A collaborative research project proposal — V2, March 25, 2020

Silent·Cities

A participatory monitoring programme of an exceptional modification of urban soundscapes

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Call for participation to a Dataset Collection

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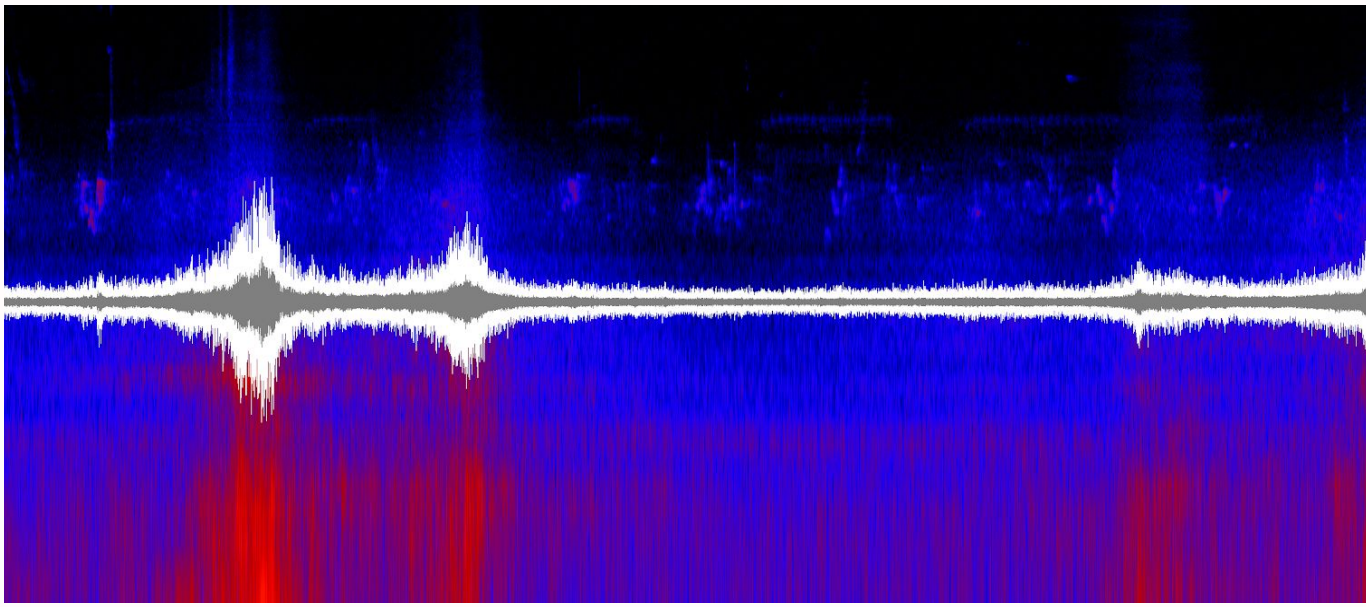

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RECORDING AN EXCEPTIONAL STATE OF URBAN SOUNDSCAPES

Context

The global COVID-19 pandemic that we are currently facing is forcing most countries around the world to put in place social distancing and/or drastic population containment measures. A notable effect of these measures is the reduction of many urban economic activities. This decline in activities is directly linked to a reduction in several inter- and intra-urban physical flows, first and foremost among which are individual travel — all modes combined — and motorized transport of people and goods. These movements and transport are two major sources of anthropogenic noise in all spaces, both urban and rural.

While we recognize the severity and serious consequences of the pandemic, we want to continue to do what we do the best: searching, testing, experimenting. In other words, we want to continue to question the world in which we live. Starting from the abnormal situation generated by the COVID-19 pandemic in territories placed in more or less strict containment, we propose to the Ecoacoustic international community to participate in a collection of urban sonic environments to document these rare urban soundscapes. Based on standardized global ecoacoustic monitoring over several weeks, we hope to achieve three scientific objectives:

1. To study in “ordinary spaces” the ecoacoustic diversity usually masked by anthropogenic noise.
2. To study the relationship between biophony and anthropophony within different levels of economic activity, as the economic activity of a territory will slowly be restored.
3. To finely characterize the relationship linking the anthropogenic noise to the level of stable economic activity of a territory.

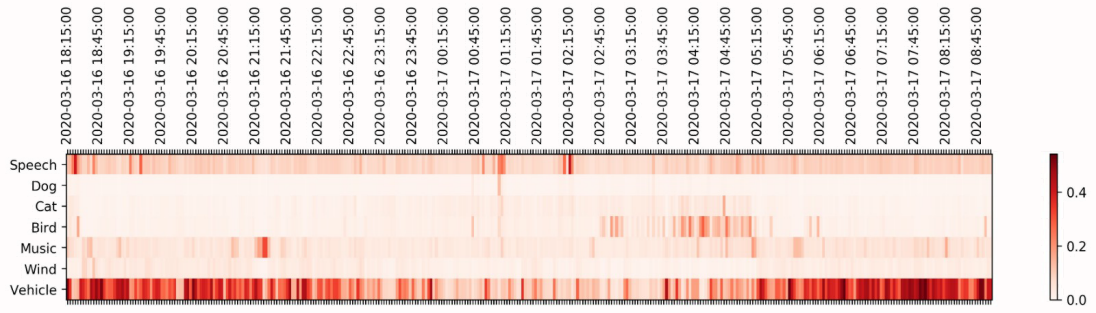

Fig. 1 — Audio tagging of one night long recording in a street of Toulouse, France (2020-03-16/17). Audio tagging was performed using a deep neural network pretrained on the Audioset dataset.

A collaborative work

The confinement of a large number of citizens worldwide limits the location of the recorders. We ask the participant to deploy their recorder on a private land or a balcony at their residency. We encourage those living in urban and suburban areas to participate.

The dataset will be stored by the Open Science Foundation (OSF) as a public dataset, with write permission for the participants. All participants will be authors on a data paper submitted to a journal (e.g. *Nature Scientific Data*), provided the collected data meet the requirements specified in this document. A DOI will be created on the OSF dataset page for citation, and will be linked with a future preprint data paper, prior to the published data paper. As a public dataset, anyone can request access, on the condition the dataset is cited.

Minimal analysis scripts are provided on the Wiki of the project page on OSF, and all participants are encouraged to contribute their own tools and/or methods, as well as the interpretation of results.

Duration of the collection

Meeting our objectives requires the implementation of medium-term monitoring, covering (i) the containment phase, (ii) the phase of a gradual return to normal, and (iii) the normal phase of urban metabolism — the "post-crisis phase" (Fig. 2). Consequently, we plan the monitoring over a long period (several months).

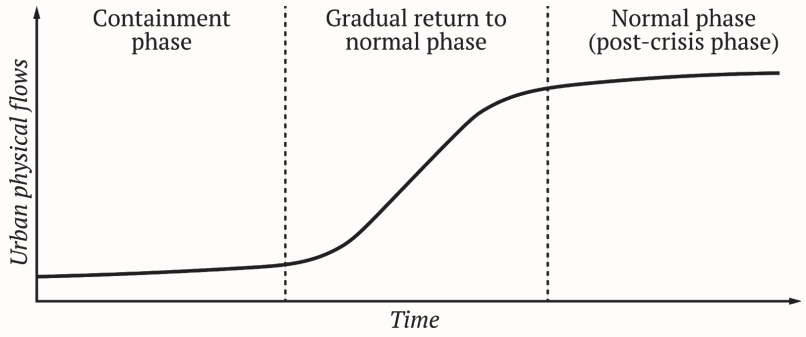

Fig. 2 — Conceptual scheme of the different phases of urban metabolism in the coming weeks.

Why a V2 of this Protocol document?

We received a lot of emails from researchers, journalists and artists interested in participating. This is why **we propose in the following pages an updated version of the project in order to include (i) different equipment and (ii) different sampling effort**.

Beware of some changes in the setting of the SM4 and AudioMoth, especially the gain has been modified.

THE "EXPERT PROTOCOL"

✓Recorder type

In order to have comparable data, we are imposing a requirement for the recording equipment to be programmable. We recommend using an audible SM4 Acoustic Microphones (Wildlife Acoustics), or an AudioMoth (Open Acoustic Devices). However, any programmable recorder that allows the configurations detailed in the following section will be accepted. The equipment will not be provided, it should be owned by the participant.

To increase spatial replication and diversity of configurations, we are soliciting recorder owners with the ability to install their instrument on their window sill, balcony, or in their garden. In its simplest configuration, the Expert protocol requires only 1 programmable recorder. If it is possible to install several recorders in different configurations (e.g. a street-side recorder, a garden-side recorder, etc.), you will need to resubmit a request for a participant identifier for each recorder (you need to fill the form above several times — see last Section "Common step for all protocols: upload your data").

✓Configure your recorder(s)

To homogenize the recordings collection, we ask the participants to configure their device to obtain a **1 minute-long recording every 10 minutes on a daily schedule, with a sampling rate set at 48 kHz**. The total duration of the collection will be locally dependent. We further ask the participant to continue recording **a minimum of two weeks after the end of the total city shut down and restoration of "normal" activities**.

The first recording needs to start at midnight and should be set in Coordinated Universal Time (UTC). You can refer to this website to manually set the clock on your device: https://www.timeanddate.com/worldclock/timezone/utc.

We will further detail the configuration for the SM4 and the AudioMoth devices. If you use another device, we won't be able to assist you with the configuration.

➢SM4 configuration

After setting the onboard clock of your device (in UTC), configure it as follows (see Fig. 3):

Settings for mono recordings

✓ Prefix: **serial number** of your device (for example: S4A12052)
✓ Channel: **left** (or right)
✓ Gain Left (or Right): **5.00 dB**
✓ Preamp Left (or Right): **26 dB**
✓ Sample rate: **48000 Hz**

Schedule

✓ START **time 00:00**
✓ DUTY **cycle** On **00:01** OFF **00:09**
✓ END **time 00:00**

You can also download the corresponding configuration file and load it directly to the SM4 (after loading the settings **beware to check the prefix name manually in the SM4** menu to be the unique serial number of your recorder).

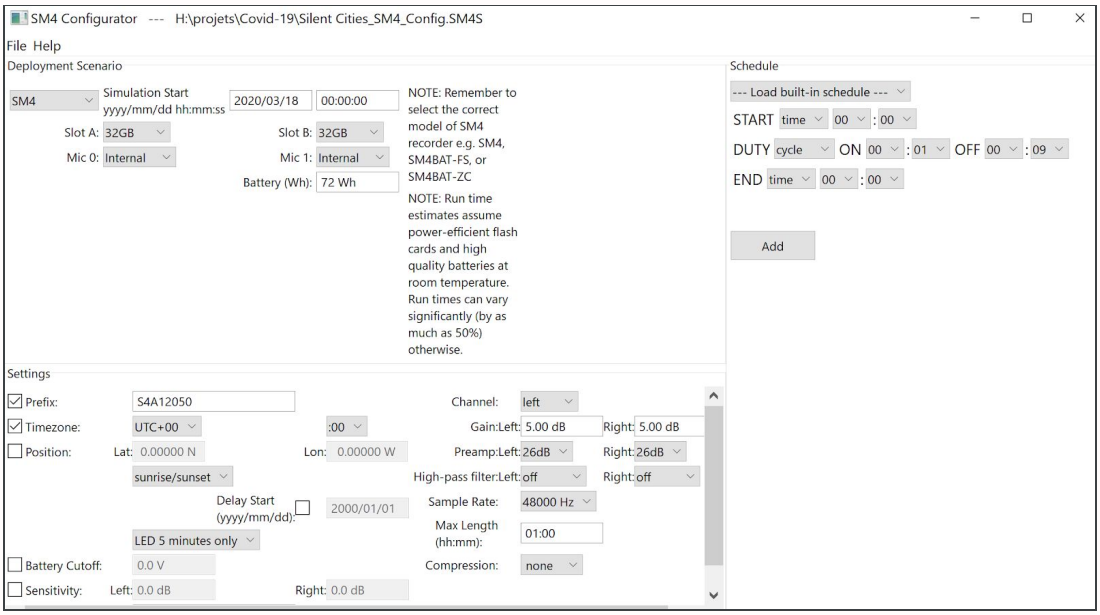

Fig. 3 — SM4 configuration window.

➢ AudioMoth configuration

After setting the onboard clock of your device, configure it as follows (see Fig. 4):

- ✓ Recording period: **00:00-24:00 (UTC)**
- ✓ Sample rate: **48 kHz**
- ✓ Gain: **Low**
- ✓ Sleep duration: **540 s**
- ✓ Recording duration: **60 s**

You can also download the corresponding configuration file and load it directly to your AudioMoth *via* the AudioMoth Configuration App.

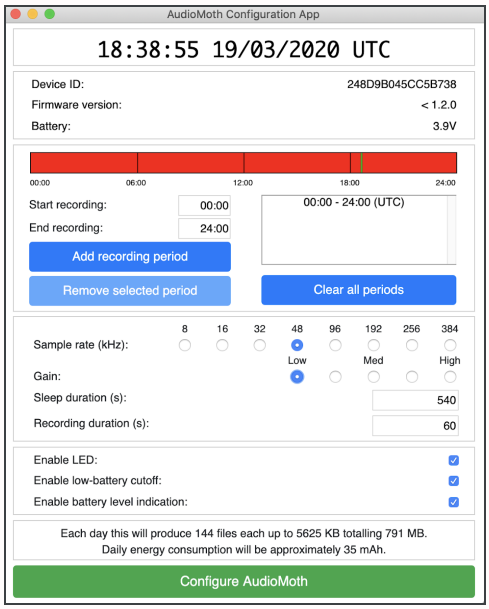

Fig. 4 — AudioMoth Configuration App window.

✓Install your recorder(s)

Install your recorder(s) outdoors, in an accessible place where you can easily change the batteries and remove the SD card to discharge the data. As we want to monitor the evolution of the ratio between biotic and anthropogenic components of noise, it is not necessary to install your recorder in a place particularly sheltered from noise pollution. A windowsill, a balcony (see the configuration given as an example below), a stake or a tree in your garden will be perfectly suitable.

Be careful, regularly check the battery charge level of your device and the memory card's fill rate!

We do not impose any restriction on the moment to change battery or remove files from the SD card.

Fig. 5 — Example of installation of an AudioMoth recorder on a balcony near an urban roadway in Toulouse, France (Photograph: S. Challéat, UMR CNRS 5602 GÉODE).

THE "LIGHT PROTOCOL"

Sampling for three months straight is too long for you? Do you want to share the use of your recorder with people who might be interested in participating in the Silent·Cities project? This light protocol may be interesting for you.

For this protocol, the recorders requirements and configurations are the same as for the "expert" protocol except for the collection duration. Instead of recording daily for three months, **we ask the participant to record for a minimum of 6 days for each of the three theoretical phases**.

✓For AudioMoth owners

This protocol is especially suitable for the AudioMoth owners because of the short duration of the battery life. In addition, it allows the participation of people who are not experienced in programming and reprogramming AudioMoth recorders. With this protocol, **you can lend to a colleague, friend or family member a pre-programmed recorder** (by dropping it in his or her mailbox, for example). The person to whom you lend the AudioMoth **just needs to install it and let it record until the batteries run out**. It is, however, important to retrieve the data once the batteries run out and re-install the AudioMoth at the same site to cover the three theoretical phases (see Fig. 2).

➢ **The AudioMoth must be configured according to the same parameters as for the expert protocol (same configuration file)**

➢ **Give the person to whom you lend the recorder the following instructions:**

- ✓ Set the small white selector **switch to "CUSTOM"** (see Fig. 6)
- ✓ Insert the recorder in a small plastic **protection bag** (see Fig. 6)
- ✓ Place the recorder on your balcony, window sill, etc.
- ✓ Leave the recorder running **until the batteries run out**
- ✓ Once the batteries are discharged, return the AudioMoth to the person who lent it to you: it will take care of the rest of the protocol (retrieve the data and upload it to the dataset)

Fig. 6 — An AudioMoth recorder in a small protection plastic bag (Photograph: A. Burens, UMR CNRS 5602 GÉODE).

A PROTOCOL FOR OWNERS OF A HIGH QUALITY NON-PROGRAMMABLE RECORDER

Do you have a good audio recorder, and possibly a good external microphone? This part of the protocol is for you. Here, we are not asking to make continuous recordings during several days, weeks, months... You can make a few short recordings (from a few seconds to several minutes) at different times of the day and night. You choose the moments that are most convenient for you and you repeat the protocol whenever you want in the coming weeks/months. Be sure, however, to record at different times and on different days (avoid recording only during weekends, for example) during each of the three "theoretical phases" (see Fig. 1). **You can set up any configuration you want, but make sure you keep the same one for all recordings!**

The essential information to follow this protocol:

➢ **Don't forget to synchronize the recorder's clock in UTC**

➢ **Set the recorder to record in .WAV format, with a sampling rate at 48 kHz, and a resolution of 16 bits.**

➢ **We don't give any instructions for the gain adjustment, except to make sure that we don't saturate, and to keep the SAME GAIN SETTINGS for each recording!**

- ✓ Be careful, **anticipate in your gain settings the return of high levels of anthropogenic noise** after the end of the containment measures in your settings.

➢ **After recording, rename the files to follow the following convention :**

- ✓ OTHEXXXX_YYYYMMDD_hhmmss.wav (XXXX corresponds to your participant identifier, YY is the year, MM is month, DD is day, hh is hour, mm is minute and ss is seconds. All the time information should correspond to the beginning of the recording.
  - *For example* : OTHE0153_20200401_034000.wav is the recording of participant ID 0153 on April 1st 2020, beginning at 03:40:00 am.

COMMON STEP FOR ALL PROTOCOLS: UPLOAD YOUR DATA!

First of all, fill in the online form

Upon completion of the online form, we will review your inputs to check that you fulfill all requirements, and we will send you your participant identifier (between 0001 and 9999).

- ✓ Create an account on https://osf.io/.
- ✓ Request access to the Silent·Cities project to get granted upload rights.
- ✓ Then **upload your files in the folder corresponding to the participant identifier we sent you by email** upon completion and validation of your participation (from Tuesday, March 24th).

Special precautions in the context of the COVID-19 pandemic: we ask participants to take proper precautions when deploying and manipulating the sensors, and follow expert advice in avoiding potential for exposure or transmission of the virus.