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The Legacy of R. Murray Schafer – Twenty-four Hours of Soundscape Measurements: An Analysis of the Acoustic Ecology of a City Centre

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Abstract

Raymond Murray Schafer, a composer, writer, environmentalist, and long-time leading figure in acoustic ecology, would have celebrated his 91st birthday this year. A versatile artist and theorist, he expanded his musical compositions to include a layer of natural-environment sound and took interpretations of his concert-hall compositions outdoors. This text works with Schafer's approach to acoustic ecology. By drawing on acoustic-ecological research mapping and the relationships between people and their environment, it shows Schafer's approaches to the investigation of our sound environment and updates of some of his theories with the soundscape of the city centre of Brno, Czech Republic.

Key words

soundscape, hi-fi, lo-fi, acoustic ecology, soundscape ecology, Brno

Raymond Murray Schafer and Acoustic Ecology

Raymond Murray Schafer, a practitioner and theorist, investigated the sounds that surround us, identifying and contextualising the related themes. He founded the World Soundscape Project at Simon Fraser University in 1969 to develop the discipline of acoustic ecology. According to Schafer, the project studies "[...] *the effects of the acoustic environment or SOUNDSCAPE on the physical responses or behavioural characteristics of creatures living within it. Its particular aim is to draw attention to imbalances which may have unhealthy or inimical effects."*[1] In creating a completely new discipline, Schafer coined new terms that have become fundamental for the different approaches to the sound dimensions of nature, flora, and fauna, and human coexistence within those worlds. They have become tools to name and frame the phenomena within the sound dimension of reality. One of these is the aforementioned term "soundscape", which he defined as "[t]*he sonic environment. Technically, any portion of the sonic environment regarded as a field for study. The term may refer to actual environments, or to abstract constructions such as musical compositions and tape montages, particularly when considered as an environment."*[2]

Acoustic Ecology Approaches within the Brno Soundscape

This paper outlines the acoustic ecology and the related quantitative and qualitative elements of sound reflection within the soundscape of Brno, Czech Republic. The source data are being collected as part of ongoing doctoral research. This research, "*Sound-mediated ecological interactions and processes: materialisation of aural history through sound time collections*", is being carried out over a period of four years. The practical research covers one year. The goal is to capture multiple records from all seasons. The outputs are continuously analysed for potential trends. The basic objectives are somewhat independent: to create a sufficiently large sound bank for a potential sound installation or edited soundtrack; and to attempt to analyse and compare possible trends related to the changing temporal dispositions of record making. Thus, 24 hours of recordings from different seasons are being recorded. The sequences are captured in two ways.

The first method is based on the field-recording approach. On the roof of the Faculty of Social Studies of Masaryk University at 218/10 Joštova Street in the centre of Brno, an ambisonic microphone, in combination with a recording device, captures and creates multi-channel recordings The output is a recording in stereo distribution, binaural distribution, and, because the source data is available, a multi-channel distribution from the recording (e.g., the traditional 5.1 cinema format).

1 SCHAFER, Raymond Murray. The *Soundscape: Our Sonic Environment and the Tuning of the World*. 1. Rochester, Vermont: Destiny Books, 1994, p. 271.

2 Ibid., pp. 274–275.

The second method relies on measurements from an instrument that records a numerical representation of loudness (i.e., sound pressure level) and frequency distribution (i.e., pitch).

Hi-fi, Lo-fi, Keynotes, Soundmarks, and Signals

The concepts developed by Schafer enable us to listen to and analyse the sound and data recordings. His terms – "hi-fi", "lo-fi", "signal", "soundmark", and "keynote" – enable us to describe the soundscape.

Schafer uses the term hi-fi, which is short for high fidelity, to refer to "[...] *a favorable signal-to-noise ratio. The most general use of the term is in electroacoustics. Applied to soundscape studies a hi-fi environment is one in which sounds may be heard clearly without crowding or masking.*"[3]

At the other end of the scale, lo-fi (i.e., low fidelity), is a specific approach to the creation of a musical composition in which the creators pay attention to the sonic "dirtiness" of the output. Lo-fi, according to Schafer, is "[...] *an unfavorable signal-to-noise ratio. Applied to soundscape studies a lo-fi environment is one in which signals are overcrowded, resulting in masking or lack of clarity.*"[4]

By dividing sound phenomena according to their location and role in the soundscape, Schafer provided analogy for various semiotic and semiological approaches and introduced the terms keynote, soundmark, and signal.

Schafer perceived the keynote sound as the key to a piece of music. Within the soundscape, keynote sounds are often not heard consciously; rather they form a sonic background. Keynote sounds are ubiquitous, so they have a profound effect on our behaviour, while also capturing the character of the people who are surrounded by them. For example, Schafer lists the keynote sounds of a landscape as insects, animals, birds, water, wind, forests, and plains. These are the entities that he believes are created by climate and geography. When he wrote his book (1977) he cited the internal combustion engine as an example for the modern city. Keynote sounds function to shape the factors for the perception of other sound signals.

Schafer derived the term soundmark from the term "landmark". Soundmark refers to a community sound that is unique or that has specific characteristics that are noticeable by the people in the community. Once a soundmark is identified, it should be protected because its markers make the acoustic life of a community unique. As an example, Schafer cited the daily cannon shot across the Vancouver harbour to inform fishermen of the time. This particular soundmark is now protected as a "sound souvenir"[5].

A sound signal can be any sound upon which attention is focused. In the context of soundscape disciplines, sound signals are contrasted with keynote sounds. Schafer

3 Ibid., p. 272.

4 Ibid., p. 272.

5 Ibid., p. 239.

compares the relationship between sound signal and the keynote to the relationship between a figure and the background in psychology. Signals are sounds in the foreground and they are heard consciously. Keynote sounds are background sounds.[6] Any sound can be heard consciously and become a sound signal. Schafer lists signals that must be listened to for the danger they present. These represent acoustic warning devices (e.g., bells, whistles, sirens).[7]

Sound Object and Sound Event

It is possible to focus upon different dimensions of sound reality. One angle is to select the most important events and try to contextualise them. If we overcome our basic programmatic scepticism and allow ourselves to contemplate the possible selection of sound phenomena from an entire 24-hour sequence, we can select several categories through which to perceive the sonic dimensions of our reality.

Just as we most often distinguish pitch, length, loudness, and colour for a tone, we can also look for similar filters to categorise the sounds involved in our soundscape. If we want to characterise a sound that we think is temporally bounded in some way, Schafer suggests the term "sound event"[8]. This is a sound that has an attack, body, and decay (i.e., one of the slightly altered forms of the sound envelope that is standard in acoustics), and we are able to comprehend some of its context. Context distinguishes the sound event from the sound object, which, in Pierre Schaeffer's approach, deliberately resigns the context to the spirit of semantic reduction:[9] "[t]*he soundscape is a field of interactions, even when particularised into its component sound events"*[10] .

Classifications of Sound Events: Possible Approaches and their Use

Before choosing specific sound events, it is relevant to introduce Schafer's approach and his categories. One possible classification is *Classification According to Physical Characteristics:*

"1. Estimated distance from observer: meters.
2. Estimated intensity of original sound: decibels.
3. Heard distinctly ( ), moderately distinctly ( ), or indistinctly ( ) over general ambiance.
4. Texture of ambiance: hi-fi ( ), lo-fi ( ), natural ( ), human ( ), or technological ( ).

6 Ibid., p. 10.
7 Ibid., p. 10.
8 Ibid., p. 131.
9 Ibid., p. 130.
10 Ibid., p. 131.

5. Isolated occurrence ( ), repeated ( ), or part of larger context or message ( ).
6. Environmental factors: no reverb. ( ), short reverb. ( ), long reverb. ( ), echo ( ), drift ( ), displacement ( )."[11]

This classification contextualises and distinguishes specific sound events. Most of the classification filters are clear from the text. No. 6 needs further explanation: the reverberation variations refer to the length of time the sound remains in the environment in relation to the acoustic conditions of the soundscape. The length of reverberation is generally based upon the obstacles in the sound's path and their ability to reflect and absorb the sound. For example, the reverberation of a car passing between high-rise buildings will persist for a longer period of time (i.e., sound is reflected several times off the walls and has nowhere to "escape") than when the car passes through a forest (i.e., tree branches are acoustically absorbent material). The terms drift and displacement are of particular note: *"Drift (fading) or displacement (ambiguous point of origin) often result from atmospheric disturbances such as wind or rain."*[12]

Another categorization option is "Classification According to Referential Aspects". This method finds its origin in a framework that Schafer and his colleagues "[...] *have been using for one of the sub-projects of the World Soundscape Project, an extended card catalogue of descriptions of sound from literary, anthropological and historical documents.*"[13] Within this project, Schafer and colleagues created an extensive categorization of sounds that is based on their functions and meanings. This includes many of the following entries:

List of Natural Sound Items

"I. NATURAL SOUNDS
- A. SOUNDS OF CREATION
- B. SOUNDS OF APOCALYPSE
- C. SOUNDS OF WATER
  1. Oceans, Seas and Lakes
  2. Rivers and Brooks
  3. Rain
  4. Ice and Snow
  5. Steam
  6. Fountains. Etc.
- D. SOUNDS OF AIR
  1. Wind
  2. Storms and Hurricanes

11 Ibid., p. 135.

12 Ibid., p. 134.

13 Ibid., p. 137.

3. Breezes
4. Thunder and Lightning. Etc.

E. SOUNDS OF EARTH

1. Earthquakes
2. Landslides and Avalanches
3. Mines
4. Caves and Tunnels
5. Rocks and Stones
6. Other Subterranean Vibrations
7. Trees
8. Other Vegetation

F. SOUNDS OF FIRE

1. Large Conflagrations
2. Volcanoes
3. Hearth and Camp Fires
4. Matches and Lighters
5. Candles
6. Gas Lamps
7. Oil Lamps
8. Torches
9. Festival or Ritual Fires

G. SOUNDS OF BIRDS

1. Sparrow
2. Pigeon
3. Killdeer
4. Hen
5. Owl
6. Lark. Etc.

H. SOUNDS OF ANIMALS

1. Horses
2. Cattle
3. Sheep
4. Dogs
5. Cats
6. Wolves
7. Gophers. Etc.

I. SOUNDS OF INSECTS

1. Flies
2. Mosquitoes
3. Bees
4. Crickets
5. Cicadas. Etc.

J. SOUNDS OF FISH AND SEA CREATURES

1. Whales
2. Porpoises
3. Turtles. Etc.

K. SOUNDS OF SEASONS

1. Spring
2. Summer
3. Fall
4. Winter."[14]

Acoustic ecology and its related disciplines (i.e., bioacoustics, soundscape ecology, psychoacoustics, landscape ecology) offer many other possibilities to categorise sounds, sound events, and the various human perceptions. A high quality and comprehensive list of additional and current approaches is provided in Almo Farina's *Soundscape Ecology: Principles, Patterns, Methods and Applications.*[15] In this text, the starting point is based on Schafer's acoustic ecology[16] and the logic presented in *The Soundscape: Our Sonic Environment and the Tuning of the World*.

This text will primarily work with the "*Physical Characteristics"* method of sound classification, as mentioned above.

Possible Analyses Based on the Methodology of Acoustic Ecology: Audio Analyses in the Form of Measurements and Content

By looking at the numerical outputs (i.e., the log) of a 24-hour sequence in terms of loudness and frequency characteristics, it is possible to analyse the data according to common scientific approaches. As with any sample population, we may be interested in minima, maxima, data on mean values (i.e., mean, mode as the most frequent value, median as the middle value), and potential trends.[17] For loudness, we can determine the median as the midpoint between the audibility level and the pain level (if we assume an ideal dynamic range for the sound pressure the human ear can process). By analogy, we consider a frequency and space between 20 Hz and 20,000 Hz to be the ideal range that the human ear should be able to hear until about 10 years of age. With sound pressure level, as with frequency, it should be noted that everyone hears differently. Hearing diminishes with age, based on predisposition and the frequency of exposure to loud and

14 Ibid., pp. 139-144.

15 For other possible approaches see e.g. FARINA, Almo. *Soundscape Ecology: Principles, Patterns, Methods and Applications* [online]. 1. Dordrecht: Springer, 2014. [Accessed 2024-01-29]. Available at: <https://www.researchgate.net/publication/287234626_Soundscape_ecology_Principles_patterns_methods_and_applications>.

16 SCHAFER, Raymond Murray. The *Soundscape: Our Sonic Environment and the Tuning of the World*. 1. Rochester, Vermont: Destiny Books, 1994.

17 A possible approach may also be to reflect on the „normality" of the distribution of phenomena in terms of loudness and frequency (i.e., to confront the measured values with a Gaussian curve of normal distribution). No relevant reason for the implementation of this approach has been found in the literature or in the data.

even dangerous sounds. According to the standard accepted consensus, a person loses the ability to hear 1,000 Hz towards the upper end of the range every 10 years.

The Case of the Bells: Opening Remarks

As part of the Brno soundscape, this text works with data from the measurement and recording of a late spring session. The data is from the roof of the Faculty of Social Studies from 16:21:56 on 5 June 2023 to 16:21:56 on 6 June 2023. It is a double recording that consists of a sound recording and data output from a measuring instrument that analysed the loudness and the frequency distribution.

Confrontation with a musicological music analysis can show possible approaches to working with soundscape. Ian D. Bent argues that "[T]he phrase 'musical analysis', taken in a general sense, embraces a large number of diverse activities. Some of these are mutually exclusive: they represent fundamentally different views of the nature of music, music's role in human life, and the role of the human intellect with regard to music. These differences of view render the field of analysis difficult to define within its own boundaries."[18] It would be possible to delve further into the different types of musicological analysis (i.e., constructional analysis, psychological analysis, stylistic analysis, analysis of the individual work, formal, kinetic-syntactic and referential, Dahlhaus: hermeneutics, energetic interpretation, Gestalt analysis, hermeneutics) and look for analogies to them within acoustic ecology. For this text, however, the possible perspectives are narrowed down to quantitative and qualitative approaches that follow the horizontal and vertical dimensions of the soundscape.

The quantitative approach expects data that represent reality within the numerical domain. In this way, we can ask about variables and the changes that can be expressed with a number (i.e., the unit dB as decibels indicates the value of sound pressure and the unit Hz, with Hertz indicating the frequency). In the qualitative approach, it is possible to listen to a recording and reflect upon specific phenomena and the relationships. Looking at the horizontal plane, one can analyse the frequency distribution and loudness (of specific frequency bands) and the change over time. In the vertical plane, we can analyse relationships between synchronous phenomena (i.e., simultaneous sound events and the relationships between them).

As in musical analysis, approaches to the substance under study differ, whether in the directionality between the general and the specific, or in the search for relationships to phenomena outside the sound universe or its notation.

It is now possible to introduce one particular sound event and look at it through the filters codified by Schafer to handle the complexity of the possible analyses of the soundscape. The sound of bells being struck will be used as an ideal soundscape event.

18 BENT, Ian D., POPLE, Anthony. Analysis. In *Grove Music Online* [online]. Page last edited 2001. [Accessed 2024-02-16]. Available at: <https://doi.org/10.1093/gmo/9781561592630.article.41862>.

The bells are normally rung every quarter hour to indicate the time of day.[19] When a full hour is sounded, the number of bells rings according to the number of elapsed hours in the day. There are, of course, specific occasions when the bells ring a special sequence.[20] The ringing can be made more specific by specifying the tone, adjusting the frequency, and changing the sound-pressure level. As a sound event, it has a specific attack, body, and decay. As a constant, it figures in the rhythm of the surroundings, where it can be heard in relation to the ambient noise level, weather conditions, and the dispositions of the listeners.

An example of a bell sound event is characterised by Schafer in his publication Classification According to Physical Characteristics as follows:[21]

"CHURCH BELL

1. *500 metres*
2. *95 dB*
3. *Moderately distinctly*
4. *Lo-fi, technological*
5. *Periodic repetition*
6. *Med. reverb., drift"*[22]

Alain Corbin's *Village bells: sound and meaning in the nineteenth century French countryside* is a significant contribution to the theme of bells in the soundscape. Corbin analyses the structuring of time through the bells.[23] He also addressed the inclusion (i.e., geographical belonging to a space, such as an estate) or exclusion of the inhabitants of the 19th century French countryside.[24] Understandably, bells in central Europe are less important today than they were in the times Corbin described.

In the particular case of the bell of the Cathedral of St Peter and Paul in Brno (from the roof of the building it is 800-870 metres as the crow flies), it can be argued that, according to Schafer's methodology, the interpretation will naturally change based on the context of the current soundscape. The enumeration of the changes in the surrounding

19 15 minutes past the hour, the bell rings once, 30 minutes past the hour twice, 45 minutes past the hour three times.

20 This includes various situations such as before Mass, on holidays and other specific occasions.

21 SCHAFER, Raymond Murray. The *Soundscape: Our Sonic Environment and the Tuning of the World*. 1. Rochester, Vermont: Destiny Books, 1994, p. 137.

22 Default structure for comparison:
1. Estimated distance from observer: meters.
2. Estimated intensity of original sound: decibels.
3. Heard distinctly, moderately distinctly, or indistinctly over general ambiance.
4. Texture of ambiance: hi-fi, lo-fi, natural, human, technological.
5. Isolated occurrence, repeated, or part of larger context or message.
6. Environmental factors: no reverb., short reverb., long reverb., echo, drift, displacement; ibid., p. 135.

23 For example, situations such as noon, the beginning and end of working hours, mass, the arrival of the monarch, danger, etc.

24 CORBIN, Alain. *Village bells: sound and meaning in the nineteenth century French countryside*. New York: Columbia University Press, 1998.

soundscape may include the sounds of human activities, living and non-living nature, precipitation, wind, atmospheric pressure, and, in the background, time as an indication of the current location of the rhythm of the city.[25] This is generally included under the term context.

Fulfilment of the Schafer matrix *Classification According to Physical Characteristics*, variant A: One ringing of the bell at the Cathedral of St. Peter and Paul on 6 June 2023 at about 03:15 am, hi-fi variant at night.

1. Estimated distance from observer:[26] 800–870 metres.[27]
2. Estimated intensity of original sound: 48 decibels.[28]
3. Heard distinctly over general ambiance.
4. Texture of ambiance: hi-fi , natural, human, technological.
5. Isolated occurrence.
6. Environmental factors: short reverb., drift.[29]

In terms of frequency distribution, the fundamental frequency of the bell, based on a joint analysis of the recording and the data, is approximately 630 Hz.

Outside of the bell, one can hear in the hi-fi soundscape sporadic early morning birdsong, indifferent city noise, and sometimes, one can suspect, that some of the noise in the lower frequencies comes from very distant passing motor vehicles. Some of the noise is also generated by the air-conditioning system on the roof where the recording is being made.

Possible interpretations of soundscape layers:
Signal: bell.
Soundmark: bell.
Keynotes: city noise, sound of motor vehicles (i.e., engine, tires on the road), air conditioning on the roof.

Fulfilment of the Schafer matrix *Classification According to Physical Characteristics*, variant B: One ringing because of soundscape congestion hardly recognizable, the Cathedral of St. Peter and St. Paul on 6 June 2023 at about 08:15 am, lo-fi variant in the early spring hours.

25 For many more cases, see Schafer‘s above-mentioned division according to Classification According to Referential Aspects.

26 In this case, from the measuring microphone and the microphone intended for recording.

27 As the crow flies.

28 The data recording option in the instrument set to „A“ frequency weighting and „F“ time weighting as recommended for environmental sound measurements. The data for sound pressure level and frequency is not an estimate, but the measured values either by the measuring instrument or by the RTA analyser in the software. As the aim of this thesis is not to precisely describe or defend the chosen methodology, the thesis does not go into this topic further.

29 SCHAFER, Raymond Murray. The *Soundscape: Our Sonic Environment and the Tuning of the World*. 1. Rochester, Vermont: Destiny Books, 1994, p. 135.

1. Estimated distance from observer: 800-870 meters.
2. Estimated intensity of original sound: 50 decibels. The total loudness is given because of the impossibility of separating individual sound objects.
3. Heard indistinctly over general ambiance.
4. Texture of ambiance: lo-fi, natural, human, technological.
5. Isolated occurrence.
6. Environmental factors: displacement.

The list of perceptible and distinguishable sound objects from the complex lo-fi soundscape includes rain, raindrops falling on the mat, a chainsaw (basic frequency approx. 400-600 Hz), birdsong, traffic noise, and indifferent city noise. Close to the actual sound monitoring is the passage of trams, cars, and the squealing of car brakes. Nearby, the sound of an aeroplane can be heard. Audible sound objects with clear sound envelopes include birdsong and the sounds of individual raindrops falling on nearby metal roofs. The larger output of sound objects blends into the reverberation that creates the corridor through which the sound travels to the microphone diaphragm. The sound of a chainsaw is subject to reverberation, as are more specifically distinguishable means of transport (i.e., trams, cars).

Possible interpretations of soundscape layers:
Signal: car horn.
Soundmark: none.
Keynotes: sound of traffic in general (i.e., cars, trams), city noise, rain, aeroplane, birdsong.

When comparing the two somewhat polar recordings, the volume at the time of ringing in the lo-fi soundscape is greater than the volume of the actual bell in the hi-fi soundscape recording. Assuming that the invention of the personal watch, as Corbin writes in his study of the 19th Century French countryside,[30] had not become widespread, and, especially if there were no smartphones, we would not be oriented in time and space due to the inability of hearing the signal in the form of a bell.

The Case of the Bells: Bells as One of the Inaudible Foundations of the Civilization's Rhythm

Schafer's opinion in its entirety is: "*If we were to make a continuous recording on a downtown street of a modern city, it would show little variation from day to day, season to season. The continuous sludge of traffic noise would obscure whatever more subtle variations might exist.*"[31]

30 CORBIN, Alain. *Village bells: sound and meaning in the nineteenth century French countryside*. New York: Columbia University Press, 1998.

31 SCHAFER, Raymond Murray. The *Soundscape: Our Sonic Environment and the Tuning of the World*. 1. Rochester, Vermont: Destiny Books, 1994, p. 230.

This can be slightly modified if the results are interpreted on the basis of actual outputs. The distance of the site from the nearest road at which the measurement and recording system detects the signal should be at least 20 metres. In addition, the building, although centrally located, is not surrounded by major multi-lane roads. Thus, the idea of a constantly congested area is irrelevant for this case. At night, when the recording site could be completely silent for research on more specific quiet sounds, the air conditioning, unfortunately, could not be turned off due to the summer temperatures.

One can certainly think about the rhythm that Schafer ascribes to a non-musical substance (i.e., our lived soundscape). In this case, it is useful to look for patterns in the particular day or days analysed. Even with zero familiarity with the environment, most of us would guess that the city would be quieter at night than during the day; we would also certainly guess the times that the sound of traffic and birdsong (i.e., dawn chorus) are likely to be heard. However, traditional ideas about sound, as based on visual experience, can be misleading. For example, one might ask, which is of greater annoyance for humans and animals alike: the sound of traffic in a city centre on a weekday or the sound of a fast-moving car with a loud engine on a Saturday afternoon.[32] Considerations come into play as to whether a person or animal is more annoyed by something that is expected and unpleasant, or, by the shock of a brief, unexpected, and loud sound signal in an otherwise quiet moment.[33] Another issue within the expressiveness of sound may be the sounds below, in, or above the standard indifferent noise of the city. This is a category that Schafer includes in his division based on *Physical Characteristics*, and it is more or less intertwined with the hi-fi and lo-fi characteristics of the soundscape.

Rhythms of Soundscapes and Sound Objects

Apart from macro factors, like bells, dawn chorus, and rush hour traffic, smaller parts can also be targeted. In the recording from 5–6 June 2023, due to rain, a rhythm of around 70-80 BPM[34] emerged around 8:15 a.m. and continues until around 8:20 a.m. It then dropped to 50 BPM by 8:25 a.m., Isolated fading drops that still occasionally sped up to a more constant tempo and eventually disappeared altogether.

However, the general idea of the rhythm of the city, of civilization, of our lives, more often works within a larger perspective. We can deal with hours and days, but also with weeks, months, seasons, and other units. In the context of recording whole days for research, it is not yet possible to speak of any relevant changes or trends from the recorded results that can be defended without doubt. For comparison, a much larger

32 This is the term Schafer and others use to describe noise annoyance. E.g. SCHAFER, Raymond Murray. The *Soundscape: Our Sonic Environment and the Tuning of the World*. 1. Rochester, Vermont: Destiny Books, 1994, p. 128.

33 For example, the use of fireworks has long been discussed by animal protection representatives, legislators, and users. It is quite clear that a short, unexpected, and loud explosion can cause some birds to go into cardiac arrest.

34 Beats per minute.

sample would be needed, spanning at least a few years or going back to the COVID-19 pandemic, during which much of the sounds generated by the human population became quieter, leaving more space for nature.

Listening to the Brno soundscape from the roof, one can imagine a theoretical score of public transportation based on a timetable. The streets below are regularly serviced by the same connections according to the established schedules. Random differences are created by traffic lights, other road traffic, and climatic conditions. The sound of a trolleybus starting or a tram going around a bend with squeaking wheels, can create certain rhythmic, loudness, and frequency regularities. The set of keynote sounds and soundmarks can thus be very similar. Public transportation timetables are a good basis for reflecting on the creation of *"isobel contour maps."* Based on the derivations from geographic and meteorological maps, the quantities show "[...] *readings on a sound level meter averaged out to produce bars of equal intensity, projected as if the observer were above the field of study.*[35] *On such a map the quietest and noisiest sections of a territory can be immediately identified."*[36]

What Can We Know?

Listening from a roof approximately 20 metres above the ground, with no nearby buildings, can provide a fair reference for sound events in their complexity. The soundscape is accessed from above, which instantly and synchronously tells us about the various relationships in the experienced reality. This macro view makes it possible to search for various phenomena in the sound dimension and to provide the basis for further analyses of smaller spatio-temporal phenomena.

Going back to Schafer, his concept of acoustic ecology has given us many tools, such that we are able to detail hard-to-describe sound phenomena and their roles in the complex web of relationships within (not only) our existence.

The practical research upon which this text is based should conclude in May 2024. The sound and data outputs will show whether there are trends worthy of analysis. The enormous breadth offered by each 24-hour sequence is the source of a large amount of data that can be accessed in many ways. Some possibilities for reflection have been briefly demonstrated, with the sound of bells as an example.

Thanks to the conceptualisation and the developed methods of acoustic ecology, a multitude of phenomena can be addressed. From this rich universe, elements can be selected for loudness and frequency, and filters can be applied for quantitative, qualitative, horizontal, vertical, temporal, spatial, micro, and macro planes, and these can all be combined in various ways. This intricate web of variables has potential outcomes that can reveal important phenomena for the coexistence of fauna, flora, and humans, such that we are unable to perceive them in our everyday lives. In the case of discovering

35 Listening from above is indeed the case with the research currently presented.

36 SCHAFER, Raymond Murray. The *Soundscape: Our Sonic Environment and the Tuning of the World*. 1. Rochester, Vermont: Destiny Books, 1994, p. 131.

a negative phenomenon that threatens the fragile relationships in nature, this will be formulated and communicated to the relevant department of the City of Brno.

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