



# COMPOSING WITH SOUNDS THROUGH DIGITAL APPS

Digital teaching materials  
for Secondary  
Education Teachers

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#### ONASSIS STEGI

Onassis Stegi ([www.onassis.org](http://www.onassis.org)) is a cultural venue in Athens, which hosts events and activities across the entire artistic spectrum, from theatre, dance, music and film to visual arts, poetry and literature. It emphasizes contemporary artistic expression, and supports Greek artists, alongside developing international collaborations and offering education opportunities for people of all ages, through continuing education programs. Every year, the Onassis Stegi organizes and coordinates international tour and exchange programs for its own productions, and promotes awareness and synergies across science, innovation and the arts. Stegi is a department of the Onassis Foundation and was officially established in December 2010.

#### EDUCATION PROGRAMS

Onassis Stegi Education Programs are addressed to school groups, families, teens, adults; educators, artists, people with disabilities, adults 18-40 years old, people over 65 years. Their main goal is to bring contemporary art closer to people's everyday lives. Each year our education programs revolve around a different theme. They cover all the fields that are included in the Onassis Stegi program, such as theater, dance, music, visual arts, and new media, and many of them are interdisciplinary. They are associated with the Onassis Stegi artistic program and draw connections with other units of the Education Pillar (Onassis Library, Special Education, Cavafy Archive).

#### INTERFACES

Interfaces ([www.interfacesnetwork.eu](http://www.interfacesnetwork.eu)) is an international interdisciplinary project which seeks to introduce new music to a wide range of new audiences. Interfaces is an Onassis Stegi initiative, supported by the Creative Europe programme of the European Union. It brings together nine partner organizations from eight European countries, all of whom have a broad spectrum of experience in fields such as performing, multi-media exhibitions, new media, acoustic and electroacoustic research and education. This trans-sectoral approach is the key to opening up new perspectives on both the creative dimension of the project and the central objective, which is to engage new audiences of all ages and those potential audience segments which, for a variety of demographic or cultural reasons have not yet been exposed to the music of our time.

FROM JUNE 2016 TO AUGUST 2020,  
THE INTERFACES NETWORK REALISED  
A VERY WIDE RANGE OF ACTIONS,  
INCLUDING:

- New performance formats in new innovative spaces and across artistic disciplines using new media for creation and dissemination
- Educational activities including physical outreach and innovative online applications
- Research & conferences
- Artist residencies

Interfaces network is coordinated by Onassis Stegi in partnership with the following organisations: De Montfort University (United Kingdom), European University Cyprus | EUC (Cyprus), IRCAM (France), ZKM | Centre for Art & Media (Germany), CREMAC (Romania), Q-02 (Belgium), Ictus (Belgium), Klangforum Wien (Austria).

The project is co-funded through the Creative Europe programme of the European Union.

# COMPOSING WITH SOUNDS THROUGH DIGITAL APPS

**Digital teaching materials  
for Secondary Education teachers**

From the sounds that surround us to auditory memories and contemporary music creation. You do not need to be musicians to open this digital handbook. You only need to be open to your students' own sounds.

*If you close your eyes, what does your listening reveal?*

## **TARGET AUDIENCE**

Secondary Education teachers

The teacher kit will be available on [onassis.org](http://onassis.org) in December 2020.

Teachers and students are not required to have prior knowledge in music or electronics.

The teaching & learning material "[Composing with sounds through digital apps](#)" is addressed towards teachers who want to explore sound with their students, to make recordings in and out of the classroom, and to compose music with the aid of digital tools.

What is sound? Soundscape? Listening? What does the term "contemporary music" entail and what is sound art? We approach these concepts on the first part of the handbook, as an introduction to different music practices. In the second part, we include activities that could form the basis for a complete workshop. You can exercise your listening, pay attention to your surrounding sounds and record them; explore auditory memories together with your students, realise the deep bonds between sounds and emotions, and learn recording techniques that will help you compose your own group work, which may be realised in connection with other school projects.

By employing an interdisciplinary approach, we propose a series of activities that do not require prior musical knowledge. Our aim is the artistic search of expression and communication, through new artistic pursuits and modes of expression.

## **AUTHORS & WORKSHOP LEADERS**

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# INTRODUCTION

This kit contains teaching & learning material, which may enrich music teaching in an interdisciplinary way, and guide teachers and students towards a creative, educationally sound use of new technologies. The activities proposed here may be carried out in collaboration with classes in computing or other arts subjects, and take place in and out of the classroom.

The kit is divided into two parts. [Part 1](#) provides background theoretical knowledge on sound, soundscapes, listening, contemporary music, sound art, computer music, as well as general bibliography and music/sound references, for further information on these subjects. [Part 2](#) is a presentation of activities that may form the backbone of a workshop; through this workshop, students will familiarize themselves with the concepts presented in the theoretical part.

The workshop activities are directly related to the theoretical background. They may be realized in whole or in part, depending on the desired duration and size of the workshop and their possible connection with other educational components. In any case, teachers may employ the sections of theory that best relate to their chosen activities, and enrich them accordingly, by resorting to the suggested bibliography.

## Educational aims of the workshop

- To cultivate students' listening skills, enabling them to listen carefully to the sounds around them, to learn more about what sounds are and how we hear them.
- To provide an introduction to acoustic ecology, and to the arts & sciences related to soundscape and environmental sound more generally, allowing students to relate to their sonic environment and to the activities taking place within it.
- To broaden students' perception of music and sound, presenting and familiarizing students with electroacoustic and experimental music developed from the second half of the 20th century up to the present day.
- To bring students in contact with sonic arts and the use of new technologies, acquainting them with the process of recording, and allowing them to discover how environmental sound can be used for artistic purposes.
- To introduce students to computer-assisted musical composition and particularly, to the composition of music with sounds from their own environment. They will learn how to record and process sound with the aid of technology, through a hands-on exploration of simple, open-access sound-processing software, which require no prior specialist knowledge or computing skills.
- To encourage students to work in groups, with the aim of realising a collaborative arts project, which—if desired—may combine music with other subjects, including photography, history and folklore, environmental science, creative writing, performance, etc.

# THEORY

## WHAT IS SOUND

Sound is a phenomenon that accompanies almost all human activity. In nature, sounds are produced all the time; humans and animals make sounds even when completely still or asleep; our cultures, especially in the cities, constantly produce sounds. But what exactly is sound?

## Soundwaves

As a natural phenomenon, sound manifests itself in the form of soundwaves. It results from the vibrational motion of a material body that we refer to as a sound source. When a body vibrates in the air, it interacts with the air particles and causes them to move. These molecules keep colliding with each other, producing energy and transmitting the disturbance towards every direction, in the form of waves. Soundwaves create certain areas in the air that have a smaller pressure than normal (rarefaction) and certain other areas with a higher pressure (compression), as the following image demonstrates:

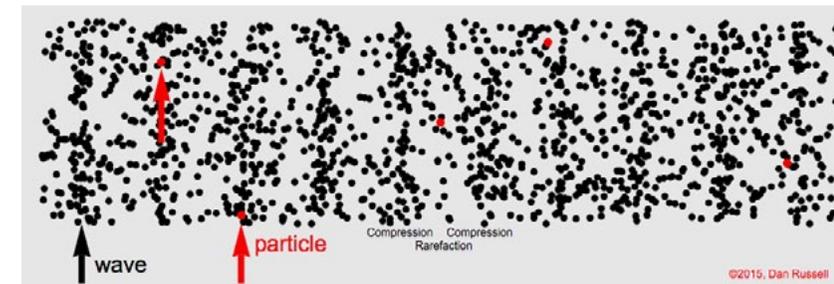


Figure 1.01. A representation of how air molecules move in soundwaves

Soundwaves are not visible with a naked eye – but sometimes we can see them on a liquid surface or with the help of electrical or electronic devices. A familiar image that represents the transmission of soundwaves in relation to their source is the formation of ripples on a lake's surface when we drop a pebble in the water.

Soundwaves are transmitted inside any liquid, solid or gas. Their transmission speed is higher in solids, smaller in liquids, and even smaller in gas. Without a medium, sound cannot be transmitted (e.g. in space, where there are no air molecules).

## Two examples:

1. Imagine it is summer and you are on a beach. You see a boat in the distance, moving quite fast. Although you are in a secluded beach without a lot of people or too many noises, you cannot hear the boat's engine. However, it is very

hot and you want to take a dive. As you dive in the sea and your head is underwater, you can hear a boat engine. As soon as you take your head out of the water, the sound disappears. Why do you think this is happening?

2. Have you watched any old Western films? Why do cowboys put their heads on the rail tracks when they want to check if a train is approaching?

## Sound and humans

A riddle: a tree breaks and falls inside a forest; no living being is anywhere nearby to hear it. Does the sound of the falling tree exist, or not?

In practice, sometimes we consider sound as soundwaves, and sometimes we think of it as the way our mind “translates” soundwaves, as what we perceive through our hearing.

We perceive soundwaves through the sense of hearing, and through our ears. Soundwaves are collected through our ear flap and are transmitted to our eardrum, causing it to vibrate. Through a detailed mechanism in our middle and inner ear, the eardrum vibrations are turned into electric signals. Through our auditory nerve, these signals are transmitted to the brain, where they are perceived as sounds.

When our brain receives the signals, it processes, analyses and interprets them. However, as we shall see further on (“Hearing and listening”), sometimes these (cerebral) functions happen automatically, without us realizing them, while at other times they require our active participation.

Humans do not have the ability to trace all auditory signals, but only those with a frequency between 20-20.000 Hz; these are the signals we call sounds. Soundwaves with a frequency higher than this range are called ultrasounds, while those with a lower frequency are called infrasounds. There are animals, like dogs, bats and rodents, with a different auditory range. They are able to receive higher frequencies, not audible by humans.

The fact that we have two ears, one on each side of our head, is also important; this combination gives us a sense of space, and helps us understand where sounds are coming from.

## Key features of sound

A sound wave is characterised by a set of natural properties such as frequency, wavelength, amplitude and period. Through these, four basic features emerge; we can discern and describe those regardless of whether the sound is singular or complex.<sup>1</sup> These features are outlined below:

### 1. Pitch

Pitch is related to the frequency of a soundwave, i.e. the number of vibrations per second. The higher the frequency (i.e. the more the vibrations in a given timeframe), the “higher” the sound; the lower the frequency, the “deeper” or “bassier” the sound. We tend to refer to lower frequency sounds as “lower”, but one ought to be careful here: sometimes the word “low” may refer to volume, which is something entirely different.

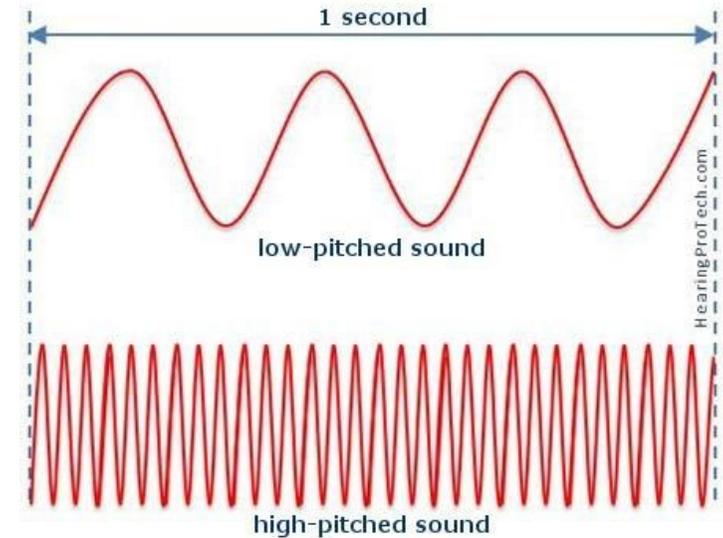


Figure 1.02. Graphic representation of low (on top) and high (at the bottom) frequencies (source: <https://www.hearingprotech.com/en/topics/noise/characterization-of-sound.html>).

Consider what is higher and what is lower between: the sound of a big dog barking or a bird singing; the sound of a passing truck or that of a motorbike; a door creaking or a thunder clapping; the teacher’s voice when (s)he calmly explains something or when (s)he shouts at us to be quiet.

### 2. Volume

A sound’s volume is proportional to the amplitude of its vibrations. The greater the vibrational force on a sounding

<sup>1</sup> The sounds we perceive rarely result from a single sound source. They are more often a combination of several sound sources, creating soundwaves that differ from the soundwaves of each individual source.

body, the wider the vibrations caused and therefore the greater the resulting sound's volume. We can instantly perceive this in practice, when we raise or lower the volume on our TV, computer or stereo.

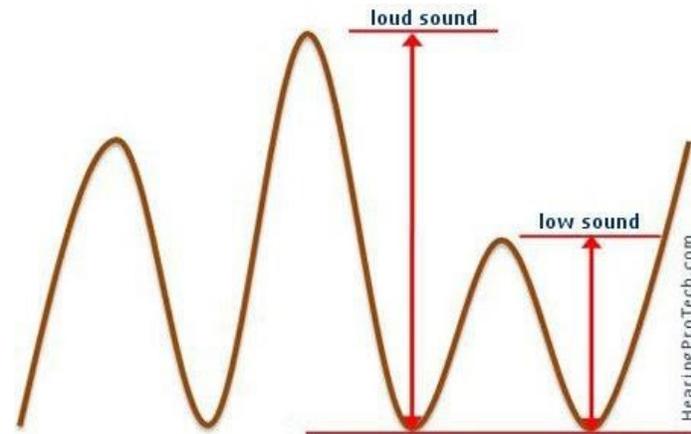


Figure 1.03: Graphic representation of high and low-volume soundwaves (source: <https://www.hearingprotech.com/en/topics/noise/characterization-of-sound.html>).

### 3. Duration

This is the total time during which a sound becomes perceptible, the length of time that a sound lasts. A sound is longer than another, shorter sound, when the vibrations last longer.

### 4. Sound colour or timbre

With the term sound colour (or timbre) we refer to the sum of special features that define and characterise a sound. It is what allows us to distinguish between two sounds that may otherwise share the same pitch, volume and duration: for example, the same musical note played by a violin, piano or other instruments, or the voices of two different people. Timbre is dependent on several parameters: the material, shape and environment of a sound source, the way the source is activated, and many other features.

The term sound colour may also help us understand this property better, if we consider how many different hues of green, red or blue there are out there, even among the light, dark, pure colours etc.

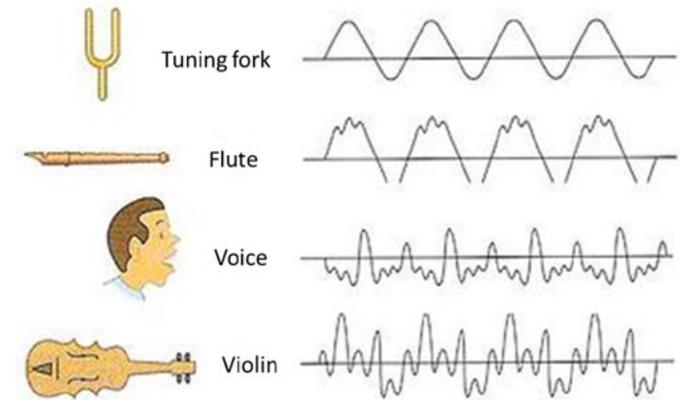


Figure 1.04: Graphic representation of soundwaves with different timbres (source: <https://www.simplifyingtheory.com/timbre/timbre-of-the-instruments-2/>).

## HEARING AND LISTENING

«Wherever we are, what we hear is mostly noise. When we ignore it, it disturbs us. When we listen to it, we find it fascinating.»  
John Cage, "The Future of Music: Credo" (1937)

There is a great difference between hearing and understanding what we are hearing. The latter is referred to as listening. Sound carries multiple and complex kinds of information. For instance, it may warn us of an imminent danger, or inform us that something is happening, even though we cannot see it. However, for this to happen, we need to actively participate in the experience of listening.

Contemporary culture is dominated by the stimuli that we receive through our vision. However, all of our senses, and hearing especially so, are constantly under stimulation: our environment is full of sounds. Even if we find absolute silence, we can still hear the sounds of our own bodies. We may also ignore some sounds, even though they are audible through our ears. Different sounds may affect us emotionally, and they may irritate, calm, or activate us, whether we consciously realise this or not. Very often, the sounds we hear, either individually or in combination, the way we hear them, and the duration and number of times we do so, may have a negative impact on our health!

From now on, when we refer to 'hearing', we imply the physical process associated with the sense of hearing. With 'listening' we mean the conscious reception of sounds that further activates deeper and more elaborative mental processes. Listening is often associated with music, but in essence it is the conscious decision to focus our hearing in a particular sonic event or, simply, the intention to distinguish between the different sounds that reach our ears. Listening will form one of the core elements of our activities.

Example 1:

I am at home doing various chores such as cooking, cleaning etc. In the background there is music coming out of speakers. It accompanies me in my duties, but sometimes it disappears and sometimes it is more audible, depending on the different sounds around the house. What I hear is the sum of sounds present. However, if I sit on a chair with the aim of just listening to music and nothing else, then I will listen to the music with my attention focused exclusively on what comes out of the speakers.

Example 2:

I am walking on a busy street downtown. Loud city sounds surround me, but I try not to pay too much attention as I am on the phone. While I am passing by people, cars and engines making various sounds, I choose to focus my hearing on the voice of the person talking to me on the other side of the phone. They are talking about something important, so I pay special attention to the tone and style of their voice. In theory, I have heard all of the sounds described above. In reality, however, I have only understood the meaning of what the voice on the phone has said.

It is important to note that the ability to hear, to discern differences or similarities, to remember something we heard and its special features, are skills that we can develop. Through specific exercises and activities we will see what we can gain by listening more attentively. The more we pay attention to the sounds that surround us by recording and describing these sounds, the more we discover and learn about the soundscape of our neighbourhood and town.

**SOUND,  
MUSIC, NOISE**

*"I believe that the use of noise to make music will continue and increase until we reach a music produced through the aid of electrical instruments which will make available for musical purposes any and all sounds that can be heard"*

John Cage, "The Future of Music: Credo" (1937)

*"Music is the entire universe sounding. We are all at once audience, performers and composers of a worldwide symphony"*

R. Murray Schafer, *HearSing* (2005)

When we speak of sound, we mean anything we perceive through our hearing. However, in common perception, sound is usually distinguished from music: sound is commonly understood as the sonic result of certain visible or invisible actions, as abstract or concrete sounds in our surrounding environment, or as a sound event. When we sit at the piano and play a melody, we call that music. On the other hand, when we place our elbow on the piano keyboard and lean on it, we usually define the result as sound, not music. When an ambulance passes by, we hear it as sound, even though the siren produces certain specific notes. However, if the exact same notes are played on the violin, we are more likely to say this is music. This is a relatively practical distinction, that results from our cultural experiences so far; however, this distinction tends to appear more and more outmoded today.

When we speak of music, we imply the human artform otherwise known as the art of sounds, or the art whose material is sounds. The French composer Edgard Varèse said that "music is organized sound". The 20th century triumphantly introduced the use of natural and everyday sounds in musical composition, alongside the sounds of musical instruments.

"Noise" is the term commonly used for undesirable sounds (when the neighbours listen to really loud music while I am trying to sleep), non-musical sounds (like a drill or chainsaw), extremely loud sounds (a speeding motorbike at very close distance), distortion (like a microphone feedback) or interference (like bad reception on a radio or mobile phone).

As we shall see later on, however, the concept and understanding of noise, just like the consideration of sounds as musical or non-musical elements, are constantly changing, both in everyday life and in artistic practice. As culture develops, different sources of sound and noise are added to our everyday experiences, and the way we interact with them also changes radically.

A big turn happened after the Industrial Revolution, when humanity was filled with new sounds coming from factories and trains, but also with the never before encountered sounds of bombs during the wars that ensued. The idea that only sounds with a recognizable pitch, sounds produced by musical instruments or human voices are musical was soon overturned. It would not be an overstatement to claim that the history of music in the 20th-century is a history of adopting more and more noise, both in the sense of accepting noise, and in terms of employing it for creative purposes. Sonic experiences that might have been entirely undesirable in the past may today sound normal, or artistically exciting.

Considering the element of volume, for instance, let us imagine the following: if someone had only heard music as loud as that of a symphony orchestra, how would they react to the volume of a rock concert? Besides, we should not forget that after the invention of recording, which drastically changed our relationship to sounds and music, a very important invention was that of electrical amplification of sound. Countless sounds, which in the past would be deemed cacophonous and unacceptable, such as the distorted sound of an electric guitar, are now hugely popular and well loved!

*«The evolution of music is comparable to the multiplication of machines, which everywhere collaborate with man. Not only in the noisy atmosphere of the great cities, but even in the country, which until yesterday was normally silent. Today the machine has created such a variety and contention of noises that pure sound in its slowness and monotony no longer provokes emotion»<sup>2</sup>*

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<sup>2</sup> Luigi Russolo, "The Art of Noises: Futurist Manifesto", trans. B. Brown, Pendragon Press. [https://monoskop.org/images/0/09/Russolo\\_Luigi\\_The\\_Art\\_of\\_Noises.pdf](https://monoskop.org/images/0/09/Russolo_Luigi_The_Art_of_Noises.pdf).

## A BIT OF HISTORY

For centuries, maybe even millennia, music was reproduced solely through musical instruments and the human voice. Before 1877, when Thomas Edison invented the phonograph, if one wanted to listen to music, one had to be in the same space with one or more instrument players or singers. How different was humans' relationship to music, and sound in general, 150 years ago?

Even a brief glance at the history of music shows us how much it was influenced by technological developments during its course. From the hydraulic system of the ancient Greek *hydraulis*, to the electrical mechanism of the church organ and from the renaissance harpsichord to the contemporary piano, musical currents were always running in tandem with advances in technology.

In the 1940s, through the wide use of magnetic tape as a medium for sound recording and reproduction, every environmental sound was put at composers' disposal for their compositions. Sound technicians and composers who had access to radiophonic studios began experimenting with the available equipment, and discovering the unlimited possibilities offered to them by this new technology for recording, processing, and reproducing sound. In the following excerpt, famous orchestral conductor Leopold Stokowski describes quite eloquently the new capacities offered to composers by magnetic tape technology:

*"Music that is composed directly with sound instead of first being written on paper and later made to sound. Just as the painter paints [their] picture directly with colors, so the musician composes [their] music directly with tone..."*

In 1948, French composer Pierre Schaeffer used the term *musique concrète* (concrete music) to describe this new musical genre that he was experimenting in. The artistic practices and theoretical work that Schaeffer developed, in collaboration with Pierre Henry, while working at GRMC (Groupe de Recherche de Musique Concrète), a research group housed at the French National Public Broadcasting Organization, attracted some of the most important composers of that time. Edgard Varèse, Karlheinz Stockhausen, Iannis Xenakis, Pierre Boulez and Luc Ferrari were just some of the composers who worked there, and made use of the technologies developed at the time in their work.

The creative significance of magnetic tape in the hands of a composer was described by pioneering composer Karlheinz Stockhausen:

*"This is the most important: for the first time in history we have the possibility to make the sound become fixed for a while and work on it. Traditionally, sound was constantly moving. Once it was produced, it was gone."*

In the 1950s and 1960s, the use of electronic media as creative tools for composers was established. Although the new technologies for sound recording and processing were already gaining ground through their use in radio, theatre, and

television, it took some years for electronic sound to decidedly enter the concert hall. Depending on the compositional "school" it was associated with, the music created by composers, either exclusively through electronic means, or through processed tape recordings, took several names: electroacoustic music, acousmatic music, *musique concrète* or, simply, electronic music.

We know that environmental sounds were always a source of inspiration for musicians and composers alike. In classical works, such as Antonio Vivaldi's *Four Seasons* or Ludwig van Beethoven's 6th Symphony, sounds of nature were rendered through orchestral musical instruments. In the following excerpt from a talk entitled "Sounds of Nature", Leopold Stokowski reveals the special relationship between natural sounds and certain parts of Beethoven's Symphony No. 6, otherwise known as 'Pastoral Symphony':

<https://www.youtube.com/watch?v=DLvze5-9rck>

So let us consider this: how differently do composers address their surrounding sounds in the present day, when they can record, reproduce and include them, raw or processed, in their composition?

## SOUNDSCAPE

*"When you listen carefully to the soundscape, it becomes quite miraculous"*  
R. Murray Schafer

A soundscape is the sound or the multitude and combination of sounds that surround us. Each place / space has their own special sonic / auditory identity. This identity is shaped through the sum of sounds that can reach a place or are generated within it as a result of natural, human or animal activity, and are influenced by the morphology of this place. Each environment, each moment in time, is tightly intertwined with specific sounds that characterize, define and distinguish that particular time and place from the acoustic identity of other regions.

The soundscape may be a vague "mass" of sounds, it may consist of more discernible sounds, or it may combine both qualities. A soundscape may in fact be so complex that it might not be possible to perceive all of it at once; we might need to listen to it very attentively, so as to identify all the different sounds that constitute it. Usually, the components that make up a soundscape have a certain "perspective". Some sounds are audible as a background, while others stand out as a foreground, and feel closer and more discernible to us. This perspective can often change, depending on where we focus our attention.

Just like the term "landscape" which is a place, a visual expanse that is unified in the gaze of a certain observer, a soundscape is the sound or the combination of sounds that surround us at any moment. We may sometimes encounter different uses of the term soundscape:

- As the acoustic environment of a certain place (whether large, e.g. a city, or small, e.g. a room), as described above.

- As the *experience* of an acoustic environment by a human, i.e. our personal perceptual construct, that stems from the acoustic environment of the place where we are located. This “construct” may differ from person to person, even though the sonic environment remains the same. This is because the relationship between people and place is influenced by several factors, like how intimate a person feels in relation to a place, what their mood is, or how they are predisposed towards the place through prior experiences and other personal parameters.

- As a musical term: in that case, the term *soundscape* denotes either a composition that employs environmental sounds as its core compositional material, or a sonic artwork that may employ other, synthesized or musical sounds, but may function as a soundscape by extending across time and creating a particular acoustic space. It works as a kind of environment which “envelops” and immerses the listener.

The term *soundscape* became widely known through the work of Canadian composer R. Murray Schafer, founder of the World Soundscape Project, an extensive research project in the late 1960s. His departure point was the discipline of *acoustic ecology*,<sup>3</sup> a new discipline which aimed at documenting and highlighting the importance of the acoustic environment (or soundscape) in everyday life. Through his research, teaching and writings, Schafer created the foundations for contemporary sound studies, and is a key reference point for scientists and artists alike. He and his students investigated real city soundscapes and began recording them. Putting technology to use, they created musical compositions, known as soundscape compositions, through which they sought to demonstrate how beautiful rural and urban soundscapes could be without sound pollution – or how ugly they could become through it.

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<sup>3</sup> “Just as a key concept in ecology is the ecosystem, a central notion in acoustic technology is that of the soundscape, i.e. the sum of sounds that are produced in an ecosystem, whether human (music, human speech, but also engine sounds from vehicles, industries etc.) or natural (like animal sounds, weather sounds, and the sounds of geological phenomena)”.

## FIELD RECORDING



Figure 1.05. Field recording.

Field recording is the process of recording sound outside of the controlled acoustic conditions offered by a studio. It requires the use of portable sound recording equipment in an outdoor or indoor space where random sound phenomena prevail. Field recording, also called environmental sound recording, is concerned with all the sounds of our environment, whether they come from humans or nature.

The development of equipment used in field recording goes hand in hand with advances in professional, portable recording technologies. From the phonograph, we went to the tape recorder, and then to the digital age, where equipment offers high-fidelity recordings, with low noise in increasingly more portable devices. In the past few decades, quality recordings can happen with several types of microphones, such as microphones designed to record electromagnetic fields, sounds in fluids (hydrophones) or in solids (contact mics), as well as with recorders in the size of a mobile phone.

Field recording has its roots in biology and ethnomusicology, where it was first used for observing, analysing, documenting and archiving the sounds of birds and other animals, recording the music of remote populations, and capturing oral testimonies. The first field recording was carried out by an 8-year-old child, Ludwig Koch, when his father gave him a wax cylinder phonograph, manufactured by Thomas Edison, as a birthday present. A wild bird was Ludwig’s first recording; he then started capturing sounds from his close environment, as well as “sonic autographs” from public figures. He then proceeded to become a pioneer of this new technique, which resulted in a whole new research field and the development of multiple new applications.

The feeling that our world is sonically captured through many different ways of listening, and through a multiplicity of

aesthetic, political and social interpretations, was constantly under development. The practice of field recording grew even further when it started being incorporated in the arts, and especially in experimental music. In our time, interests in field recording can be found at the intersection of several domains including science and technology, history and the arts. In this particular teacher's kit, we approach field recording creatively, as a relatively common artistic practice. The result, of course, will be based on each participant's particular, personal conception of sounds, and their subjective aesthetics.

Through the field recording activities in this workshop, we will sharpen our sense of hearing and discover new aspects of our everyday reality. We begin with observation, curiosity and reflection. We record, in order to develop an understanding. Decisions on issues such as where to place microphones or when to start and stop recording form a key part of our creative process. We will see how patterns, structures and rhythms are discernible in random everyday sounds. Cultivating skills like active listening and contact with our sonic environment, we can change our attitude towards sound and musical composition and develop new ways of relating to the world around us.

Field recordings can be divided into two categories:

#### Location recordings:

Recordings of all the sounds that compose the sonic environment of an outdoor or indoor space.

#### Focused recordings:

Recordings where the intention is to document a specific sonic event. Other sounds may be audible in the site of recording, but the documentation focuses on a specific sound, sonic scene or sonic event, in isolation.

The practices described above are applied in several different contexts. Think about the rich sonic environment of a film. How were all these sounds recorded? From the sound of thunder and lightning in a horror scene to the urban sounds accompanying a car chase, the sounds that transport us to the site of a film's plot, are often the result of field recording.

Some common applications of field recording are the following:

- Film, television, radio, documentary
- Music composition and audio production
- Videogames
- Ethnomusicology
- Acoustic ecology and bioacoustics

## IS OUR SOUNDSCAPE MUSIC?

A photographer takes a picture of a sunset, that (s)he then exhibits as a work of art. In a similar way, could we not record our environment, then present its sounds as music?

As we saw in previous chapters, the accelerated technological and artistic development that took place during the 20th century led many innovative composers to adopt the use of recorded sounds and electronic media. Until the 1960s, there was a wide tendency to process recorded sounds quite heavily. Artists used to cut and splice tapes (editing), change their playback speed, and modify the pitch and timbre of particular sounds, to form complex musical works. In the end result of their compositions, sounds did not retain their initial identity, and their source might even become completely unrecognizable to listeners. Today however, as we shall see in the ensuing sections, many artists treat their recordings as the end result. In other words, a raw, unprocessed environmental sound recording, just as it was made by the artist, may constitute the finished composition.

The first step towards this direction was made in 1970 by composer Luc Ferrari, a close associate of Pierre Schaeffer (see previous mention). The title in Ferrari's *Presque rien*, a series of field recording compositions, refers exactly to this near-absence of processing of the original sound files. In the first of these works, *Le lever du jour au bord de la mer* (Dawn by the seaside), we listen to sounds exactly as recorded by the composer on magnetic tape, during the early morning hours on a Dalmatian coast. In other words, this particular soundscape also constitutes the composer's finished product.  
[https://www.youtube.com/watch?v=8C6X1F\\_2VrQ](https://www.youtube.com/watch?v=8C6X1F_2VrQ)

Since then, more and more artists use environmental recordings as their main mode of expression.

The evolution of technology also played a key role in the rapid spread of this art practice, as it greatly facilitated access to environmental recording equipment.

#### Below you can listen to some indicative works by contemporary artists:

*In St Cuthbert's Time*, Chris Watson (Touch, 2013)  
<https://chriswatsonreleases.bandcamp.com/album/in-st-cuthberts-time>

Field recordings from Northumberland in the Northeast of England. In this record, Watson attempts to draw attention to the natural sounds that were most probably audible by St. Cuthbert several centuries ago, back in 700 AD.

*YANAYACU*, Francisco López (Nowhere, 2014)  
<https://franciscolopez.bandcamp.com/album/yanayacu-environmental-sound-matter-from-the-peruvian-amazon>  
Environmental recordings from the tropical Amazon rainforest in Peru.

40:43, Yorgis Sakellariou (Ot0, 2013)  
<https://mecha-orga.bandcamp.com/album/40-43>  
Field recordings from London and Athens.

In the links below, we can listen to artworks highlighting sounds which, under normal circumstances, are not audible with our human ears:

*Eldfjall*, Jacob Kirkegaard (Touch, 2005)  
<https://touch333.bandcamp.com/album/eldfjall>  
Recordings of geothermal phenomena in Icelandic regions with intense volcanic activity, The recordings were effected with special microphones that record underground vibrations.

*Electrical Walks*, Christina Kubisch (2004-)  
<https://electricalwalks.org>  
Through the following link we can explore areas in Oslo, Norway, and listen to electromagnetic phenomena in these areas:  
<https://electricalwalks.org/virtual-walk-oslo/>

*The Noisiest Guys on the Planet*, Jana Winderen (Ash International, 2019)  
<https://janawinderen.bandcamp.com/album/the-noisiest-guys-on-the-planet>  
Underwater recordings of decapods (crabs, shrimps, crayfish etc.)

**COMPOSITION** Like sound, music is time-dependent. A musical work has a beginning, development and end. The way a piece is developed, and the structure of this development, is a matter of personal choice. The beginning and end frame the main part of the piece, but also play an important role in conveying a general idea about the piece. Therefore, they deserve special attention. A musical or sonic composition may tell a story. It may aim to induce a certain state in listeners (such as calmness, reflection etc.) It may be an experiment, a study on certain sounds or on a certain technique.

A classical composer usually selects his/her material, the instruments for which (s)he will compose, the style and character of the composition. In our case, our material is the recordings we have made. We do not have musical instruments, and the type of piece to be composed will be determined by us. Instead of using a pencil and paper, as a classical composer would, we will use our computer and a suitable type of software (examples of which will be presented in the Activities section).

As we will create a musical / sonic composition of c. 2 minutes duration, here are a few examples of how to develop different types of beginning and ending, as well as ways of handling our material and structuring our piece.

Do keep in mind that the process of composing is a process of making choices. A composition is "successful" when the end results correspond to your initial intention.

Examples:

1. Work in 3 parts. We begin with a brief introduction. We proceed to the central section, where we can have more, and denser sounds, perhaps also greater volume (we could name this the "main theme"). We close off by using elements from the previous sections, more sparsely, gradually relaxing the mood we have created, leading up to a quiet closure.

2. We have a main idea (a dominant sound) for the whole duration of the piece. The sound is enriched through the gradual entrance of other, complementary sounds. The piece starts quietly / slowly, eventually reaches a climax, then slowly fades towards the end. We start the piece with a fade in, and end with a fade out.

3. The piece consists of 2 different sections (A – B). It is important to ensure that these two sections are markedly different among them, and also to be mindful of how to make the transition between sections. We may also try out two different versions: one where the transition between sections is smooth, and one where it happens abruptly.

4. We create a sonic collage of many different sounds. Here, we are mainly interested in rhythm. In our collage, we focus on the repetition of short sounds (sounds of short duration), which will help us create multiple repetitive rhythmic patterns (loops).

Notes:

- While the suggested duration is around 2 minutes, we can of course be flexible if there is musical reason to do so. If the piece feels complete in one and a half minute, there is no reason to ask for an additional 30 seconds.

- The timeframe is suggested for compositional as well as educational reasons. It sets out a framework (or canvas) within which we can work.

## TECHNOLOGY AND MUSIC PRODUCTION – THE EVOLUTION OF THE STUDIO AS AN INSTRUMENT AND AS A COMPOSITIONAL TOOL

As seen earlier, the appearance of technologies for sound recording, processing and reproduction played a key role in the history of music; so did the transition from a sonically transient music to a recorded experience, which can be examined and investigated anew with every playback, and the introduction of “non-musical” sounds in the creation of new music. From the invention of the phonograph onwards, rapidly evolving technological advances led the way for music, through the introduction of innovative techniques such as multi-track recording and processing, as well as through the technique of sampling, which allows us to reuse any type of sound file or musical material<sup>4</sup> in a new composition. In the digital age, yet another new technological advance would become a catalyst for musical changes.



Figure 1.06 (1984).

The use of computers as musical instruments that can make “music out of numbers” (as computer music pioneer Max Matthews put it), was developed to such an extent, that computers quickly surpassed their role. They are now much more than musical instruments; countless possibilities are available to computer users.

The development of software for manipulating sound would forever change the way we listen to, compose, and play music. Through digital processing, the process of manipulating a large amount of different sources was accelerated. Digital effects, virtual instruments and other tools allowed for greater accuracy and much more creative choice for artists in search for different

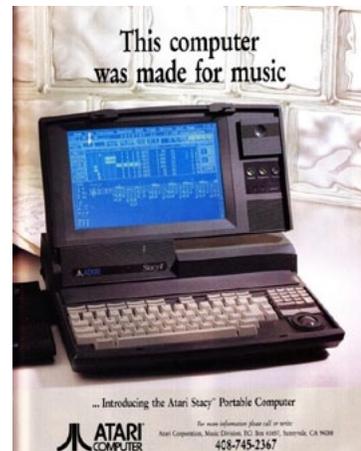


Figure 1.07 (1990).

sounds. Furthermore, the visualisation of sound on a computer screen made sound much more easy to handle as a material, making sound processing feel more like putting pieces together, as in a puzzle. This allows us to try out different combinations and variations of material.

Highly esteemed musician, composer and producer Brian Eno explains how the contemporary relationship between humans and music is transformed under these new circumstances:

“It was not only a technological history, or a technological series of changes. There was also a change in concept of what music was for.”

Computers became portable, accessible, and all the more powerful. The know-how for recording and processing sound is constantly updated. The digital audio workstation (DAW), which comprises a laptop plus relatively basic equipment, now constitutes a complete studio; it can be set up even in one’s own home (home studio).

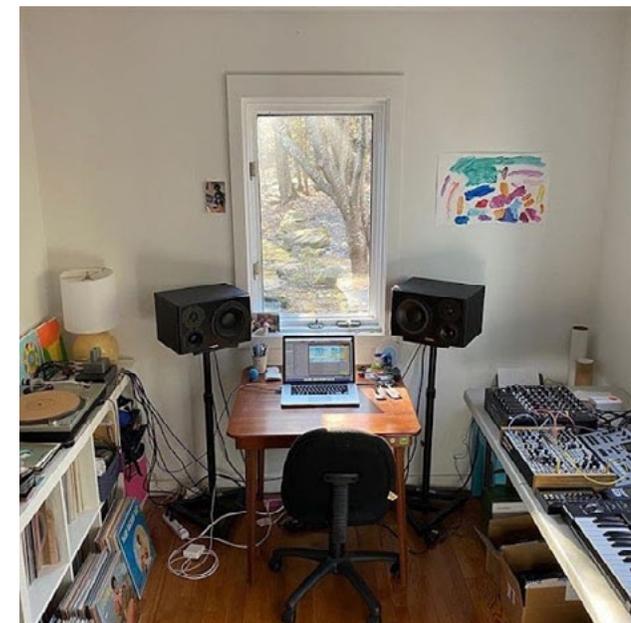


Figure 1.08. The space and equipment used by renowned British electronic music producer Four Tet to record and mix his record, *Sixteen Oceans* (source: <https://www.instagram.com/fourtetkieran/?hl=en>).

<sup>4</sup> This should be done with the necessary permissions. The use of sonic material without the creator’s permission is a breach of copyright.

All of the above shape a new reality, much greater than a source for creative inspiration. This new state of play exerts powerful influence through its accessibility, simple functionality and internet connectivity. Innumerable compositions are created all the time, from artists who have the ability to produce, promote and distribute their material, even independently (DIY), through a variety of online platforms (SoundCloud, Bandcamp, YouTube, Spotify etc.), thus making their work available to a global audience. The music industry is changing and offering new models for production and collaboration. What is more, through the new conditions of human-computer interaction, novel ideas are constantly generated, and new compositional styles are emerging, often at the intersection between music, informatics and artificial intelligence (computer music, algorithmic synthesis). The laptop can become an entire orchestra on stage. Musical apps are turning mobile phones and latest generation tablets into musical instruments and pocket studios. Music is now listened to, played and even created in motion, everywhere and at any time.

## ACTIVITIES

### LET US CLOSE OUR EYES (GONG)

For this activity, we need an instrument whose sound decays very slowly, such as a gong or other cymbal, a triangle or vibra-tone.



Figure 2.01. From left, small gong, Vibra-Tone, triangle.

1. We all close our eyes.
2. Whoever has an instrument in their hands, makes a tone, i.e. gently beats the instrument once.
3. We listen to the instrument's tone, for as long as it keeps sounding.
4. We raise our hand and open our eyes when we no longer hear the instrument's tone.

#### Questions:

- Are we certain about when the sound stops?
- Were you impressed at all by how long a percussive sound can actually last?

We repeat the procedure above, this time noticing all other sounds that can be heard around. While the instrumental tone keeps sounding, we try to concentrate on all other audible sounds in our surroundings.

When the instrumental sound stops, we open our eyes and make a list of all the sounds we heard.

#### Let us discuss the sounds we just heard and outlined in our lists:

- Which sounds are the closest / farthest?
- Which sounds are produced by humans, machines, or nature?
- Which sounds were louder / softer?
- Did you notice any sounds that are always there, but have never been paid attention to? For instance the sound of fluorescent lighting, the classroom clock, sounds coming from the street.



Here are a few examples:

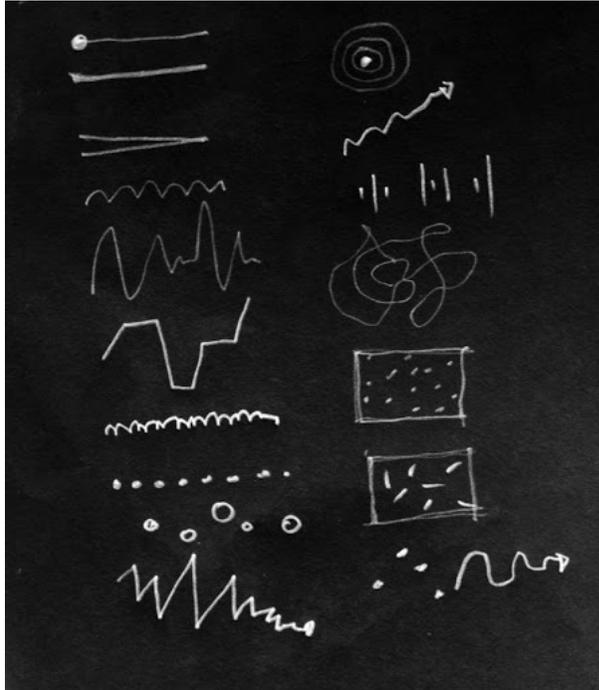
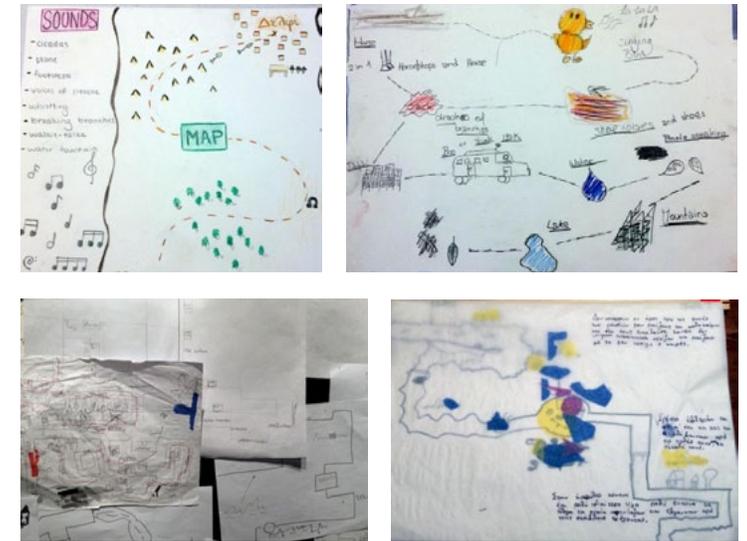


Figure 2.03. Examples of different ways of visualising / symbolising sounds.

Now, let us listen to the sounds around us, and let us try to draw / visualise them. We can free our imagination and draw the sounds we hear in all kinds of different ways. It is important, however, not to draw the sound source, but the sound itself. For example, if we hear a dog barking, we should not draw the dog. Instead, we listen carefully and try to draw all the different features of the sound we hear (volume, duration, timbre etc.)

## OUR SOUND-MAP

Let us draw a map with all the sounds we can hear. We take a blank piece of paper and put a circle or a big dot in the centre. This represents our own position (where we are located). Around this centre, we draw all the different sounds according to their location and features.



Figures 2.04-2.07. Examples of soundmaps.

## A WALK FULL OF SOUNDS (SOUNDWALK)

*"We must listen to our cities as the indigenous people listen to their forests!"*

Hildegard Westerkamp



Figure 2.08: A soundwalk in Elefsina.



Figure 2.09: Sketching sounds on paper

This is an outdoor exploration of the sonic environment, in the form of an attentive listening walk. You will take a walk around the school. Your main tool will be your sense of hearing. Your aim will be to listen and locate sounds.

Discuss and decide collectively the course you will take, based on the different spaces and activities taking place in the nearby area. You can designate a soundwalk "guide", someone among you who will decide on the exact directions the group will take during the walk, when to make stops, etc.

- Walk without talking. While walking, try to trace as many sounds as you can among all the audible sounds around you. Consider whether you like some of these sounds or whether they annoy you, whether some sounds impress you and why. Take notes.
- During the walk, make a few stops, where you will listen without walking; take time to reflect on the sounds you have heard in your soundwalk so far.
- Listening takes time! You need some time to adjust, in order to be able to concentrate on your sonic environment and discern all the different details and features that define it.

### Preparatory discussion

1. Do you live in a quiet or loud neighbourhood? Do you have a place in your neighbourhood where sounds differ from the rest of the surrounding area? How do your neighbourhood sounds affect you? You can have the same discussion about the neighbourhood around your school.
2. What / which sounds do you expect to hear during the soundwalk?

### Follow-up discussion on the soundwalk's outcomes

1. What sounds did you hear?
2. Did you like certain sounds? Did certain sounds bother you? Did some sounds surprise or impress you, so that you'd want to hear them again? Were there sounds you would like to "keep" from the soundwalk? Why would you like to keep those sounds?
3. Did you cross a relatively stable soundscape, with very few changes, or were there intense variations / abrupt changes in what you heard during the soundwalk?
4. What sounds were loud, and what sounds were soft? What sounds were high or low in pitch? What sounds were long or intermittent, rhythmical or continuous? What sounds varied and what sounds were stable? Were there sudden, momentary sounds? Which ones?

Now that you have realised how much information sound can convey, we invite you to include "soundwalkink" in your own daily activities.

### Accompanying listening activity:

(Listen without revealing the name of the piece in advance)

"Cricket's Voice", Hildegard Westerkamp  
<https://www.youtube.com/watch?v=pJ18yFwMwqY>

### Discussion:

- Many composers take soundwalks to get inspired, in order to compose music based on sounds, rather than musical notes and instruments.
- Can you figure out what sounds have been used here?
- Does the piece make you think of a particular place or environment?
- Can you hear different rhythms and pitches within the piece?

## "SOUND CHAMBERS"

Have you ever thought that the space we are in "changes" the sounds we hear?

### Activity 1:

Find a short, curt sound that you can make with your own body (like handclapping). Explore different spaces in your school and observe how differently your handclap sounds in each space.

- Is the sound the same in the hallway and in the smallest room you found?
- What happens if you go outdoors?

*Note: for this activity, it is important to allow enough time after each short sound. Try to tell if the sound's duration changes in different spaces.*

### Activity 2:

We can make our own version of the work *I Am Sitting In A Room*. Written in 1969 by American composer Alvin Lucier, *I Am Sitting In A Room* demonstrates how each space's acoustics can transform sounds completely. The work's first recording is 45 minutes long. During the first few minutes we hear the composer reading out the following text:

"I am sitting in a room, different from the one you are in now. I am recording the sound of my speaking voice and I am going to play it back into the room again and again until the resonant frequencies of the room reinforce themselves so that any semblance of my speech, with perhaps the exception of rhythm, is destroyed. What you will hear, then, are the natural resonant frequencies of the room articulated by speech. I regard this activity not so much as a demonstration of a physical fact, but more as a way to smooth out any irregularities my speech might have"

Just like the composer describes it, we hear the same text / reading "again and again". By recording, replaying, re-recording and replaying this reading in the same space several times, the sound gradually loses the features that allow us to make out speech features, and understand what the composer is saying. Towards the end of the recording we only hear pure tones (frequencies). The frequencies we hear are the ones who have been naturally amplified thanks to the particular space's acoustics. Therefore, the space where something is recorded determines the final outcome of the recording.

If we have equipment for recording / replaying sounds, we can make our own version of the work:

- We find a quiet space.
- We place the microphone / recorder on a stable spot.
- We record the text given above.
- We replay (through the speakers) the recording (text), while recording through a second recorder: we are recording our initial recording.
- We repeat the action above several times, always replaying the more recent recording. We notice how the sound changes.

*Note: It is important to be absolutely quiet during the recordings. If we record other sounds, beyond the sound that is replayed through the speakers, we will not be able to hear the tuning frequencies of the space we are in.*

## HOME ACTIVITIES

These exercises aim at “sharpening” the way we listen and take notice of sounds around us, beyond the classroom. This is a personal, intimate activity, different from the in-group activities.

- A. Sound diary (from my room). I stay in my room, keeping quiet for a certain amount of time (5-10 minutes), and note down the sounds I hear in as much detail as possible. I repeat this process, in the same spot inside the room, but at a different time during the day (maybe also during the weekend). After doing this three times (morning, afternoon, evening), I compare the three different sets of notes, searching for differences and similarities.
- B. In search of two specific sounds. During a whole day, from any part of the house, I search for two sounds I do not hear often, two extremely rare sounds.
- C. I try to highlight the difference between sounds that are audible from indoors, and sounds coming from outdoors, with specific examples. For instance, a fridge buzzing (indoors) and a motorbike passing (outdoors). How are they different? I make a list with five sounds in each category (indoor-outdoor)
- D. I try to highlight the difference between “foreground” and “background” sounds, through specific examples. The radio playing next to me (foreground) and the sound of an outdoor market down the street (background). I make a list with five sounds in each category (foreground-background).

## OUR FIRST RECORDING



Figures 2.10 & 2.11. Outdoor field recording ventures at the Kallithea Secondary School, Athens, Greece.



Figures 2.12 & 2.13. Recording at Halandri stream and Neos Kosmos, Athens, Greece.

Now, having “opened our ears” we are listening carefully to our surrounding sounds. Knowing the basics about our equipment too, we are ready to venture outdoors for our first recordings.

Let us prepare:

- We split into groups of three or four and take on the following roles (ideally, taking turns between us):
  - a) recording operator
  - b) assistant recording operator (provided we have a splitter and second pair of headphones, the assistant also wears headphones)
  - c) archivist (takes notes and keeps a list of all the recordings made, on paper)

- Before starting to record, we notice how differently we hear through the headphones. The recorder's microphones are now our ears. They work rather differently from our actual ears, and can pick up sounds we could not have imagined. Attention: we do not shout or play around when someone is listening through a recorder, because we might damage their ears!
- We operate as quietly as possible. While we record, we can communicate through signs and signals, not by talking.
- If possible the groups keep long distances between them.
- We avoid unnecessary noises caused by any contact or friction between the recorder and our hands, cables or other objects. We hold our equipment carefully and avoid sharp or sudden movements.
- If it is windy, we will need a special accessory for the mic, called a windshield. If we do not have a windshield, we choose to record in areas that are relatively protected from the wind.
- We are now ready to start. As mentioned before, curiosity and imagination are our guides. We may have formulated in advance a few ideas about what we want to record, but it is important to remain open to chance events and unpredictable sounds. Consider this as an exploratory venture.
- We first listen carefully, then press the record button, as soon as a sound draws our interest.
- We ensure that each file we record has a duration between 30 and 90 seconds. Very short or very long files make computer-assisted composition more difficult.
- If we want to record a sound event, we take care not to stop the recording before the event is completed.
- For the entire duration of our venture, we take notes and keep an archive (list) of our recordings. We take care to ensure we have a manageable number of recordings.
- We notice the sounds' sources and try to approach them, as if trying to amplify and augment each sound. Even a soft sound will sound loud if we approach it with our microphone.
- At regular intervals, we check if our equipment is working normally, and ensure that the recording levels are set as desired.

To ensure variety in our material, we record both indoors and outdoors. We can record our sonic environment, i.e. the entire set of sounds we hear, or focus on individual sounds and events. At the end of the recording venture, we try to have both types of categories on file.

#### Location recordings:

Most of the time we can hear a whole set of sounds. In the Theory sections, we have defined the soundscape as this sum of different sounds that we can hear in a place. These sounds may be soft or loud, continuous or intermittent. During our venture, we try to locate the spot where these different sounds – or better, the different levels of sounds – are at a balance that we like. For example, if a ventilation unit is operating in our recording location and we stand near it or put the microphone next to it, the sound of the machine will cover all sounds that reach our microphone at a lower volume, cancelling them out. Notice the ways in which the sounds' balance changes, depending on the microphone's position. Remember that, in the context of artistic practice, there is no right or wrong position for recording sounds.

#### Focused recordings:

We focus on a particular sound or sonic event, in order to isolate it from the rest of the soundscape. We try to record sounds in as much detail as possible. If the sound is low in volume, we should bring the microphone very close to the sound's source. If it is loud, as in the ventilator example above, and we specifically want to record this sound, we should approach it and focus our recorder there (but make sure that the recording levels are not too high, so that our recording does not come out distorted. See section on "Volume / Levels" below for how to set recording levels).

# GETTING TO KNOW OUR EQUIPMENT

In the figures below you can see a few examples of sound recorders:



Figure 2.14



Figure 2.15

## Basic functions:



Figure 2.16

### **Play**

Reproduces recorded sound



Figure 2.17

### **Stop**

Stops the reproduction (during "play") or the recording (during "record")



Figure 2.18

### **Pause**

Pauses the reproduction or the recording (useful when we want to pick up at the exact point when we left off during a sound file)



Figure 2.19

### **Record**

To record, we usually have to press this button twice, in order to start the recording function. The first time we press it, we can set recording levels and listen carefully through the headphones, to check how everything sounds.

## Input (sound entry point) | Microphones

Whatever recorder we use will most probably have two mics. These are usually visible on the top part of the recorder. In case of using a mobile phone, these are not visible. Why are there two microphones instead of one? Because we also have two headphones, one for each ear. Sound gets into the recorder through the microphones, and it exits through the headphones. The technical terms we use for this entry / exit process are "input" and "output".

## Output (sound out) | Headphones

In order to know exactly how our recording will sound, we can listen to it in real time through our headphones. We need to check if we have worn them correctly. Usually, the letter L (left) is marked on the headphone meant to go on the left ear, and the letter R (right) is marked on the right. The sounds recorded from the left microphone end up on the left side of our headphones; sounds recorded from the right microphone end up on the right side.

## Volume / Levels

In virtually every type of recording equipment, it is possible to set the microphone and headphone levels separately. Here we must pay special attention: without the right settings, our recordings may not be useable. Always keep in mind that the most important level is that of the microphone (input). Even if we are using a mobile phone, we can see the volume at which sound comes in (input signal). If it is too loud, it will sound distorted (noisy). If it is too low, then later on, when we work on our computer, we will have to raise the volume a lot. This means the level of our microphone's noise will also go up (no microphone is completely noise-free).

Once we are certain that we have set the microphones' input signal correctly, we set the volume of our headphones (output level) to our desired level, i.e. the volume at which we want to hear sounds. The output level (i.e. the level of our headphones) does not affect our file.

## COMPOSING WITH SOUNDS ON THE COMPUTER



Figure 2.20 Composing with sounds on the computer.

The use of a personal computer, through the recommended (Audacity, Compose with Sounds, Garageband etc.), constitutes the next important stage in our workflow. On the computer, we can easily process our recordings, using basic tools and techniques, in order to combine them into a single, unified end result.

Once we have recorded our sounds, we transfer the sound files from the recorder to the computer, where we will work on our compositions.

### Transferring files to a computer:

For the file transfer we will need a USB cable, which will connect our recorder with the computer, or a card reader, which can read the recorder's flash card.



Figure 2.21



Figure 2.22

### Selecting files:

It is expected that some of our files will have more interesting material than others; this is because the recordings did not take place inside a studio, where we would have more control over sonic events, but in various outdoor and indoor spaces. It is also

possible that some of our recordings include unwanted noises, or maybe they have been completely distorted because of strong wind or very high input signal (an effect called "peaking").

Therefore, it is important to listen to our files and select the ones we will use in our composition. We can open the files using any media player installed on our computer, we listen to each file carefully, and choose the ones we find more interesting.

### Tools and techniques:

Most digital programmes offer unlimited possibilities and options. Even professional sound recordists, producers and composers sometimes find it hard to filter the amount of options available to them and apply the tools that can best suit their desired goals. In the context of a school-based workshop, it is important to focus on the more basic tools, and leave enough space for students to experiment and play around with their material. The descriptions that follow cover only a small part of the possibilities available to us through digital software; the aim is to introduce students to the basic tools they will use in their compositions, in simple words.

### Editing (choosing sounds and splicing them together)

From the 1950s to the present day, editing has been one of the key uses of music technology. Its function in music is similar to film editing. Just like film editing is about deciding which scenes and images will make it into a film, and putting them in order, music editing is about choosing sounds and music themes, and deciding on their order of presentation.

Once we have inserted the files we want into our Project (by dragging them on the screen, or by using the command "Import" or "Place"), we can use the following tools:

**Cut** - We cut the sound file or parts of it

**Copy** - We copy the sound file or parts of it

**Paste** - We paste the sound file or parts of it in any part of our piece

**Fade in / Fade out (Gradual rise / fall in volume)** - If we feel that the sound file starts or ends too abruptly, we can include a fade in the beginning or the end of the file. In this way, the sound will start and/or stop gradually.

### An example of applying these techniques - Making a loop

We select (with Cut or Copy) a brief part of a file (1 to 4 seconds). We then Paste this at the end of our selection, again and again, at least 8 times. In this way, we construct a repetitive sound motif (pattern). If the pattern is rhythmical, this could form the rhythmic basis for our composition. We may also repeat a longer segment, several times. In both cases, we will have constructed a loop.

### Processing:

Just like with music editing, we can find many analogies between music processing and processing in visual media, like photography and film. When we add a filter to a photo, we are processing image. Similarly, through various music technology applications, we have several tools for processing sound. In music and sonic arts, we often process sounds to such an extent that they might no longer remind us of the initial sound in any way.

### Basic processing tools:

#### **EQ (equalizer)**

As we have seen a sound does not consist of one single frequency; rather, it entails multiple frequencies, which compose its characteristic timbre and define its pitch. The sounds we have recorded also have a “frequency content” (which may be wider or narrower, richer or poorer) and are located in a specific “frequency range” (e.g. between 150 and 1000 Hz). With EQ we can intervene in order to reduce or increase some frequencies. We cannot add frequencies to a sound if it does not contain them in the first place; however we can enhance or reduce the sound’s own frequencies. For example, if we have recorded a stream with running water and the sound feels a bit blurry, we may try to cut some of the lower frequencies. As a start, we can completely lower any frequency below 150 Hz. This way we are applying a so-called “low cut”. We can then boost or cut more specific frequency areas, until we reach the desired result.

#### **Reverb (Resonance)**

As demonstrated through previous activities, each space has its own unique acoustics. A handclap sounds different in our bedroom and in a cathedral. By applying a Reverb, we “place” our sounds in the kind of space we want. We can achieve a realistic result, like footsteps and chatter in a train station, or create an impossible imaginary situation, like the sound of passing truck going through a well or cave. If we want to create the impression that a sound is very near us however, it is better not to use any Reverb. We may also apply Reverb on a file to change its character. For example, we can “soften” a sound which sounds dry, or “spread out” a sound that feels very short. We can determine how intense the effect will sound, what kind of “space” we want to introduce around the sound, as well as the duration of the effect.

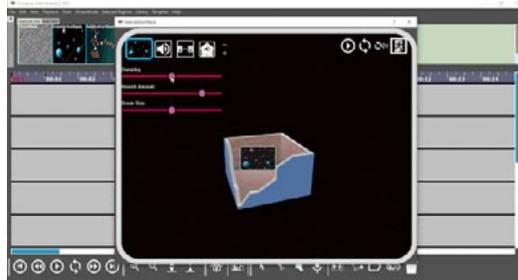


Figure 2.23. Setting different Reverb parameters in Compose with Sounds software.

#### **Delay (echo)**

By using Delay, we can repeat sound as an echo. At the same time, we can define how sparse or frequent these repetitions are, as well as their duration.

#### **Reverse (time reversal)**

Reverse gives us the ability to reproduce a sound file backwards, i.e. from the end to the beginning. Through Reverse, we can render a familiar sound completely unrecognizable. This particular process does not involve different parameters.

#### **Pitch shift / Transpose / Time stretch (Changing pitch and playback speed)**

Have you ever seen a record player in action? Have you heard how a 45rpm record plays at 33rpm, or vice versa? In a medium such as vinyl records, when we play a recorded sound over a longer time span than recorded, the pitch is lowered, and the sound becomes more bassy. Conversely, when we reproduce a sound over a shorter timespan (by raising the record player speed at 45 rpm or by fast-forwarding a cassette tape while it plays), the pitch is heightened and so is the sound. Most digital software enable us to raise and lower the pitch while retaining the playback speed. For instance, if we have recorded the piercing sound of a house alarm, we can lower its pitch while retaining the sound’s remaining features. Usually, software allows for a number of options: a) change of pitch & speed, b) change of pitch without a change of speed, c) change of speed, without a change of pitch.

#### **Mixing**

Mixing is about how we will balance different sounds in our piece. For this procedure, it is more difficult to find analogies with film and photography. In film, usually one shot follows another. If, for instance, we were to project five shots simultaneously, one over the other, then the resulting images would appear quite blurry and abstract. Shapes and colours would be completely altered and maybe we might not be able to distinguish between any of the five scenes originally shot. Sound, however, works quite differently. In most musical pieces we can hear several different recordings at once, and we can distinguish quite easily the melody of a piano from that of a saxophone. We might compare a sonic composition with a building, made up of several different sounds instead of different building blocks. Some of these sounds are more central and easily discernible, while others are in the background.

The balance between different sounds in our composition will determine our work’s end result. It is therefore important that we dedicate the necessary amount of time to experiment and play around with the different levels and layers of our composition, until we reach a result we are happy with.

The mix of all the individual channels with all their different sounds, forms a new channel, which we can process as a whole, in the same ways we process the individual channels.

Below are two key tools for when you reach the mixing stage:

- Adjustment of volume levels is a particularly important stage, and we should dedicate enough time to achieve the desired balance between our sounds. We can experiment freely with the different channel levels, until all the different layers are audible or discernible enough. For example, if a channel with loud sounds (e.g. from a construction site) plays simultaneously with a channel that contains a soft sound (e.g. the dragging of fingers on a notebook), the loud channel should have a very low level.
- With Pan, we can adjust our stereo image. This is about deciding which sounds / channels we want to hear more from the right side, which ones from the left, and which ones at the centre (both right and left). It is a very useful tool, which helps us reproduce a sense of space more effectively, and allows us to discern all the sounds in our composition more clearly. For the adjustment of stereo image, it is helpful to use of headphones.
- During the mixing stage, it will be useful to use the EQ again (also mentioned at the start of this chapter). Along with the volume adjustment, we can also boost or cut certain frequency ranges, so as to avoid having too many simultaneous sounds with a similar frequency content.

### Software (Sequencers)

Sequencing software (and especially freeware such as Compose with Sounds, Audacity, Garageband) is the most commonly used interface for music production. The desktop consists of a mainframe (sequencer) along with channels (tracks) and toolboxes on the sides or at the top part of the screen. We can "load" our sounds, which appear in soundwave form, on the channels. On each channel we can see a vertical indicator (timeline) moving along the soundwave. This shows us where we are in time.

Examples of sequencer interfaces:

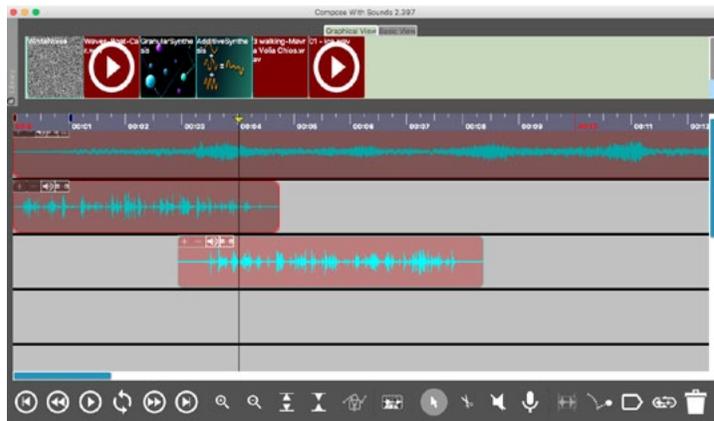


Figure 2.24. CWS (Compose with Sounds).



Figures 2.25 & 2.26. CWS (Compose with Sounds).

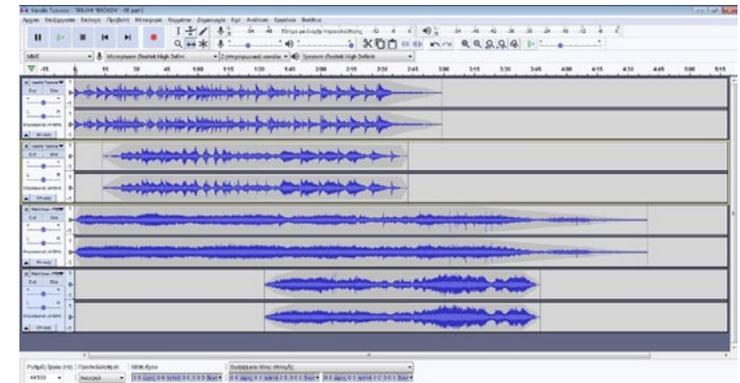


Figure 2.27. Audacity.

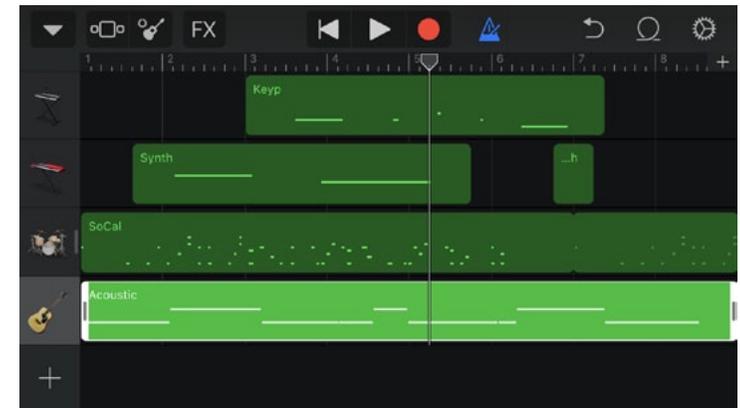


Figure 2.28. Garageband (mobile app).

Usually on the left of each soundwave there are certain settings which can be applied to this particular channel. On the various toolboxes and menus available with each software, we can find many more options, including all the key features described above. CWS in particular can also visualize the effects we use (see Figures 2.21 & 2.22). This might help us understand the different types of processing applied on our sounds.

## PLAYING LIVE WITH SOUNDS ON THE COMPUTER



Figure 2.29. Playing live with Soundplant application.

Applications such as Soundplant and Compose with Sounds Live offer the same functions as all the aforementioned types of sequencing software. What differs considerably from other multi-track sequencers is the desktop interface, which is designed in such a way as to serve live performance! Here, we can play and process our sounds in real time (live), provided we have set certain parameters beforehand. These types of software are ideal for improvisation and group play.

### Soundplant:

We have a keyboard image on our screen. We can assign a sound to each key, and apply different parameters of our choice. We can assign the same sound to more than one key, then apply different parameters on each key. Selecting a key with our mouse, we can change the playback settings for the sound that corresponds to this particular position on the keyboard.

At the bottom of the screen we see the file in soundwave form. On the right, we can see which sound is being reproduced during playback. Above the soundwave, there are options concerning how a sound will play, as well as how it will be processed live. This way, our keyboard is turned into an instrument (a sampler), which can play back the sounds we put into it.

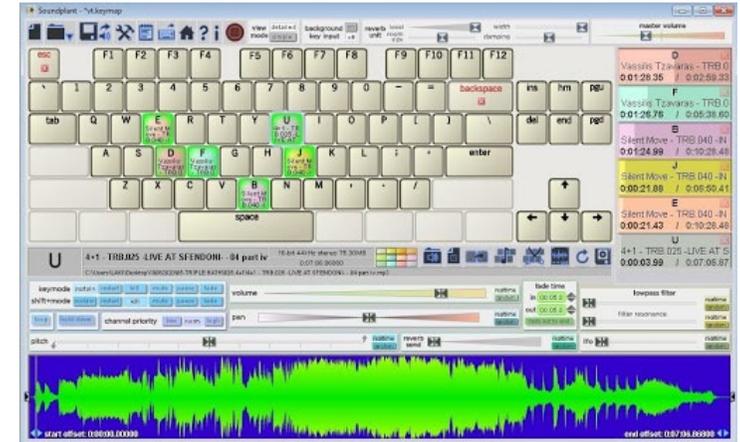


Figure 2.30. Soundplant.

### Compose with Sounds Live:

Compose with Sounds Live has a rather different desktop interface. Just like Soundplant however, it also enables us to play our sounds in real time, on a laptop, a tablet or a smartphone or more than one of these playing simultaneously or networked together. In addition, it allows us to connect our computer to an external controller (e.g. midi keyboard, a joystick or any other interface), which we can use to have even better control of all the different parameters.

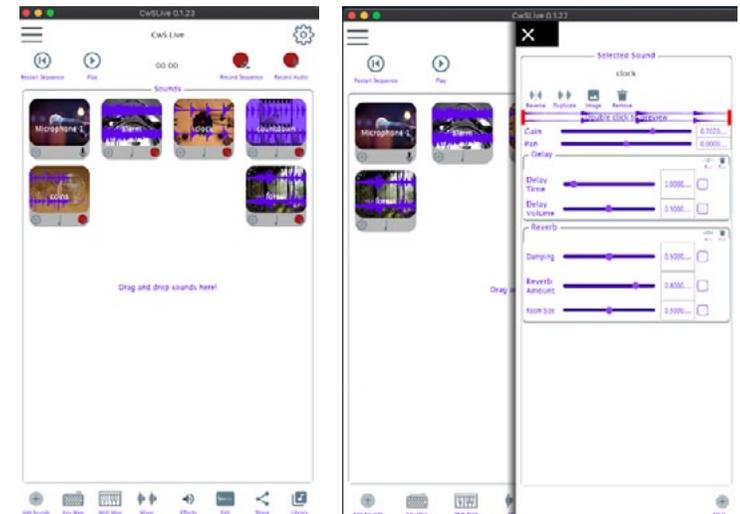


Figure 2.31. Compose with Sounds Live.

Figure 2.32. Sound Processing in Compose with Sounds Live.

A special feature in Compose with Sounds Live similar to the original Compose with Sounds, is the selection of images for each sound we use. For instance, if we have a file with a recording of the sea, we can load a photo that we took during the recording, depicting the sea. This way, the file will always be accompanied by that specific image, making it easier for us to choose the sounds we want, both quickly and accurately.

You can download all the apps mentioned here and find their usage instructions in the links below:

Audacity:

<https://www.audacityteam.org>

[http://www.pi.ac.cy/pi/files/epimorfosi/ekpaid\\_yliko/Mousic\\_mesi/udacity\\_1.3\\_manual.pdf](http://www.pi.ac.cy/pi/files/epimorfosi/ekpaid_yliko/Mousic_mesi/udacity_1.3_manual.pdf)

Compose with Sounds:

<https://ears2.dmu.ac.uk/cws>

<http://ears2.dmu.ac.uk/cws/download>

Garageband:

<https://www.apple.com/mac/garageband/>

<https://help.apple.com/garageband/mac/10.3/?lang=en>

Soundplant:

<http://www.soundplant.org/>

## RECOMMENDED LISTENING

Below you will find an indicative list of pieces for recommended listening, including works from the 20th and 21st century like the ones described above.

A work written for Intonarumori (noise machine) ensemble, designed by the artist and his assistant<sup>5</sup>:

Luigi Russolo, *Risveglio di una Città* (1912-19)

A work rendered in a kind of descriptive score – the composer provides a list of sounds and rests (pauses), as well as time durations:

Filippo Tommaso Marinetti, *Cinque Sintesi Radiofoniche* (1933)

A sound film for radio. A collage of words, musical excerpts and sounds, that form an auditory image of the urban landscape in Berlin during a weekend (which is also the title of the work in German):

Walter Ruttmann, *Wochenende* (1930)

Work for record player, recordings, piano and cymbal:

John Cage, *Imaginary Landscape No. 1* (1939)

Chronologically, the first ever work of electroacoustic music:

Halim El-Dabh: *The Expression of Zaar [Ta'abir al-Zaar]* (1944)

The first electroacoustic work by Pierre Schaefer, the composer who introduced the term *musique concrète* (concrete music) and created the GRMC research centre (Groupe de Recherche de Musique Concrète) in Paris:

Pierre Schaeffer, *Etude aux chemins de fer* (1948)

One of the first works for tape and orchestra:

Edgard Varèse, *Déserts* (1950-54)

Music from a machine constructed by Daphne Oram, to allow the composer to design her own sounds:

Daphne Oram, *Oramics* (1958)

<https://vimeo.com/30368714>

Electroacoustic work by famous Greek composer; in this work we can hear the processed sounds of burning charcoal:

Iannis Xenakis, *Concret PH* (1958)

Another example of “*musique concrète*” by Pierre Henry. This work (Variations for a door and a sigh) has been used by famous dancer and choreographer Maurice Béjart:

Pierre Henry, *Variations pour une porte et un soupir* (1963)

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<sup>5</sup> The original instruments were lost or destroyed during the 2<sup>nd</sup> World War and have now been re-designed based on sketches and descriptions by Russolo. Only the score for the work mentioned here, *Risveglio di una Città*, has been salvaged.

The music theme from the famous British TV series Doctor Who, which brought electronic sounds to a wider audience:

Delia Derbyshire, "Doctor Who Theme" (1963)

Composition with recordings of national anthems from different countries, using collage techniques:

Karlheinz Stockhausen, *Hymnen* (1966-67)

The first ever work to include completely unprocessed (raw) field recordings:

Luc Ferrari, *Presque rien No. 1* (1970)

[https://www.youtube.com/watch?v=8C6X1F\\_2VrQ](https://www.youtube.com/watch?v=8C6X1F_2VrQ)

Music composition by British composer, whose starting point is the voice of a homeless man in the streets of London:

Gavin Bryars, *Jesus' Blood Never Failed Me Yet* (1975)

A musical work with magnetic tape loops of various different durations, which are played back simultaneously. A composition / sound installation which aims at "neutralising" the intense atmosphere of an airport terminal:

Brian Eno, *Ambient 1: Music For Airports* (1978)

<https://www.youtube.com/watch?v=LKZ3fGR2SDY>

Use of editing and sampling techniques in a popular electronic music track:

DJ Shadow, "Organ Donor" (1996)

Famous American Jewish composer Steve Reich uses recorded testimonies from Holocaust survivors, along with recordings of trains and sirens, and a string orchestra:

Steve Reich, *Different Trains* (1988)

[https://www.youtube.com/watch?v=sq5jmTx\\_g00](https://www.youtube.com/watch?v=sq5jmTx_g00)

Recordings of Vancouver soundscapes, as well as sound compositions based on these recordings. The work is drawn from a landmark study on Vancouver's sonic landscape, a sonic portrait of a growing city, entitled *World Soundscape Project: The Vancouver Soundscape* (Canada 1972-73, 1981, 1996),

*The Vancouver Soundscape*, 1973 and 1996

<https://www.sfu.ca/~truax/vanscape.html>

Ultra-Red (<http://www.ultrared.org/directory.html>) are a collective of artists, researchers and social activists who "investigate acoustic space as an expression of social relations". They have created musical works based entirely on field recordings made during social protests. The compositions in this album make use of recordings of resident demonstrations from the degraded Aliso Village public housing project in Los Angeles, which was demolished and replaced by a new apartment block (1999):

Ultra-Red, *Structural Adjustments* (2000)

<https://www.allmusic.com/album/structural-adjustment-mw0000051610>

Renowned British group of electronic music producers, Autechre, use a wide spectrum of analogue and digital electronic and electrical media in their works. Some machines have been modified in their electronic circuits, so as to generate sounds that would not be possible through the original circuit:

Autechre, *Gantz Graf* (2002)

A DIY electronic music production. In the album *Untrue*, London-based music producer Burial, includes sounds from internet videos, phone recordings, videogames and environmental sounds in his compositions, with the help of simple sequencing software:

Burial, "Shell of Light" (2007)

<https://www.youtube.com/watch?v=0mkLNYaCJns>

A track from the album *El Tren Fantasma* (Phantom Train). All the sounds were recorded on the train that connects the west and east coasts of Mexico:

Chris Watson, "El Divisadero" (2011)

[https://www.youtube.com/watch?v=fDQZTXz2-7o&list=PLKtI6DyKnYmNKifc4UTBY4ktRhDmBEnf\\_&index=5&t=0s](https://www.youtube.com/watch?v=fDQZTXz2-7o&list=PLKtI6DyKnYmNKifc4UTBY4ktRhDmBEnf_&index=5&t=0s)

A record with processed recordings made in the Antarctica peninsula: Lawrence English & Werner Dafelecker, *Shadow of the Monolith* (2014)

<https://soundcloud.com/holotype-editions/lawrence-english-werner-dafelecker-fathom-flutter>

A record based on field recordings made by the artist at the mountain village of Ambeliona in the Peloponnese:

Yorgis Sakellariou (Mecha/Orga), *Ambeliona* (2014)

<https://triplebath.bandcamp.com/album/trb-036-34-13-ambeliona>

A record by the pioneering British electronic music producer Aphex Twin, consisting of electronically controlled acoustic instrument sounds (piano, drums and other percussion):

Aphex Twin, *Computer Controlled Acoustic Instruments pt2* (2015)

<https://www.youtube.com/watch?v=VyNQenMGr90>

A record bringing environmental recordings closer to ambient electronic music and ASMR:

Crys Cole & Oren Ambarchi, *Hotel Record* (2017)

<https://orenambarchi.bandcamp.com/album/hotel-record>

Icelandic musician Björk, in her album *Utopia*, collaborates with Venezuelan producer Arca, and uses field recordings from Venezuela and Iceland, adding a special natural environment element in her compositions:

Björk, "Body Memory" (2017)

<https://www.youtube.com/watch?v=ncj50V97uG4>

Kate Carr composed this piece by recording everyday sounds in her neighbourhood of Brixton in London, trying to conserve memories of her local community during a time of constant pressure and change caused by gentrification:

Kate Carr, "I Ended Out Moving to Brixton" (2018)  
<https://katecarr.bandcamp.com/track/i-ended-out-moving-to-brixton>

The soundtrack of well-known TV series Chernobyl is based on field recordings made in an abandoned nuclear plant:

Hildur Gudnadóttir, "Bridge of Death" (2019)  
[https://www.youtube.com/watch?v=aM\\_HhU\\_CV44&feature=emb\\_title](https://www.youtube.com/watch?v=aM_HhU_CV44&feature=emb_title)

A composition of field recordings made in wind turbine parks:

Aino Tytti, *Slicing the Troposphere* (2019)  
<https://touchradio.org.uk/wp-content/uploads/sites/18/Aino-Tytti-Slicing-the-Troposphere-headphones-mix.mp3>

## SUGGESTIONS FOR FURTHER READING BOOKS, ARTICLE AND USEFUL LINKS

### Sound and listening

<https://digitalzoot.weebly.com/phiepsilon-2--deltaiota940deltaomicronsigmaeta-tauomicronupsilon-942chiomicronupsilon.html>

Lawrence English, "We Can See Someone Looking, But Can We Hear Someone Listening?":

<https://www.youtube.com/watch?v=FA9hkqFbx1k&feature=youtu.be>

Encyclopaedia Britannica online, article on musical sound:  
<https://www.britannica.com/science/musical-sound>

Sound and graphic scores in the Greek secondary school music syllabus:

[http://ebooks.edu.gr/ebooks/v/html/8547/2258/Mousiki\\_A-Gymnasiou.html-empl/index1\\_3.html](http://ebooks.edu.gr/ebooks/v/html/8547/2258/Mousiki_A-Gymnasiou.html-empl/index1_3.html)

### Acoustic ecology, soundwalks and soundscapes

R. Murray Schafer, *Ear Cleaning: Notes for an Experimental Music*, BMI Canada Limited, 1967

R. Murray Schafer, *The Soundscape*, Destiny Books, 1977

Jean-François Augoyard & Henri Torgue, *Sonic Experience: A Guide To Everyday Sounds*, McGill-Queen's University Press, 2006

Hildegard Westerkamp, "Soundwalking", 2001:

[https://www.hildegardwesterkamp.ca/writings/writingsby/?post\\_id=13&title=soundwalking](https://www.hildegardwesterkamp.ca/writings/writingsby/?post_id=13&title=soundwalking)

A. Lex Brown, Truls Gjestland & Danièle Dubois, "Acoustic Environments and Soundscapes", 2015

World Forum of Acoustic Ecology:

<https://www.wfae.net/>

### Field recording

Paul Virostek, *Field Recording: From Research To Wrap: An Introduction To Gathering Sound Effects*, Airborne Publications, 2013

Field recording: The practice and its possibilities:

<https://www.residentadvisor.net/features/2709>

<https://www.factmag.com/2014/11/18/a-beginners-guide-to-field-recording/>

<https://www.ableton.com/en/blog/art-of-field-recording/>

### Sound-based music

David Chapman, "Noise into Notes: BCMG Schools' Concerts Resource Pack", 2013:

<http://resources.bcmg.org.uk/assets/Uploads/Noise-into-Notes-pack-FINAL.pdf>

Leigh Landy, *Understanding the Art of Sound Organization*, MIT Press, 2007

Leigh Landy, *Making Music with Sounds*, Routledge, 2012

### Technology and Music Production

<https://www.ableton.com/en/blog/studio-as-an-instrument-part-1>  
<https://www.ableton.com/en/blog/studio-as-an-instrument-part-2>  
<https://www.ableton.com/en/blog/studio-as-an-instrument-part-3>

<https://techcrunch.com/2016/03/28/revisiting-brian-eno-the-studio-as-a-compositional-tool/>

[http://music.hyperreal.org/artists/brian\\_eno/interviews/downbeat79.htm](http://music.hyperreal.org/artists/brian_eno/interviews/downbeat79.htm)

<https://classicalbumsundays.com/how-has-the-recording-studio-affected-the-ways-in-which-music-is-created/>

<https://flypaper.soundfly.com/features/sampling-as-instrumentation-history-of-sampling/>

[https://en.wikipedia.org/wiki/Bedroom\\_production](https://en.wikipedia.org/wiki/Bedroom_production)

## Musical avant-gardes:

Jacques Attali, *Noise: The Political Economy of Music*, trans. Brian Massumi, University of Minnesota Press, 1977

John Cage, *Notations*, Something Else Press, 1969

Michel Chion, *Audio-vision: Sound on Screen*, trans. Claudia Gorbman, Columbia University Press, 1994.

Christoph Cox & Daniel Warner (eds.), *Audio Culture: Readings in Modern Music*, Continuum Books, 2002

Caleb Kelly (ed.), *Sound*, MIT Press, 2011

Michael Nyman, *Experimental Music: Cage and Beyond*, Cambridge University Press, 1999

Tim Rutherford-Johnson, *Music After the Fall: Modern Composition and Culture since 1989*, University of California Press, 2017

Joanna DeMers, *Listening through the Noise: The Aesthetics of Experimental Electronic Music*, Oxford University Press, 2010

Alex Ross, *The Rest is Noise: Listening to the Twentieth Century*, Farrar, Straus, and Giroux, 2007

Luigi Russolo, 'The Art of Noise' ("L' arte dei rumori"):  
<https://elsito.gr/index.php/arts/item/670-luigi-russolo-the-art-of-noise>

David Toop, *Ocean of Sound: Aether Talk, Ambient Sound and Imaginary Worlds*, Serpent's Tail, 1995.

David Toop, *Sinister Resonance: The Mediumship of the Listener*, Continuum, 2010

## IMAGE CREDITS

Figures 1.06 & 1.07

<http://www.preservationssound.com/2013/11/computer-music-the-80s/>

Figure 2.01 (a, b and c, respectively)

<https://www.objectlessons.org/ceremony-and-celebration-music/brass-gong-china/s80/a995/>

<https://www.x8drums.com>

[www.infokids.gr](http://www.infokids.gr)

Figure 2.14 (Zoom Digital Recorder)

<https://www.artmusic.gr/zoom-h1n-digital-recorder-stereo-handy-just-press-p-1801.html>

Figure 2.15 (Tascam Digital Recorder)

[https://www.thomann.de/gr/tascam\\_dr\\_40x.htm](https://www.thomann.de/gr/tascam_dr_40x.htm)

Figure 2.21 (USB cable)

<https://www.officeworks.com.au/shop/officeworks/p/1m-micro-usb-cable-cou2mb01>

Figure 2.22 (Memory card)

<https://platinumdatarecovery.com/blog/5-major-causes-of-sd-card-failure>

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