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Research Article

URBAN SOUNDSCAPE CHANGES IN TURKEY BEFORE AND AFTER COVID-19: ESKİŞEHİR, AN ANATOLIAN CITY

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Abstract

In line with the Covid-19 measures taken in Turkey, there have been some changes in daily life and these changes affected the acoustic environment particularly in terms of dominant sound type and sound level. In the study conducted to examine the effects of changes in daily life as a result of the measures taken by the state on the sound environment, through sound level, sound types and soundscape components, the changes in the acoustic environment in commercial-recreational areas, as well as historical-touristic areas at the city center of the sample city Eskişehir, Turkey before and after Covid-19, were reviewed and evaluated by comparison. Before Covid-19, the sounds that existed but masked in the LO-FI acoustic environment (especially the natural sounds) became audible in the HI-FI acoustic environment created with the lowered sound level after pandemic (5 to 10 dBA), and they took their place among the keynotes and soundmarks. While the soundmarks that define urban areas consisted of the sounds arising from the area usage by function before the pandemic, they turned into natural sounds throughout the pandemic.

Keywords: Covid-19, urban soundscape, Eskişehir, Turkey

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Araştırma Makalesi

COVID-19 ÖNCESİ VE SONRASI TÜRKİYE'DE KENTSEL İŞİTSEL PEYZAJ DEĞİŞİMLERİ: ESKİŞEHİR, BİR ANADOLU KENTİ

Özet

Türkiye'de alınan Covid-19 önlemleri doğrultusunda günlük hayatta bazı değişiklikler olmuş ve bu değişiklikler akustik ortamı özellikle baskın ses türü ve ses seviyesi açısından etkilemiştir. Devlet tarafından alınan önlemler sonucunda günlük hayatta meydana gelen değişikliklerin ses ortam üzerindeki etkilerini ses düzeyi, ses türleri ve işitsel peyzaj bileşenleri aracılığıyla incelemek amacıyla yapılan çalışmada örnek şehir olan Eskişehir'in şehir merkezindeki ticari-rekreasyon alanları ile tarihi-turistik alanlardaki akustik ortamda Covid-19 öncesi ve sonrasında meydana gelen değişimler incelenmiş ve karşılaştırmalı olarak değerlendirilmiştir. Covid-19 öncesi LO-FI akustik ortamda var olan ancak maskelenen sesler (özellikle doğal sesler), pandemi sonrası düşen ses seviyesi (5 ila 10 dBA) ile oluşan HI-FI akustik ortamında duyulabilir hale gelmiş ve bu sesler ön plan sesleri ve sembol sesler arasında yerini almıştır. Kentsel alanları tanımlayan sembol sesler pandemi öncesinde işleve göre alan kullanımından kaynaklanan seslerden oluşurken, pandemi boyunca doğal seslere dönüşmüştür.

Anahtar Kelimeler: Covid-19, kentsel işitsel peyzaj, Eskişehir, Türkiye

1. INTRODUCTION

The global epidemic of the SARS-Cov-2 virus (COVID-19 disease) first emerged in China, in December 2019. From the emergence of the virus, epidemic disease has spread rapidly across the globe. A day later the first officially reported COVID-19 case in Turkey was on 10 March, 2020 and a day later when World Health Organization (WHO) declared the outbreak a pandemic on March 11, 2020. Since then, Turkey, like all countries in the world struggle to control the virus, has taken required measures to prevent the spread of the SARS-Cov-2 virus.

According to the decisions made by the Turkish government regarding the fight against Covid-19, a lock-down was imposed for the citizens who are older than 65 years and younger than 20 years; a shift-work pattern was implemented for the employees in public and private sectors, and new business hours were set accordingly; education in educational institutions (schools and universities) was suspended, the dorms were evacuated and the education continued remotely as online; collective activities such as religious ceremonies, artistic activities, conferences, panels, exhibitions, meetings, workshops, congresses were prohibited; many places including theaters, cinemas, show centers, concert halls, sports halls, restaurants, coffee shops, diners, wedding halls, entertainment venues, museums and the malls were closed; entrances to recreation areas such as parks, gardens, beaches, playgrounds and picnic areas were banned; intercity travels to metropolises were restricted by subjecting to permission; people were recommended to “declare their own state of emergency” and stay home unless they have to go out; a lock-down was declared for the weekends and official holidays, but people such as the healthcare professionals, security personnel, employees in logistics sector and the manufacturers and distributors of staple food were excluded from this scope. With these measures implemented in the country, the number of vehicles on the roads, the number of people going out, and the commercial activities except for healthcare and food sectors were decreased. Such changes in daily life were reflected in the acoustic environment of the cities.

After the Covid 19, a number of studies have been carried out on the acoustic environment in urban areas for collecting data including recording, measurement and analysing sound type changes (Aletta F., Osborn 2020, Dutheil F., Baker J.S., Navel 2020, Aletta and others 2020, Acoucité 2020, Sakagami 2020, COVID-19: The Quiet Project 2020, Locate Your Sound 2020). In this study, we focus on Eskişehir, a typical Anatolian city with an average population as in other cities of Turkey. The urban acoustic environment that has changed with Covid-19 was reviewed in terms of the changes in the sound type and sound level with the soundscape approach (Shafer, 1969) in the historic city center. The soundscape changes were analyzed over the soundscape components defined through the soundwalk (ISO/TS 12913-1, 2014) recordings made before Covid-19 (on an ordinary day) and after Covid-19 (on an ordinary day and a lock-down day) in two mixed-used urban areas comprising different types of land use as commercial, recreational, historical and touristic.

The aims of this study are to examine the effects of the changes that occur in daily life as a result of the measures imposed by the government, on the sound environment through sound level, sound types, and soundscape components, and to investigate the differences that occurred according to urban land use.

2. MATERIALS AND METHODS

2.1. SITE SELECTION

Traditional and historic city centres are typical urban spaces, reflecting the urban identity associated with physical, natural, historical, socio-cultural, visual and acoustic characteristics of a particular city. The number of studies carried out for the purpose of researching the soundscape and acoustic properties of the historical environment, especially in urban spaces, is increasing day by day. The specification, assessment, and basic components of the soundscape in urban open public space and the factors that affect its evaluation have been examined (Huang and Kang, 2015). In this study, the urban soundscape of Eskisehir was examined through the Taşbaşı Bazaar and Hamamyolu among the commercial and recreational areas and the Settlement of Odunpazarı among the historical and touristic areas (Table 1).

Traditional commercial and recreational area: Taşbaşı Bazaar and Hamamyolu
Taşbaşı Bazaar is a busy traditional commercial area of Eskişehir. Hamamyolu assumed a commercial function upon becoming the extension of the existing bazaar. A recreative green area was constructed on the middle axis of the avenue which is closed to traffic. The activities in the region on an ordinary day after Covid-19, which had a busy commercial and recreative use by the local community before Covid-19, consisted of cleaning and maintenance activities of the municipality personnel, the storage and logistics activities of the merchants and the activities of the personnel providing security services.

Historical and touristic area: Odunpazarı
Odunpazarı, has a traditional and historic fabric with low-rise buildings with gardens, and mosques built in the past. Therefore the region became a protected area for its historical value and gained a touristic quality with its new areas of use (catering places and commercial units). The use of the area on an ordinary day after Covid-19, which had an intense touristic use before Covid-19, mostly consisted of activities of the locals to fulfill their daily needs.

Table1. Description and photos of the selected sites

Land-use type	Dominant sound source(s) in typical condition	Pictures before Covid 19	Pictures After Covid 19
Traditional commercial and recreational area: Taşbaşı Bazaar and Hamamyolu	intense human voices, sounds from commercial functions		
Historical and touristic area: Odunpazarı	intense human/ tourist voices and commercial music broadcast		

2.2. ACOUSTIC MEASUREMENT AND SOUNDSCAPE COMPONENTS

The "soundscape" concept recommended in line with the pioneering studies conducted by R.M. Schafer, a renowned Canadian composer, in 1960's for the identification of the acoustic environment independent from positive or negative impressions (Shafer, 1969) is defined as the "acoustic environment as perceived or experienced and/or understood by a person or people, in context" in ISO 12913-1:2014 standard. Recordings and measurements during sound walk in auditory landscape studies are widely used in studies on urban acoustics.

Researchers working on urban acoustics often conduct measurements and recordings with soundwalk to collect data about the soundscape and understand the acoustic environment (Semidor, 2006; Jeon et al., 2011; Suhanek et al., 2010; Smyrnova and Kang, 2010). Sound recordings were also made using several methods (stereo, binaural, and ambisonic) during soundwalks (Yong Jeon and others, 2013). It was stated that binaural recording is more practical than other methods because it is possible to recreate the spatial characteristics of the acoustic environment (Yong Jeon and others, 2013). Even though SPLs are limited in their ability to fully represent the sound environment (Raimbault and Dubois, 2005), most studies have used various A-weighted sound levels (LAeq, Lmax, and Lmin) to characterize sound environments (Yong Jeon and others, 2013). In addition, percentile sound levels (L_{10}, L_{50}, and L_{90}) were used as soundscape indicators (Semidor, 2006; Berglund and Nilsson, 2006).

In this study sounds were recorded during the walks taken on designated routes by using the soundwalk method defined as the "method that implies a walk in an area with a focus on listening to the acoustic environment" in ISO/TS 12913-2:2018, the sound level measurements were taken, and the sound types (Kang, 2007; Bones et.al., 2018) were analyzed over the soundscape components used in the soundscape approach focusing on the sound sources in the

acoustic environment (Yang and Kang, 2005). A total of six sound walks conducted on two different routes with the participation of four researchers on three different days, on an ordinary day before Covid-19 (May 2019), on an ordinary day (May 2020) and on a lock-down after Covid-19 (May 2020). During the soundwalks, one of the researcher carried out 10 minute's and 15 minute's binaural recordings via binaural headset (Genuit and Fiebig, 2014) connected to a calibrated portable recorder (B&K Type 2270-S Sound Level Meter / Analyzer). From the binaural recordings datasets (both the May 2019 and May 2020 series), the following acoustic parameters were analyzed and computed by Pulse Reflex software for the left and right channels and the arithmetic average was presented: LAeq, LA10, LA50, LA90.

Figure 1. The routes of the soundwalks in Taşbaşı Bazaar and Hamamyolu (left) and in Odunpazarı (right)

During the soundwalks, the other three researchers listened carefully to the sound environment and took note of the sounds they heard and evaluated the acoustic environment according to the sound types through the soundscape components which were defined by Schafer as "keynotes" (the fundamental sound created by the geographical and climatic conditions in the selected landscape), "signals" (the preliminary temporary sound that is surprising or leading to immediate effect), and "soundmarks" (sound that may identify the area) (Schafer, 1977).

3. RESULTS AND DISCUSSION

3.1. EFFECTS OF LOCKDOWN MEASURES ON ACOUSTIC

Traditional commercial and recreational area: Taşbaşı Bazaar and Hamamyolu

Leq, Leq90, L50 and L10 values have calculated by analyzing the data obtained with the recordings conducted during the soundwalk of the Taşbaşı Bazaar and Hamamyolu route for before Covid-19, An ordinary day after Covid-19 and Lock-down after Covid-19 (Table 2).

Table 2. The sound levels measured in the traditional commercial and recreational area before Covid-19, on an ordinary day and on a lock-down after Covid-19.

Measurement Period	Leq(dBA)	L90(dBA)	L50(dBA)	L10(dBA)
Before Covid-19	60.75	54.24	59.01	69.69
An ordinary day after Covid-19	52.94	50.76	53.98	66.13
Lock-down after Covid-19	49.89	47.91	52.62	60.91

According to the measurements taken during the soundwalks in the area, LeqA value decreased by 7 dBA on an ordinary day after Covid-19 and by 10 dBA on a lock-down day. The decrease in the L90 value associated with keynotes by up to 6 dBA occurred particularly as a result of the reduced use by people after Covid-19, while the decrease in L10 value associated with signals by up to 9 dBA occurred particularly as a result of the decrease in the sounds from commercial functions (Figure 2).

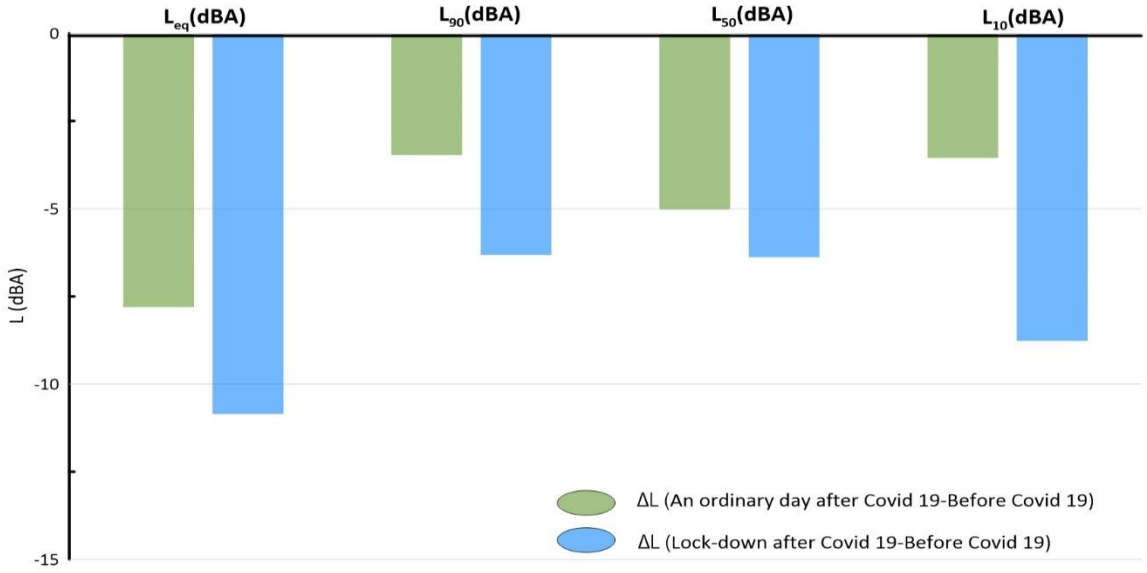

Figure 2. Differences L(eq/90/50/10)A, After Covid 19 – L(eq/90/50/10)A, Before Covid 19 on the route of Taşbaşı Bazaar and Hamamyolu

Historical and touristic area: Odunpazarı

Leq, Leq_{90}, L50 and L10 values have calculated by analyzing the data obtained with the recordings conducted during the soundwalk of the Odunpazarı route for before Covid-19, An ordinary day after Covid-19 and Lock-down after Covid-19 (Table 3).

Table 3. The sound levels measured in the historical and touristic area before Covid-19, on an ordinary day and a lock-down day after Covid-19.

Measurement Period	Leq(dBA)	L90(dBA)	L50(dBA)	L10(dBA)
Before Covid-19	59.56	50.85	61.35	68.97
An ordinary day after Covid-19	54.99	46.82	54.26	64.49
Lock-down after Covid-19	47.43	45.29	53.69	63.42

According to the measurements taken during the soundwalks in the region, LeqA value decreased by 5 dBA on an ordinary day after Covid-19 and by 12 dBA on a lock-down day. The decrease in L90 value up to 5 dBA occurred particularly due to the decrease in the intense touristic use after Covid-19, and the decrease in L10 value by up to 5 dBA occurred particularly due to the decrease in the number of vehicles on the road with Covid-19 (Table 2).

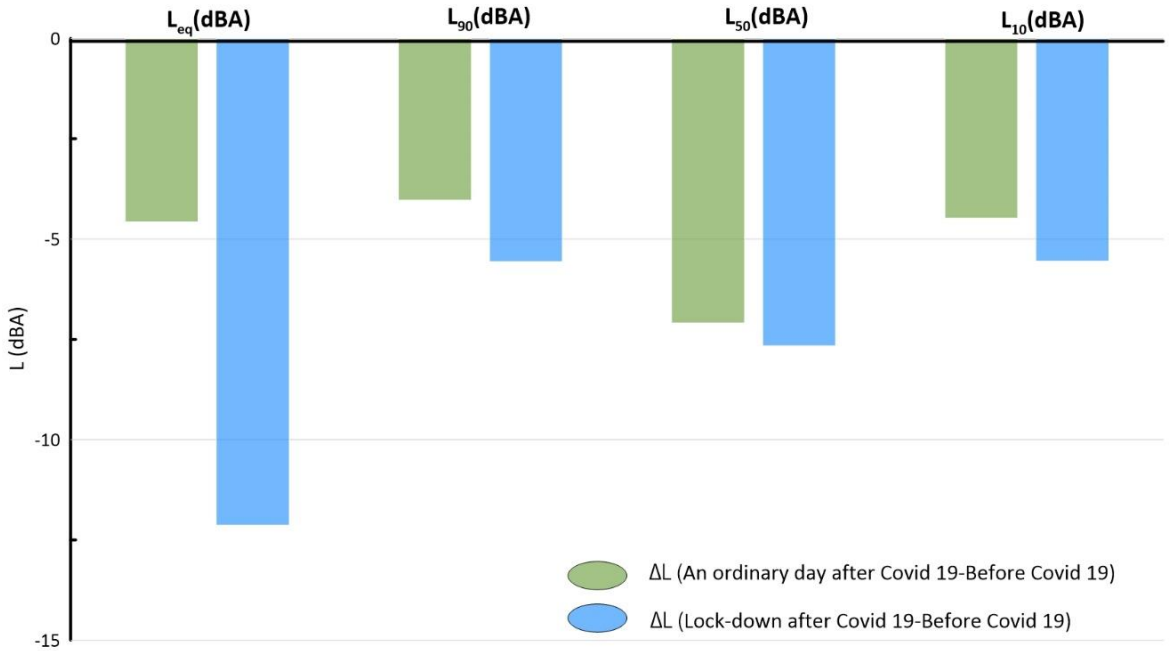

Figure 3. Differences L(eq/90/50/10),A,After Covid 19 – L(eq/90/50/10),A, Before Covid 19 on the route of Odunpazarı

3.2. SOUNDSCAPE COMPONENTS

Traditional commercial and recreational area: Taşbaşı Bazaar and Hamamyolu

Keynotes determined in the acoustic environment before Covid-19 were: intense human voices; signals were: children, sprinkler/water, sounds from commercial functions, sounds of street performers, vehicle sounds, jet aircraft sounds; soundmarks were: commercial addressing, intense human, children, sprinkler/water, jet aircraft sound.

Keynotes determined on an ordinary day in the acoustic environment after Covid-19 were: bird calls, human voices (casual chats of security and tertiary sector employees); signals were: sounds from municipality services (mowing, street cleaning, repair sounds), sounds from commercial functions (commercial music broadcast (1 shop), service vehicle sound, loading-unloading sound, water sales sounds), construction sound, water/sprinkler sound, motorcycle sound, the sound of ventilators in cool stores in commercial areas; soundmarks were: sound of water and bird calls. Keynotes determined on a lock-down day were: birds, wind; signals were: sound of ventilators in cool stores in commercial areas, water/sprinkler sound; soundmarks were: sound of water and bird calls.

The acoustic environment which was characterized by intense human voices due to the commercial and recreative use of the area before Covid-19 has been replaced by natural sounds as expected after Covid-19.

Table 4. The soundscape componets in the traditional commercial and recreational area before Covid-19, on an ordinary day and on a lock-down after Covid-19.

Soundscape Components	Before Covid-19	An ordinary day after Covid-19	Lock-down after Covid-19
Keynotes	**sounds from human beings:** intense human voices	**naturel sounds and sounds from human beings:** bird calls, human voices (casual chats of security and tertiary sector employees)	**naturel sounds:** birds, wind
Signals	**sounds from human beings, naturel sounds, traffic noise and other noise:** children, sprinkler/water, sounds from commercial functions, sounds of street performers, vehicle sounds, jet aircraft sounds	**naturel sounds and other noise:** sounds from commercial functions (commercial music broadcast (1 shop), service vehicle sound, loading-unloading sound, water sales sounds), construction sound, water/sprinkler sound, motorcycle sound, the sound of ventilators in cool stores in commercial areas	**naturel sounds and other noise:** sound of ventilators in cool stores in commercial areas, water/sprinkler sound
Soundmarks	**sounds from human beings, naturel sounds and other sounds:** commercial addressing, intense human, children, sprinkler/water, jet aircraft sound	**naturel sounds:** bird calls	**naturel sounds:** sound of water and bird calls

Historical and touristic area: Odunpazarı

Keynotes determined in the acoustic environment before Covid-19 were: intense human/tourist voices; signals were: vehicle sound, commercial music broadcast, commercial addressing; soundmarks were: intense human/tourist voices, calls to prayer, jet aircraft sound, tea glass sounds. Keynotes determined on an ordinary day in the acoustic environment after Covid-19 were: bird calls, cat/dog sounds, wind sound; signals were: vehicles (security, service and private cars) and human voices (talks for shopping); soundmarks were: calls to prayer, bird

calls, cat/dog sounds. Keynotes determined on a lock-down day were: bird calls, cat/dog sounds; signals were: vehicle sounds (mostly security and service vehicles); soundmarks were: bird calls and calls to prayer.

In the acoustic environment, which was characterized by intense human/tourist voices due to the historical and touristic use before Covid-19, the daily voices of the locals (like for shopping) and natural sounds became dominant after Covid-19. The sounds of vehicles continued to exist in a perceivable manner even after Covid-19 as the main arterial road of the area is open to traffic.

Table 5. The soundscape componets in the traditional commercial and recreational area before Covid-19, on an ordinary day and on a lock-down after Covid-19.

Soundscape Components	Before Covid-19	An ordinary day after Covid-19	Lock-down after Covid-19
Keynotes	**sounds from human beings:** intense human voices	**naturel sounds:** bird calls, cat/dog sounds, wind sound	**naturel sounds:** bird calls, cat/dog sounds
Signals	**sounds from human beings, naturel sounds, traffic noise and other noise:** vehicle sound, commercial music broadcast, commercial addressing	**sounds from human beings and traffic noise:** vehicles (security, service and private cars) and human voices (talks for shopping)	**traffic noise:** vehicle sounds (mostly security and service vehicles)
Soundmarks	**sounds from human beings and other sounds:** intense human/tourist voices, calls to prayer(azan), jet aircraft sound, tea glass sounds	**sounds from human beings and naturel sounds:** calls to prayer, bird calls, cat/dog sounds	**sounds from human beings and naturel sounds:** bird calls and calls to prayer

4. CONCLUSIONS

In consequence of the research, there was no significant difference between the two different urban uses, and similar changes occurred after covid 19. As a result of the decreased traffic density and the decreased functional area use after Covid-19, the sound levels decreased, and a HI-FI acoustic environment was created. The high-frequency and relatively low sounds (especially natural sounds) which existed in the LO-FI acoustic environment but masked particularly with low-frequency technological and transportation sounds before Covid-19 became audible in the HI-FI acoustic environment created after the pandemic, and took their place among the keynotes and soundmarks. The soundmarks which define the acoustic identity which is a part of the spatial identity in urban areas are the sounds mainly arising from the functional use of the area before the pandemic as they define the acoustic life specific to the society. The natural sounds, which became dominant and continuous in urban areas with different uses because of the restrictions in the pandemic period and which are identified as soundmarks, caused the acoustic identity to be non-differentiated.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Acoucité, (2020). Sound Environment Observatory. *Lockdown during Covid-19 pandemic: Impact on Sound Environment* (Summary Report, version 11th June 2020), Lyon: Acoucité, 2020.

Aletta F., Brinchi S., Carrese S., Gemma A., Guattari C., Mannini L., et al., (2020). Analysing urban trafic volumes and mapping noise emissions in Rome (Italy) in the context of containment measures for the COVID-19 disease, *Noise Mapp., 7.1.* DOI:10.1515/noise-2020-0010.

Aletta, F., Osborn, D. (2020). The Covid-19 global challenge and its implications for the Environment – what are we learning, UCL Open, *Environment, 1, 5,* DOI:10.14324/111.444/ucloe.000008

Bones, O., Cox, T. J. and Davies, W. J. (2018). Sound Categories: Category Formation and Evidence-Based Taxonomies, *Front Psychol. Vol 9:* 1277.

Berglund, B., Nilsson, M. E. (2006). On a tool for measuring soundscape quality in urban residential areas, *Acta. Acust. Acust. 92,* 938–944.

Covid-19: The Quiet Project—Call for Measurements. Available online: https://www.ioa.org.uk/news/covid-19-quiet-project-%E2%80%93-call-measurements (accessed on 21 June 2021).

Dutheil, F., Baker, J.S., Navel, V. (2020). COVID-19 as a factor influencing air pollution? *Environ. pollut., 263,* 114-466.

Genuit, K., Fiebig, A. (2014). The measurement of soundscapes – Is it standardizable? *Inter-noise 2014*, Melbourne, Australia.

Huang, L., Kang, J. (2015). The sound environment and soundscape preservation in historic city centres—the case study of Lhasa, *Environment and Planning B: Planning and Design 2015, volume 42,* 652 – 674.

ISO/TS 12913-1:2014. (2014). Acoustics – Soundscape- Part 1.

ISO/TS 12913-2:2018. (2018). Acoustics – Soundscape- Part 2.

Jeon, J. Y., Lee, P. J., Hong, J. Y., and Cabrera, D. (2011). Non-auditory factors affecting urban soundscape evaluation, *J. Acoust. Soc. Am. 130,* 3761–3770.

Kang, J. (2007). *Urban Sound Environment,* Taylor & Francis Group, New York, USA.

Locate Your Sound—Paesaggi Sonori Italiani #Covid19. Available online: https://locateyoursound.com/en/(accessed on 21 June 2021).

Raimbault, M., and Dubois, D. (2005). Urban soundscapes: Experiences and knowledge, *Cities 22,* 339–350.

Sakagami, K. (2020). How did "state of emergency" declaration in Japan due to the COVID-19 pandemic affect the acoustic environment in a rather quiet residential area?, *Environment Preprint*, DOI: 10.14324/111.444/000034.v1.

Schafer, R. M. (1969). *The New Soundscape,* Universal Edition, Vienna.

Schafer, R. M. (1977). *Our Sonic Environment and the Soundscape: the Tuning of the World,* Destiny Books, Rochester, Vermont.

Semidor, C. (2006). Listening to a city with the soundwalk method, *Acta. Acust. 92,* 959–964.

Suhanek, M., Durek, I., and Jambro - sic, K. (2010). The soundscape of urban public places in Zagreb, *in Proceedings of EAA Euroregio 2010,* Proceedings CD Rom, 6.

Smyrnova, Y., Kang, J. (2010). Determination of perceptual auditory attributes for the auralization of urban soundscapes. *Noise Control Eng. J. 58,* 508–523.

Yang, W., Kang, J. (2005). Soundscape and sound preferences in urban squares: a case study in Sheffield, *Journal of Urban Design 10,* 61-80.

Yong Jeon, J., Young Hong, J., Jik Lee, P. (2013). Soundwalk approach to identify urban soundscapes individually, *The Journal of the Acoustical Society of America, vol. 134,* issue 1, 803.