscape during the two periods, before and after the lockdown, and to check if there is a change in the soundscapes of these two periods, using McNemar's Test and Marginal Homogeneity Test. In the second stage, a principal component analysis (PCA) was performed on the data of the Semantic difference analysis of the soundscapes evaluation. This analysis is widely used in the recent scientific literature in the field of this study.[60] In addition, Marginal Homogeneity tests were also used in this second stage to verify whether there are statistically significant differences between the evaluation of the semantic difference analysis indices of the soundscapes of the cafe terraces in the two periods, before and after the lockdown.

Results

Stage one: Soundscapes composition before and after the COVID-19 lockdown

The comparison between the soundscape compositions of the cafe terraces before and after the lockdown, evaluated in the first stage by the first group of architecture students is presented in Figure 2. Figure 2 shows that the anthrophonic sound components (human, traffic, and mechanical sounds) dominate the soundscapes of the cafe terraces in both periods, before and after the lockdown, with percentages of 53.52% and 72.95%, respectively. However, the difference between the soundscapes of the terraces studied in these

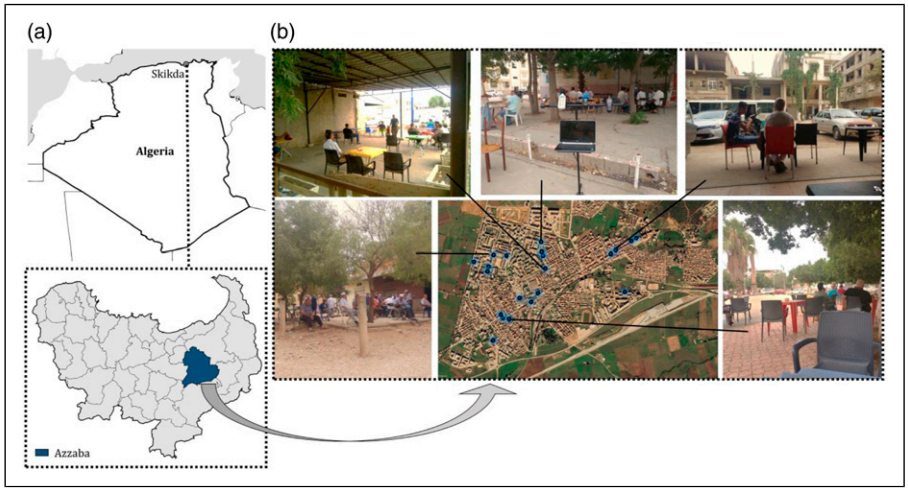

Figure 1. Case study: (a) Azzaba city location, (b) location of the studied cafe terraces.

Table 1. Questionnaire of stage 1: Soundscape composition.[56]

Sound category	Sound sources
Human sound	Surrounding speech, playing children, footsteps
Traffic sound	Street traffic, bicycle riding, motorcycle noise
Biological sound	Bird song, dog barking, frog croaking, insects
Geophysical sound	Wind blowing, grass rustling, tree rustling, raining, water sound
Mechanical sound	Phone ring, construction sound, alarm, grass mowing, broadcasting music, live music, singing, broadcasting music, exercising

Table 2. Questionnaire of stage 2: Soundscape evaluation.[59]

	Very	Fairly	Little	Neutral	Little	Fairly	Very	
Agitating	3	2	1	0	−1	−2	−3	**Calming**
Comfort	3	2	1	0	−1	−2	−3	**Discomfort**
Directional	3	2	1	0	−1	−2	−3	**Everywhere**
Echoed	3	2	1	0	−1	−2	−3	**Deadly**
Far	3	2	1	0	−1	−2	−3	**Close**
Fast	3	2	1	0	−1	−2	−3	**Slow**
Gentle	3	2	1	0	−1	−2	−3	**Harsh**
Hard	3	2	1	0	−1	−2	−3	**Soft**
Interesting	3	2	1	0	−1	−2	−3	**Boring**
Like	3	2	1	0	−1	−2	−3	**Dislike**
Meaningful	3	2	1	0	−1	−2	−3	**Meaningless**
Natural	3	2	1	0	−1	−2	−3	**Artificial**
Pleasant	3	2	1	0	−1	−2	−3	**Unpleasant**
Quiet	3	2	1	0	−1	−2	−3	**Noisy**
Rough	3	2	1	0	−1	−2	−3	**Smooth**

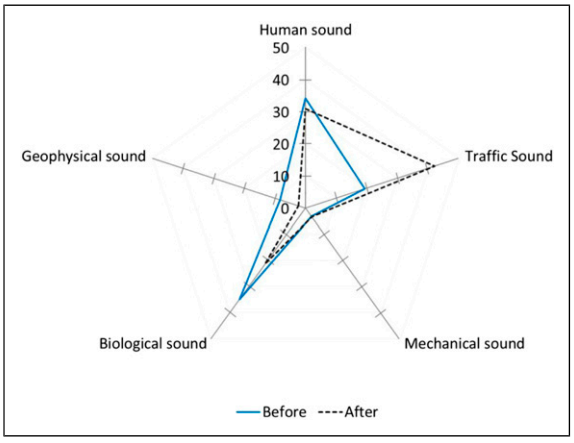

Figure 2. Percentages of architecture students who evaluated soundscapes compositions of the cafe terraces, before and after lockdown.

two periods was marked by the traffic sounds, by a standard deviation of 16.03%, the highest compared to the other components, where the traffic sounds were increased in the period after the lockdown from 19.33% to 42%. Human sounds are present in the soundscapes, in both periods, before and after lockdown, by percentages of 30.95% and 34.19% (±2.29%), respectively. While mechanical sounds are characterized by a low presence for both cases, with an average of 3.19% with a very low standard deviation of 0.07%, this is due to the rare presence of this sound category, which is characterized by short sequences not dominating the soundscapes. The notable decrease in the presence of human sounds in the soundscape and the predominance of traffic sounds in the after-lockdown period may explain that inhabitants have been increasing their use of cars, on the one hand. On the other hand, the occupants of the cafe terraces change their behaviors, by the respect of the social distance required by the state (not less than 1m between two people) and by less verbal contact due to the use of masks.

Biological and geophysical sound components are more present in the soundscapes of the terraces during the before-lockdown period, with a percentage of 43.33% compared to those of the after-lockdown period which has a percentage of 23.81%, only. Biological and geophysical sounds are more present when compared with geophysical sounds in the terrace's soundscapes during both periods. The biological sound component is present in the soundscapes during the before-lockdown period by percentages of 34.95% and 21.43% (±9.56%), respectively. While the geophysical sounds had a low presence compared to the other components with 8.38% and 2.38% (±4.24%), respectively.

The identification of the soundscapes of each cafe terrace in the periods before and after lockdown is presented in Figure 3. The soundscapes of the 21 studied terraces are classified according to their changes concerning the lockdown in four categories. Where 40.86% of the terraces were characterized by soundscapes of antiphonal category in both periods, while 14.29% of them were affected by the lockdown by a change of their soundscapes from anthrophony to the natural category in the after-lockdown period. On the other hand, 9.52% of terraces have soundscapes identified by a natural category in both periods, while 33.33% of them have soundscapes that have been changed from the natural category to a predominance of anthrophonical sounds. This confirms

that the lockdown has an impact on the change of the soundscapes of the cafe terraces.

The soundscapes of the terraces predominated by natural sounds in both periods were evaluated by 42.19% of the architecture students, while only 14.47% of the cafe terraces were affected by the lockdown, where their soundscapes were changed from a predominance of natural sounds to a predominance of anthrophonical sounds. On the other hand, the terraces that have soundscapes predominated by the anthrophony in both periods are less compared to those that were changed, with an evaluation of 9.33% and 34% of the participants, respectively.

Table 3 presents the results of MCNemar's Test to verify the impact of lockdown on the soundscape. MCNemar's Test shows that lockdown affects the soundscape components of the cafe terraces, because there is a significant difference between the soundscape components, concerning the two periods before and after lockdown (p-value < 0.05), where the change in the soundscape components of the period before the lockdown was from the dominance of geophonic and biophonic sounds (natural sounds) to a predominance of the anthrophony, according to 34% of the participants' responses.

The average responses of the first group of architecture students to the different attributes of the anthrophonical and natural sounds, concerning the different soundscapes of the terraces before and after lockdown, are presented in Figure 4. The changes in responses are presented in Figure 4 according to a coding (Before_After). While Table 4 presents the Marginal Homogeneity Test of the results of the anthrophonical sounds to compare the participants' evaluation of the soundscapes of the cafe terraces in both periods. The average of the participant's responses was from 2.65 (Agree) to 2.97 (Strangely agree) that the studied soundscapes are predominated by anthrophonical sounds. However, the Marginal Homogeneity Test shows that there is a statistically significant difference (p-value < 0.05) between the architecture students' evaluation of the studied terrace soundscapes before and after lockdown. This confirms that the lockdown has an impact on the change of soundscapes, which is the cause of the increase in the predominance of anthrophony on the soundscapes of the cafe terraces.

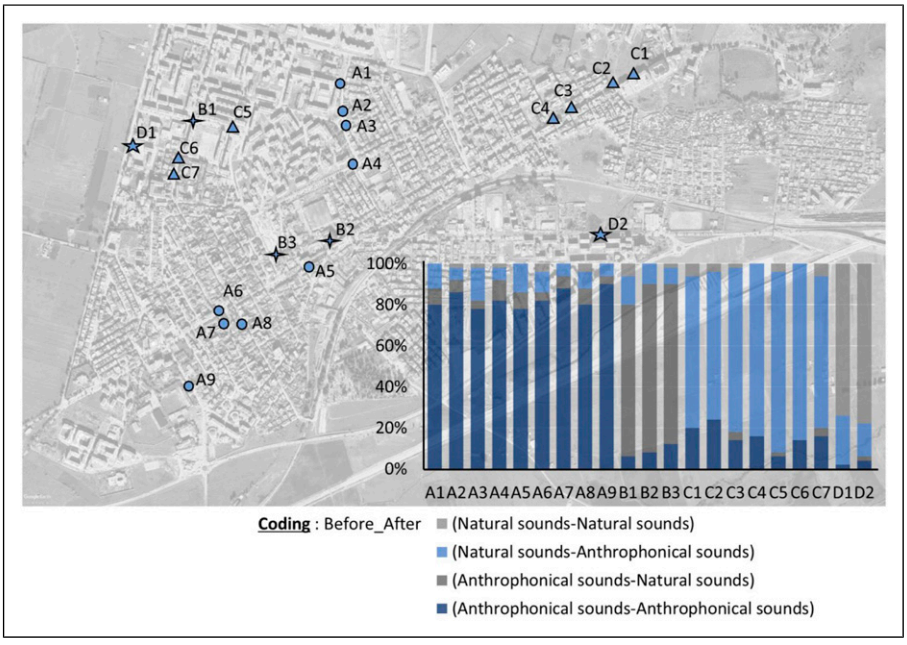

Figure 3. Soundscape identification of each cafe terrace before and after lockdown.

Table 3. Impact of lockdown on the change of soundscape components, using MCNemar test.

Effectives			MCNemar's test	
	After- lockdown			
Before- lockdown	Anthrophonical sounds	Natural sounds	N	Sig
Anthrophonical sounds	443	152	1050	0.000
Natural sounds	357	98		

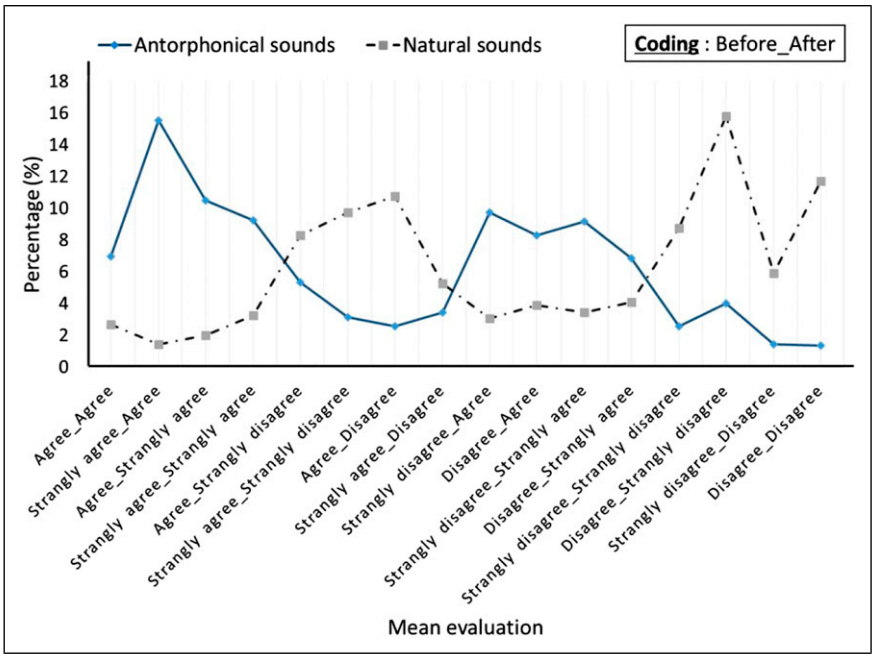

Figure 4. Comparison between soundscapes before and after lockdown periods in terms of anthrophonical and natural sound attributes, assessed by the first group of architecture students (See coding).

Table 4. Comparison by Marginal Homogeneity Test of the before and after lockdown soundscapes in terms of anthrophonical and natural sound attributes.

	Average	Standard deviation	N	Sig
Before -lockdown	2.65	1.15	1050	0.000
After -lockdown	2.97	1.02	1050	

Table 5. Factor analysis of the evaluation of the soundscape of cafe terraces before lockdown.

	Factors	
Indices	1 (66.24%)	2 (15.45%)
Natural-artificial	−0.966	
Quiet-noisy	−0.966	
Pleasant-unpleasant	0.947	
Interesting-boring	0.936	
Meaningful-meaningless	0.933	
Like-dislike	0.920	
Hard-soft	0.915	
Rough-smooth	0.866	
Agitating-calming	0.717	
Far-close	−0.605	
Fast-slow		0.936
Gentle-harsh		0.924
Echoed-deadly		0.842
Directional-everywhere		0.727
Comfort-discomfort		0.591

Stage two: Semantic difference analysis of the soundscapes before and after the COVID-19 lockdown

The second stage of this research was based on the comparison between the Semantic difference analysis of the soundscapes evaluation before and after the COVID-19 lockdown, based on the evaluation of the second group of architecture students. Tables 5 and 6 present two-factor analyses of the evaluation of soundscapes before and after the lockdown, respectively. The factor analyses used in this study were based on principal component analysis (PCA) as the extraction method, and varimax with Kaiser normalization as the rotation method. The Kaiser-Meyer-Olkin (KMO) measures of sampling adequacy were 0.72 and 0.77 for the two PCA analyses, corresponding to the evaluation of soundscapes before and after lockdown, respectively.

Table 5 shows that the PCA analysis of the soundscape assessment, of the before-lockdown period, yielded a two-component solution accounting for 81.68% of the variance. Factor 1 (66.24%) is principally associated with the function (relaxation and communication), including Quiet-Noisy, Pleasant-Unpleasant Meaningful-Meaningless, Like-Dislike which are related by relaxation, and Interesting-Boring, Meaningful-Meaningless, Rough-Smooth, Agitating-Calming which are associated with the communication. Factor 2 (15.45%) is generally related to space-time (space and time), including Echoed-Deadly, Directional-Everywhere which are related to space, and Fast-Slow which are related to time. From this analysis, it is interesting to note that the main facets of the design of

Table 6. Factor analysis of the evaluation of the soundscape of cafe terraces after lockdown.

	Factors		
Indices	1 (53.47%)	2 (14.04%)	3 (8.31%)
Meaningful-meaningless	0.901		
Directional-everywhere	0.856		
Interesting-boring	0.852		
Like-dislike	0.768		
Quiet-noisy	0.762		
Natural-artificial	0.726		
Pleasant-unpleasant	0.656		
Comfort-discomfort	0.626		
Rough-smooth		0.875	
Hard-soft		0.838	
Agitating-calming		0.698	
Fast-slow		0.518	
Far-close			0.829
Echoed-deadly			0.784
Gentle-harsh			0.563

urban public open space acoustics (function, space, and time) are overlapped in these two factors.[59]

The PCA analysis of the after-lockdown soundscape evaluation presented in Table 6 gave a three-component solution accounting for 75.82% of the variance. Factor 1 (53.47%) is primarily associated with relaxation, including Like-Dislike, Quiet-Noisy, Natural-Artificial, Pleasant-Unpleasant, and Comfort-Discomfort. Factor 2 (14.04%) is mainly related to dynamics, including Hard-Soft and Fast-Slow. Factor 3 is particularly associated with spatiality, including Far-Close and Echoed-Deadly. In contrast, the association of the other indices of spatiality (Directional-Everywhere, Interesting-Boringrelated) and communication (Meaningful-Meaningless, Agitating-Calming, Rough-Smooth) with factors 1 and 2 are likely since these indices were not well understood and evaluated by the architecture students participating in the second stage of the investigation. However, the three factors of this PCA analysis of the evaluation of cafe terrace soundscapes after lockdown also cover the main acoustics design dimensions of the urban public open spaces, including relaxation that reflects the function, as well as, space and time.

The average scores and percentages of the semantic difference analysis indices of the soundscape evaluation for the two periods are presented in Figure 5. Figure 5 shows that although the soundscapes of the cafe terraces were classified as a little agitating at 0.98 and 1.31, and a little noisy at −0.71 and −0.98 during the two periods, before and after the lockdown due to social measures, respectively; the soundscapes of the terraces during the period before the lockdown were identified as a little uncomfortable (1.37), and a little pleasant (1.49), while those during the period after the lockdown were classified as a little uncomfortable (−1.11), and a little unpleasant (−1.34).

To perform a comparison between the evaluation of the soundscapes of the cafe terraces before and after the lockdown by the second group of participants in terms of the indices of the semantic difference analysis, and to check the impact of lockdown on the soundscape, a Marginal Homogeneity Test was performed. The test of Marginal Homogeneity presented in Table 7 shows that there is a statistically significant difference (p-value < 0.05) between most of the indices of the Semantic difference analysis of the soundscape evaluation of the cafe terraces of the two periods linking with relaxation as Comfort-Discomfort, Like-Dislike, Natural-Artificial, Pleasant-Unpleasant, Rough-Smooth (p-value 0.000), Agitating-Calming (p-value 0.049), and indices associated with communication like Meaningful-Meaningless, Rough-Smooth (p-value 0.000) and other such as the indices Interesting-Boring (p-value 0.000), Far-Close (p-value 0.01). This means that lockdown has an impact on participants' evaluation of the soundscapes of the cafe terraces regarding the indices associated with the function (relaxation and communication), while the indices that are related with space and time are not changed for the soundscape's evaluation of the terraces, during the period after lockdown.

Discussion

Synthesizing the findings

The findings from the first stage of this study suggest that the lockdown measures in Algeria due to the COVID-19 social measures affect the soundscape components of the cafe terraces, where the anthrophonical components predominate over the soundscapes that were characterized by geophony and biophony (natural sounds) during the before lockdown period. Interestingly, the findings also show that the strong presence of the traffic sound component in the terrace soundscapes in the after-lockdown period was followed by a decrease in the presence of the human sound component. Although several investigations in the scientific literature confirm that lockdown measures cause a strong decrease in urban noise levels (during lockdown) such as those of Alsina-Pagès et al.,[61,62] this study shows that the predominance of traffic sounds on the soundscapes during the after-lockdown period does not reflect an increase in noise level, by the fact that the soundscapes of the terraces were similar, where they were identified as a little agitating and a little noisy during both periods, before and after lockdown.

Furthermore, the findings from the second stage explored that the soundscapes of the cafe terraces are potentially perceived in both periods by the most important facets of the acoustics design of the urban public open spaces, where the soundscapes of the period before lockdown are reflected by the indices related to the function, space and time, while those of the period after lockdown is mainly represented by the indices associated with relaxation that reflect the function, as well as,

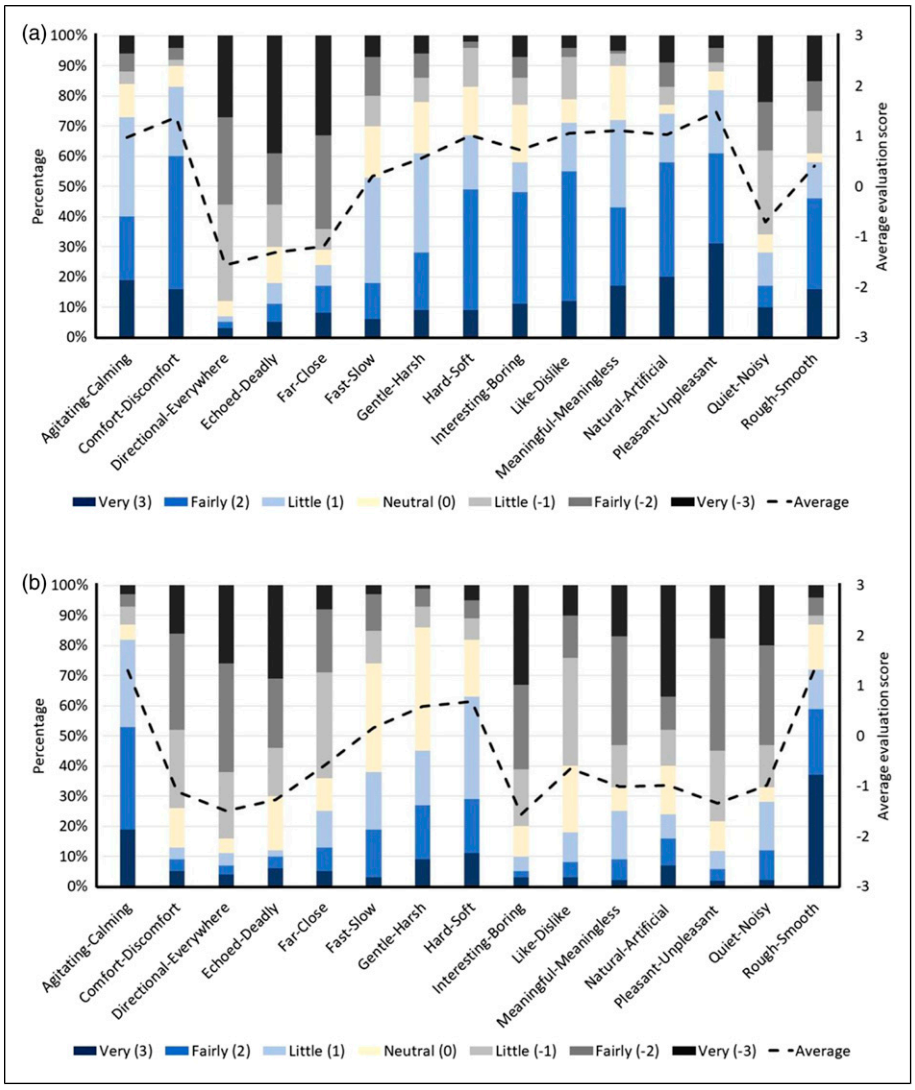

Figure 5. Average scores and percentages of the semantic difference analysis indices of soundscape assessment, scored by the second group of architecture students: (a) During the period before lockdown, (b) During the period after lockdown.

the indices related to space and time. Somewhat surprisingly, COVID-19 lockdown has an impact on participants' evaluation of the soundscapes of the cafe terraces regarding cues associated with the function (relaxation and communication), whereas cues that are related to space and time are not changed in the evaluation of the soundscapes of the terraces during the post-lockdown period. This confirms the results of the first stage, as the indices that are connected with relaxation (Comfort-Discomfort and Pleasant-Unpleasant…etc.) and commination (Meaningful-Meaningless and Rough-Smooth...etc.) are associated with the anthrophonical sounds.

Strengths and limitations of the study

The strength of this study is mainly due to its qualitative approach to examining the impact of lockdown on cafe terrace soundscapes using the method of reactivated listening (in the laboratory) of field-recorded soundtracks. Concerning regions in North Africa and even those in the Mediterranean, none of the previously published papers have compared the soundscapes of cafe terraces in the periods before and after lockdown due to COVID-19.

The findings from this research are limited to the study of the soundscape of a single type of urban space which is the cafe terrace by using a short-term evaluation. However, this research can be considered as a complementary step in the study of Ulloa et al. (2021)[63] who analyzed information on the soundscape during containment that could be used for urban planning in developing countries, where urban expansion occurs in a rapid and unplanned manner. Regarding the future strategy to improve the acoustic comfort and sustainability of the city, this research can be considered also as a subsequent step to the work of Lee and Jeong (2021)[64] who found that neighbor noise from indoor

Table 7. Comparison of the soundscapes evaluation of periods before and after a lockdown in terms of the indices of semantic difference analysis, using Marginal Homogeneity Test.

	Before lockdown		After lockdown		
Indices	Average	Sd	Average	Sd	Sig
Agitating-calming	0.49	1.89	0.66	1.87	0.049
Comfort-discomfort	0.69	1.88	−0.55	1.87	0.000
Directional-everywhere	−0.77	1.88	−0.74	1.93	0.758
Echoed-deadly	−0.65	2.03	−0.63	1.98	0.852
Far-close	−0.59	2.09	−0.29	1.82	0.001
Fast-slow	0.11	1.81	0.08	1.73	0.749
Gentle-harsh	0.29	1.83	0.30	1.72	0.913
Hard-soft	0.51	1.79	0.35	1.81	0.051
Interesting-boring	0.37	1.91	−0.77	1.94	0.000
Like-dislike	0.54	1.87	−0.32	1.77	0.000
Meaningful-meaningless	0.56	1.84	−0.51	1.89	0.000
Natural-artificial	0.51	2.02	−0.49	2.06	0.000
Pleasant-unpleasant	0.75	1.96	−0.65	1.85	0.000
Quiet-noisy	−0.36	1.99	−0.49	1.94	0.132
Rough-smooth	0.21	2.07	0.70	2.00	0.000

spaces is more problematic than outdoor noise during the lockdown.

Implication on practice and future research

The health crisis due to the COVID-19 pandemic has raised the importance of the study of soundscape which is considered a crucial element of a comprehensive urban design strategy that aims to improve the health and quality of life of increasingly large and dense populations in the future.[65] And as this pandemic has significantly altered urban noise environments, it has the potential to open up an opportunity for research areas[66] to study the effect of this pandemic in several cases. The results of this research help to explore the change in the soundscape due to lockdown by conducting a comparison between two periods, before and after a lockdown in response to the COVID-19 pandemic. Based on our findings, the authors advise urban planners and decision-makers to give more importance to the soundscapes of cafe terraces and other urban spaces in the cities of northern Algeria, to preserve and improve them without losing their sonic identities, as well as, to ensure the well-being of users, because the soundscape is part of cultural heritage.[67–70] Unfortunately, this research confirms once again that the current urban strategy of Algeria is outdated concerning the maintenance of the cultural sound heritage[9]

Another interesting implication of this study is that it presented a translation from English to Arabic of the different soundscape attributes and evaluation indices (see Tables 1 and 2) so that the participants could understand these attributes in both stages of the evaluation. This translation may be useful for the future studies of the researchers who are engaged in the translation of the soundscape attributes such as the international network of soundscape researchers constituting from different regions of the world which were established under the name of "Soundscape Attributes Translation Project" (SATP) and started its activity by the first group of collaborators in 2019 in a first stage with the expertise by a considerable geographical distribution, covering 15 different languages,[71] where the attributes translated by the SATP group was carried out mainly based on the study of the soundscape attributes identified by Axelsson et al.[72]

The authors are aware that subjective measurements have important potential in the soundscape evaluation,[73] in parallel with measurements of the different physical dimensions of the acoustic environment.[74,75] Therefore, future research should focus on the subjective and objective investigation of long-term soundscape evaluation to preserve and improve the cultural soundscapes of different urban spaces in Algeria, taking into account, as a lesson, the negative effects of COVID-19 on the environment and public health in general, and its effect on substantial cultural, political and urban design changes, especially that COVID-19 will not be the last virus that will strike our cities.[76]

Conclusion

In this paper, a qualitative approach was conducted in the laboratory, in two stages, after the execution of several in situ short-term sound recordings that were carried out before and after the confinement in the different cafe terraces available in the city of Azzaba, to examine the impact of the lockdown measures in Algeria due to the social measures COVID-19 on the compositions of the soundscapes of twenty-one cafe terraces of the city, and to compare the perceptions of the users of these spaces concerning the soundscapes during the two periods, before and after the lockdown. Overall, this study suggests that the lockdown measures in Algeria affect the soundscape components of the cafe terraces, which causes a predominance of anthrophonical sounds instead of the geophonic and biophonic components (natural sounds), during the period after lockdown. This anthrophony predominance was characterized by an increase in the traffic sounds component and a decrease in the human sounds in the soundscapes. In contrast, the predominance of traffic sounds on the soundscapes during the after-lockdown period does not reflect an increase in noise level, where the soundscapes of the terraces in both periods were identical, identified as a little agitating and a little noisy.

This research also highlights that the soundscapes of the cafe terraces are possibly evaluated in both periods, before and after lockdown, by the most important facets of the acoustics design of an urban public open space, using indices related to function, space, and time. In addition, this study

shows that there are statistically significant differences in the soundscape's indices associated with the function (relaxation and communication), regarding the cafe terraces soundscapes evaluation in both periods, before and after lockdown. Further research is needed, which focuses on conducting a qualitative and quantitative study based on a long-term subjective investigation and the measurement of the different physical dimensions of the outdoor acoustic environment of different urban spaces in the Mediterranean, desert, and oasis regions of Algeria, to preserve and improve their cultural soundscapes, and to ensure the acoustic comfort of the occupants and to preserve their health.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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