CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Environmental Sciences

Department of Land Use and Improvement

Urban and rural soundscapes and their impacts

DIPLOMA THESIS

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DIPLOMA THESIS ASSIGNMENT

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Landscape Engineering
Landscape Planning

Thesis title

Urban and Rural Soundscapes and Their Impacts

Objectives of thesis

The word “landscape” evokes various associations, usually with the environment ordifferent types of art: painting, sculpture or design, all of them being visual terms. It is not so often used to describe the context for sounds. Such a concept was first described in 1969 and since then has been functioning in the literature under the name “soundscapes”. Soundscape ecology was formed as a branch of science only a decade ago and few studies are available in this topic. This thesis research will attempt to contribute to soundscape research through the following aims and objectives:

- To determine to what extent soundscapes affect mood and well-being,
- To characterise how respondents’ feelings change after being exposed to a series of soundscapes,
- To determine how people react to each kind of soundscapes (biophony, geophony and anthrophony).

These questions focus on emotional welfare and hence answering them is very meaningful in the era of the ubiquitous mental health issues. The long-term goal of this work is to apply the findings to support the improvement of landscape planning techniques through the introduction of design solutions that would help in relaxation and reducing stress.

As such, this thesis research will test the following hypothesis: anthrophonic soundscapes impact on humans negatively, while soundscapes created by nature affect people in positive ways.

Methodology

The research is going to be carried out mostly as a desktop study, with the use of

numerous journal articles and books. Where possible, a site analysis might be done, too (onsite or through online datasets). Case studies will be chosen from different music genres, as well as different landscape types, to present a wide spectrum of examples and make the research as objective and unbiased as possible.

The student will conduct original research using a survey with recorded sounds from a variety of urban and rural contexts. The respondents will be asked to characterise their mood changes after hearing each of them using a scale from 1 to 5. They will also have an option to describe their feelings through open-ended questions.

The proposed extent of the thesis

65 pages

Keywords

biophony, geophony, anthrophony, urban and rural landscapes, urban planning

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Recommended information sources

KANG J. and SCHULTE-FORTKAMP B., 2016: Soundscape and the Built Environment. CRC Press, Boca Raton.

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The Diploma Thesis Supervisor

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Electronic approval: 29. 6. 2020

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Electronic approval: 29. 6. 2020

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Dean

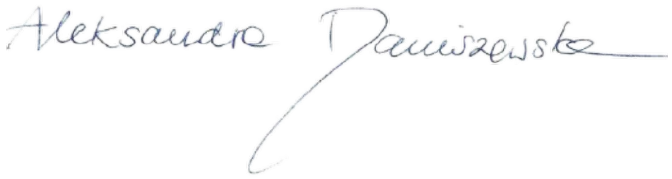
Prague on 29. 06. 2020

Author's declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by reference or acknowledgment, the work presented is entirely my own.
I have listed all literature and publications from which I have acquired information.

Prague, 30 June 2020

B.Sc. Aleksandra Daniszewska



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First of all, I would like to express my sincere thanks to doc. Peter Kumble, Ph.D., my supervisor, for his enthusiastic encouragement, guidance and academic support throughout all stages of this research work.

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Abstract

The following thesis is an attempt to contribute to the research on soundscapes. This concept has only been used in science for a few decades. By definition, a soundscape is a combination of acoustic sensations unique to a given environment and reliant on the listener's perception. There are 3 types of soundscapes with regards to their origin: biophony (vocalising organisms), geophony (ambient, non-biological sounds) and anthrophony (caused by human activity).

This thesis aims to examine changes occurring in emotions upon being exposed to a variety of soundscapes from different contexts and test the following hypothesis: anthrophonic soundscapes impact on humans negatively, while soundscapes created by nature affect people in positive ways. The research was based on the online survey, containing recordings of 15 soundscapes, 5 from each category, listed in random order. The respondents were asked to assess their mood transitions after hearing each track, using a scale and optional open-ended questions. The answers were then plotted on graphs and analysed.

The geophonic soundscapes received the best reception. The sounds produced by living organisms (both people and animals) were not as well perceived but were still more enjoyed than the sounds generated by the man-made machinery. Furthermore, as it turns out, a single soundscape generally does not evoke very strong feelings, however, the accumulation of soundscapes might impact on emotions to a great extent.

The findings of this thesis could be implemented in future urban planning practices. It is suggested that more water features should be present in cities as well as "quiet" zones for those willing to isolate themselves from crowds and noise. Other recommended solutions include "muting" artificial sounds and incorporation of soundmarks into the urban fabric.

Keywords: biophony, geophony, anthrophony, urban and rural landscapes, urban planning

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1. Introduction

Landscapes play an important role in human lives. They constitute a great resource for material, aesthetic, social and cultural benefits, and impact on people in various ways through the economy, tourism and art. Landscapes are characterised by specific physiognomy, that might be presented graphically (Bogdanowski et al., 1981). For these reasons, the word “landscape” usually evokes visual associations, such as photography or paintings. However, landscapes provide much more than only visual sensations. All 5 human senses might be involved in discovering landscapes. In fact, only using sight may even result in distancing one from their environment (Porteous and Mastin, 1985).

This thesis focuses on how people perceive landscapes through their acoustic features. Such a concept was first described by Michael Southworth in 1969 and since then has been functioning in the literature under the name “soundscapes”. The soundscape might be defined as an integration of sounds in a given environment, subject to the listener’s perception.

The following thesis aims to examine the extent to which soundscapes affect the listeners’ mood and test how their emotions change upon hearing a variety of soundscapes from different contexts.

2. Literature review

This chapter summarises the history of noise pollution studies and the current state of research on the topics of sonic environments and soundscapes, with regards to the most important definitions within these subjects. It also provides an overview of various soundscape models, proposed by the experts from the field of acoustic ecology.

2.1 Background

Although humanity has always been surrounded by landscape sounds, they were mostly neglected or omitted throughout history. It was not until 1962 when an American scientist and author Rachel Carson published her far-reaching, groundbreaking book “The Silent Spring”, and pointed these sounds out. The first chapter alone was rather intimidating: it described a small American town without any children or animals, which made it disturbingly quiet. "Over increasingly large areas of the United States," wrote Carson (1962) in her book, "spring now comes unheralded by the return of the birds. The early mornings are strangely silent where once they were filled with the beauty of bird song.". Even though it was only Carson’s fictional vision, not supported by any scientific research, the book gained her international popularity and a reputation as a natural scientist and an environmental activist (Carson and Lear, 1998). However, what is more important for the overall human welfare, is that “The Silent Spring” illustrated the significance of the sounds of nature and inextricably linked them to the environmental quality, which triggered the public debate about the urgency of nature protection for the sake of human health (Pijanowski et al., 2011b; Dybas, 2012).

Around the same time as the impact of “The Silent Spring” reached governments and societies around the world, the first noise regulation guidelines were issued. The 20th century was the period of the most intensive urbanisation in the history of the human race (Reba et al., 2016). With the population in cities rapidly growing and industries quickly developing, numerous new economical and environmental problems arose - including various types of mass pollution. Over time, scientists and policymakers began to notice their negative impacts, and initial attempts were made to ameliorate them, with air pollution having been tackled first

(Markham, 1994). Noise pollution, however, was considered a nuisance for a long time and only a very high sound level of noise was associated with potential danger to health (Ising and Kruppa, 2003). The first governmental statute, defining noise as pollution and regulating its amount, duration and source - the Noise Pollution and Abatement Act - was passed in the United States as late as in 1972. It established emission levels with regards to every type of noise, e.g. aircraft, vehicles, household equipment and appliances. Moreover, the Act put the local authorities in charge of noise mitigation while implementing new land-use plans. Since the Act was published, scientists have repeatedly collected evidence that accumulation of loud sounds poses similarly serious threats to public health as other forms of pollution (Münzel et al., 2018). Noisy environments might be responsible for hearing impairment, sleep disturbances, problems with communication, cardiovascular diseases, mental health issues, impaired task performance and negative social behaviour (Goines and Hagler, 2007). Furthermore, a growing body of literature suggests that noise is even more hazardous to school children, who are still developing and therefore are particularly prone to environmental stressors. Chronic exposure to noise may result in difficulties in concentrating, deficits in cognitive functions and diminished motivation (Stansfeld and Matheson, 2003). Additionally, as Blickley and Patricelli (2010) affirm, noise pollution menaces wildlife at both individual and population levels. The potential impacts include communication interference, shifts in predator - prey relations, elevated stress hormones and even regional extinction. All of these studies highlight the problem of noise and emphasise the necessity to abate it within the environment.

Both the aftermath of the publication of “The Silent Spring” and the discovery of noise pollution issues led to the growing interest in sonic environments. According to Merriam-Webster online dictionary, “sonic” means “utilizing, produced by, or relating to sound waves, or involving sound” and acoustic “relates to the sense or organs of hearing, to sound, or to the science of sounds”. These terms will be used synonymously in this thesis. Historically, the topic of acoustic environments was already studied in the past, however, as Coates (2005) indicates, the majority of the pre-existing work in this area refers to the periods before the 20th century. In other words, the lion’s share of

the research on environmental sounds discusses the times before the appearance of environmental science and environmental problems as we understand them nowadays.

Undoubtedly, these outdated findings are not of great use today, especially that modern researchers tend to adopt a holistic approach and cooperate between different branches of science and professions. This might have motivated R. Murray Schafer, a Canadian composer educated in both music and environment studies, to popularise the concept of soundscapes (Brooks et al., 2014). He noticed it was a common denominator that scholars from various areas of sonic studies had to deal with and described it comprehensively in his book “The Tuning of the World” (later republished as “The Soundscape: Our Sonic Environment and the Tuning of the World”) in 1977, creating a foundation for the research to follow.

2.2 Soundscapes

The suffix “-scape” refers to an “area, scene, space or view” (Zonneveld and Forman, 1990) and hence the term “soundscape” might be translated as “sounds occurring over an area” (Pijanowski et al., 2011a). It appeared for the first time in Southworth’s “The Sonic Environment of Cities” (1969). Soundscapes were employed there in the context of the built environment. Southworth surveyed deaf people in Boston in order to find out to what extent sounds help to form a “sonic identity” of a place. He desired to examine how sounds within urban landscapes affect people’s perception of areas, thus resulting in soundscapes having been initially associated with urban planning studies. Schafer (1977), by contrast, identified soundscapes as “the acoustical characteristics of an area that reflect natural processes.”. He recognised that sounds are ecological features of landscapes, therefore altering the meaning of the term “soundscape” and placing it within the field of landscape ecology (Pijanowski et al., 2011b). Schafer’s publication “The Tuning of the World” was a direct outcome of the World Soundscape Project, initiated by him during the late 1960s and early 1970s. It was an international

research project, the main goal of which was to provide a basic framework for the study of acoustic ecology through balancing relations between humans and sonic environments in positive ways (on the contrary to the previous negative anti-noise approach) (Truax and Barrett, 2011). The Project members embarked on two tours (in Canada and Europe), which culminated in the creation of the World Soundscape Library (Sonic Research Studio, 2019).

Since the Project was launched, various other authors have proposed their own definitions of soundscapes: as “an environment of sound (sonic environment) with emphasis on the way it is perceived and understood by the individual, or by a society” (Truax, 1980), “sonic, or acoustic, environment, with the receiver, or listener, at the centre of the sonic landscape” (Brown and Muhar, 2004), “the relationship between the ear, the human being, the sound environment and society” (Yang and Kang, 2005), “the totality of sounds that can be heard at any moment in any given place” (Rudi, 2011). Despite being differently worded (depending on the author, the environments are called sound, sonic or acoustic), all of these definitions indicate that the soundscape of a place is a person’s perceptual construct of the acoustic environment of that place (Brown et al., 2016 in Kang and Schulte-Fortkamp, 2016), with a special emphasis on the distinction between the origins of the concepts (the soundscape being entirely subject to a person’s perception and the acoustic environment being a universal physical phenomenon) (Brooks et al., 2014). This kind of approach contributed to the change in noise evaluation techniques. Former noise examinations were mostly based on physical measurement. The soundscape research shifted this paradigm so that human perception became more salient. Current soundscape studies rely on sound walks, questionnaires, interviews and recordings (Schafer, 1977; Brooks et al., 2014). However, some sources still present the term “soundscape” in a physical sense, as a synonym for the “acoustic environment” (e.g. “the overall sonic environment of an area” (Porteous and Mastin, 1985) or “the collection of sounds in a place” (Oliveros, 2005)). Nevertheless, the focus of this work is the people’s responses to various sounds and therefore the former approach will be adopted in the following paragraphs.

2.2.1 The division of soundscapes

In his analysis, Schafer (1977) introduced 3 key terms for describing the composition of soundscapes:

- Keynote sounds - analogically to music, keynotes dominate in a soundscape and define its specific sonic character. They are considered background sounds, yet they provide information about the context and type of a place, such as wind in natural environments or traffic in urban areas,
- Sound signals - also called “foreground sounds”, they represent all the sounds that are intended to catch attention and be listened to consciously. Examples include crosswalk signals, horns, bells etc.,
- Soundmarks - derived from the term “landmark”, soundmarks are sounds unique to and associated with particular areas, for instance, the Big Ben bell from Westminster Palace in London. They play a significant role in a local community acoustic life. Many soundmarks also belong to sound signals (Yang and Kang, 2005; Rudi, 2011).

What is more, Schafer suggested that soundscapes should be divided with regards to the density of signals and the amount of background noise that might be heard. He proposed two types of soundscapes:

- Hi-fi - represented by a low density of signals and very little or no background noise, hi-fi soundscapes allow listeners to hear sounds clearly and with a lot of detail. Hi-fi frequencies are found in rural landscapes much more than they are in cities,
- Lo-fi - opposite to hi-fi soundscapes, lo-fi soundscapes are characterised by a high density of signals, which are often covered up by too many sounds, and the presence of broadband noise. It is difficult for a listener to identify single sounds, as all of them are compact, and any distant sounds are almost impossible to hear.

Krause (1987) redefined this taxonomy, focusing on the sources of sounds. He presented the following division:

- Biophony - the composition of biological sounds produced by vocal organisms, such as singing birds or barking dogs,
- Geophony - the series of ambient non-biological sounds, originating from the geophysical environment, e.g. wind, waterfalls or flowing water.

In addition to these two categories, Pijanowski et al. (2011b) introduced the third part of the acoustic spectrum - anthrophony. Anthrophony is the combination of sounds generated by humans and human-made objects (both stationary and moving).

Other forms of soundscapes division might be found in literature, for example, the immediate and distant soundscapes (extending to 20‑200 metres and 15-20 kilometres from the receiver, respectively) (Ohlson, 1976). However, the biophony - geophony - anthrophony model is the most objective and the most convenient to implement, and hence will be used in this thesis.

2.2.2 The current state of research

In his pioneering work, Schafer (1977) expressed his hope that the soundscape studies could provide a base for a new discipline, merging acoustics, psychology, social sciences and the arts. This initiated the field of acoustic ecology. Brown et al. (2016) expanded the idea by suggesting that the sonic environments should be of interest in both urban and natural landscape planning. However, mostly negative aspects of soundscapes have been taken into account by researchers so far, leaving all potential positive uses ignored. General sounds usually go unnoticed unless they suddenly become annoying and gain the city planners' attention in the form of complaints (Aiello et al., 2016). Accordingly, although the sound is a key element of any environment, its cartographic depiction comes down to noise mapping in urban and suburban areas (Papadimitriou et al., 2009). Pleasant sounds are mainly overlooked in the literature, despite having been proven to impact on human health, emotional state and decision-making processes (Gage et al., 2004; Aiello et al., 2016). Acoustic ecology is therefore considered as complementary to ecological

studies rather than being part of them (Pijanowski et al., 2011b).

Bioacoustics is another research area related to soundscapes. Its main concern is the communication between animals from a physical and evolutionary point of view (Fletcher, 2007 in Rossing, 2007). This concept was also described by Gage et al. (2004), whose intention was to utilise soundscapes for characterising wildlife and biodiversity. As long as bioacoustics constitutes a valuable supplement to the overall soundscape studies, it is concentrated predominantly on individual species (Pijanowski et al., 2011b), which makes it a very limited reference to this thesis.

2.2.3 Soundscape ecology

Pijanowski et al. (2011b) realised that no consistent theory about the ecological importance of all sounds generated in a landscape was ever developed. This led to the creation of the new field called soundscape ecology - a compendious study of soundscapes, built from spatial ecology, psychoacoustics, bioacoustics and acoustic ecology (Figure 1). Each of these disciplines contributed to the soundscape ecology through bringing appropriate patterns, terminologies and research techniques. Currently, the main focus of soundscape ecologists is to use soundscapes to comprehend the ecological features of landscapes. Additionally, more research is conducted to test whether changes in natural sounds may be treated like signals, warning about the presence of pollution or upcoming climatic hazards (Dybas, 2012).

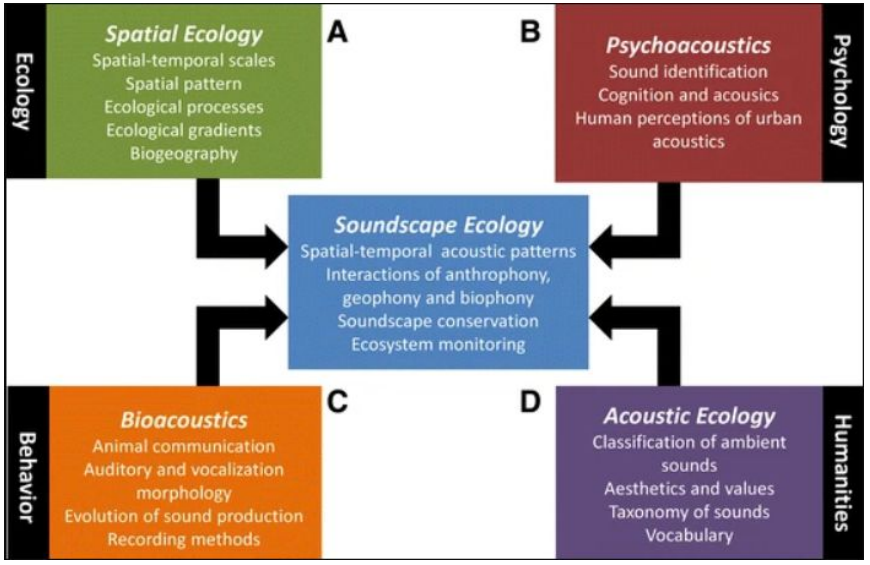

Figure 1: Foundations of the soundscape ecology (Pijanowski et al., 2011a).

3. Thesis aims and objectives

The soundscape ecology has only been regarded as a field of science for the past decade. This results in a limited number of studies available on the topic of soundscapes. Consequently, this phenomenon has been barely tested in relation to other branches of science, technology, society and the arts, where it could be very advantageous and profitable. This thesis is, therefore, an attempt to contribute to the soundscape research through the following aims and objectives:

- To find out to what extent soundscapes affect mood and well-being,
- To characterise how respondents' feelings change after being exposed to a series of soundscapes,
- To determine how people react to each kind of soundscapes (biophony, geophony and anthrophony).

These questions focus on emotional welfare and hence answering them is very meaningful in the era of the ubiquitous mental health issues. The long-term goal of this work is to use its findings to support the improvement of landscape planning techniques through the introduction of design solutions that would help in relaxation and reducing stress in a variety of environments, but with the emphasis put on urban spaces.

The study was designed to test the following hypothesis: anthrophonic soundscapes impact on humans negatively, while soundscapes created by nature affect people in positive ways.

The negative impact is understood as an increase in negative emotions and feelings as a direct outcome of hearing the soundscape. The negative emotions might be defined as "unpleasant or unhappy emotions which are evoked in individuals to express a negative affect towards an event or person" (Pam, 2013). Analogously, the positive impact is understood as an increase in positive emotions, which are defined as "pleasant or desirable situational responses (...), distinct from pleasurable sensation and undifferentiated positive affect" (Cohn and Fredrickson, 2009 in Lopez and Snyder, 2009).

4. Methodology

This thesis was written on the grounds of the original research, based on an online survey containing recordings of sounds from a variety of locations. I chose to include 5 different soundscapes from each category (biophony, geophony, anthrophony), resulting in 15 tracks in total. My decision was motivated by the fact that this number gives a satisfactory cross-section of different sounds from both urban and rural contexts while ensuring the survey stays within a reasonable extent. In this case, it is approximately 15 minutes, which is an optimal survey length (Revilla and Ochoa, 2017), as after this time many respondents tend to lose their interest and abandon the survey (Chudoba, n.d.).

The soundscape subjects for the survey were picked subjectively, yet maintaining diversity. The selection procedure was based on the soundscape examples mentioned in the literature (such as Pijanowski et al., 2011a). I also tried to include soundscapes with both a single type of sound prevailing, as well as the ones that are composed of different, similarly intensive sounds. The final sound themes chosen for the project are presented in Table 1.

I tried to record as many original tracks as possible for this research project. This resulted in sounds no. 6, 7, 8, 11, 12, 13, 14, 15 having been recorded by me using the mobile application Recorder on the Xiaomi Redmi Note 7 phone between December 2019 and January 2020. However, due to my restricted mobility and the limited accessibility of fauna and flora in wintertime, it was impossible to capture some of the chosen sounds. I solved this problem by extracting the audio from various videos I had recorded in the past. All of them were created using the YI 4K Plus camera. The tracks in my set, therefore, come from several locations (Figures 2 - 7).

ID	Soundscape theme	Soundscape type
1.	Buzzing insects in a meadow	Biophony
2.	Crickets / cicadas	
3.	Vocalising countryside livestock	
4.	Forest fauna	
5.	Croaking frogs	
6.	Calm wind moving leaves	Geophony
7.	Light rain hitting the impervious surface	
8.	Flowing river	
9.	Calm waves hitting the shore	
10.	Strong wind in an open space	
11.	Cars passing by	Anthrophony
12.	People in a busy tourist spot	
13.	Ringing church bells	
14.	Construction site noises	
15.	Public transportation	

Table 1: The selection of soundscape subjects chosen for the research project.

Sounds no. 12, 13 and 15 were recorded in Prague city centre, next to St. Gallen's church, on the Charles Bridge and at the Staroměstská metro station, respectively. Sounds no. 7, 8 and 14 come from Prague 6. Track no. 8 is the recording of the Šárecký Potok, just before it joins the Vltava river by the V Podbabě bus stop. Tracks 7 and 14 were captured in close proximity to the Kamýcká street. Overall, Prague as a huge metropolis constitutes an ideal source of urban soundscapes, hence almost all the human-induced sound combinations were recorded there. As for the tracks 7 and 8 - sounds of nature - it was the sites' easy accessibility that determined their selection. Sounds no. 1, 5, 6 and 11 were recorded in Kleosin, a village in north-eastern Poland by the city of Białystok. Track 11 is the sound of vehicles on the 4 lanes section of the voivodeship road 678, which is one of the major roads in the region, a transit route and an entry to the city. All of that produces heavy traffic, which is a great background for the recording of passing cars and a reason why the location was chosen for this purpose. The area is surrounded by forests and meadows with rich fauna that provided satisfactory material for the recordings of naturally induced soundscapes. Tracks 1, 5 and 6, however, were derived from videos captured there prior to the research period in wintertime. Sounds no. 3 and 4 also come from the videos made in north-eastern Poland, in the Białowieża village located in the centre of the Białowieża National Park protecting the oldest European forest and full of unique animal species. The extraordinary biodiversity of the place and the sonic possibilities it offers decided on its inclusion in the research. The audio for the sounds no. 2 and 9 was taken from the videos recorded in the harbour in Zakynthos town, on the Greek island of the same name. This coastal site is inhabited by thousands of loud cicadas, typical for that part of the world, but also includes a small pier, which provides convenient access to water. The combination of these factors came up with the location of the recording. Finally, track no. 10 was extracted from the video captured in southern Iceland, in the Fjaðrárgljúfur area, which is a vast empty space, typified by extremely strong wind gusts, hence presenting an ideal setting for the recording of the sounds of wind.

Figure 2: The location of soundscapes 12, 13 and 15. Prague, Czech Republic (own work, data source: Worlds Street Map, ESRI).

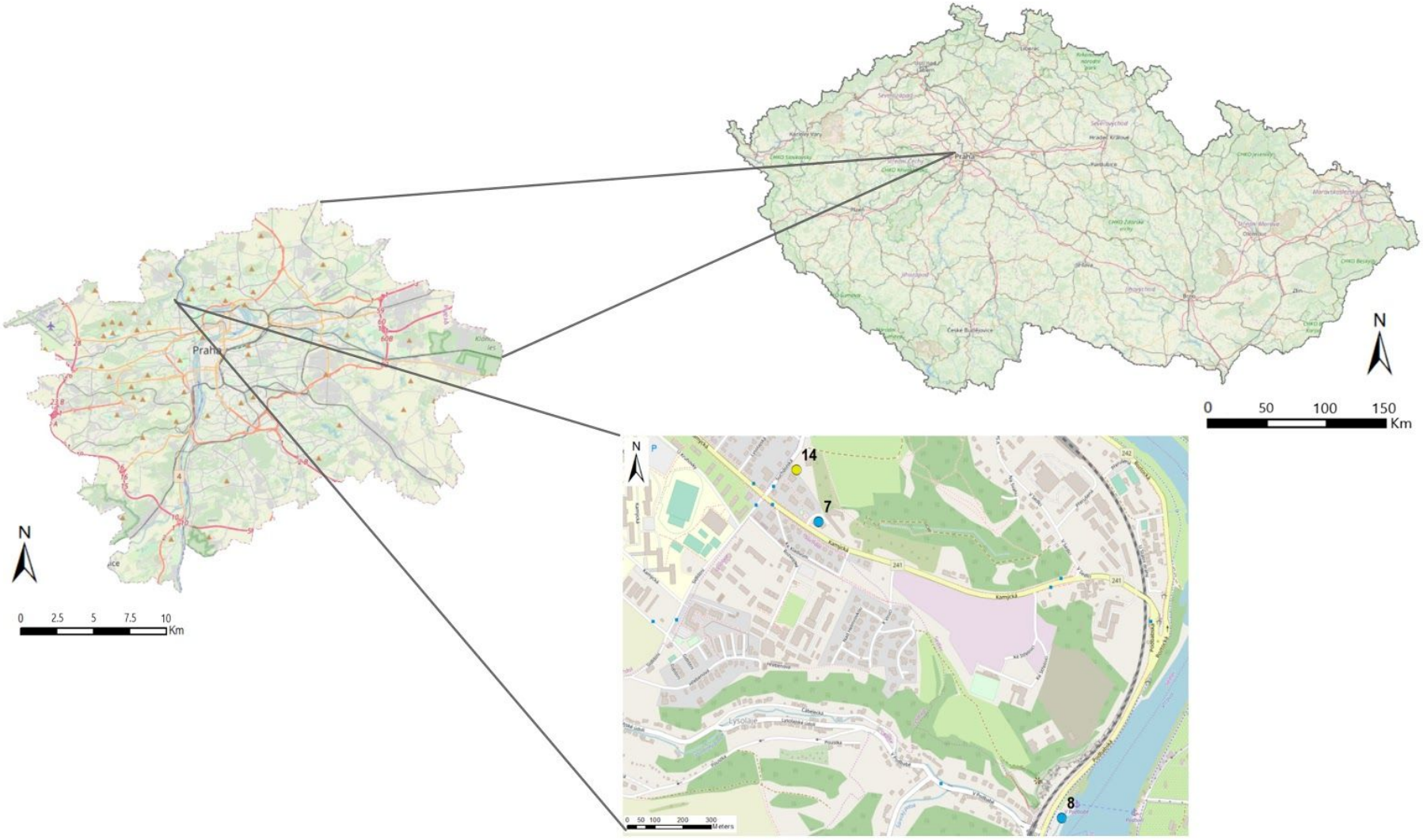

Figure 3: The location of soundscapes 7, 8 and 14. Prague, Czech Republic (own work, data source: Worlds Street Map, ESRI).

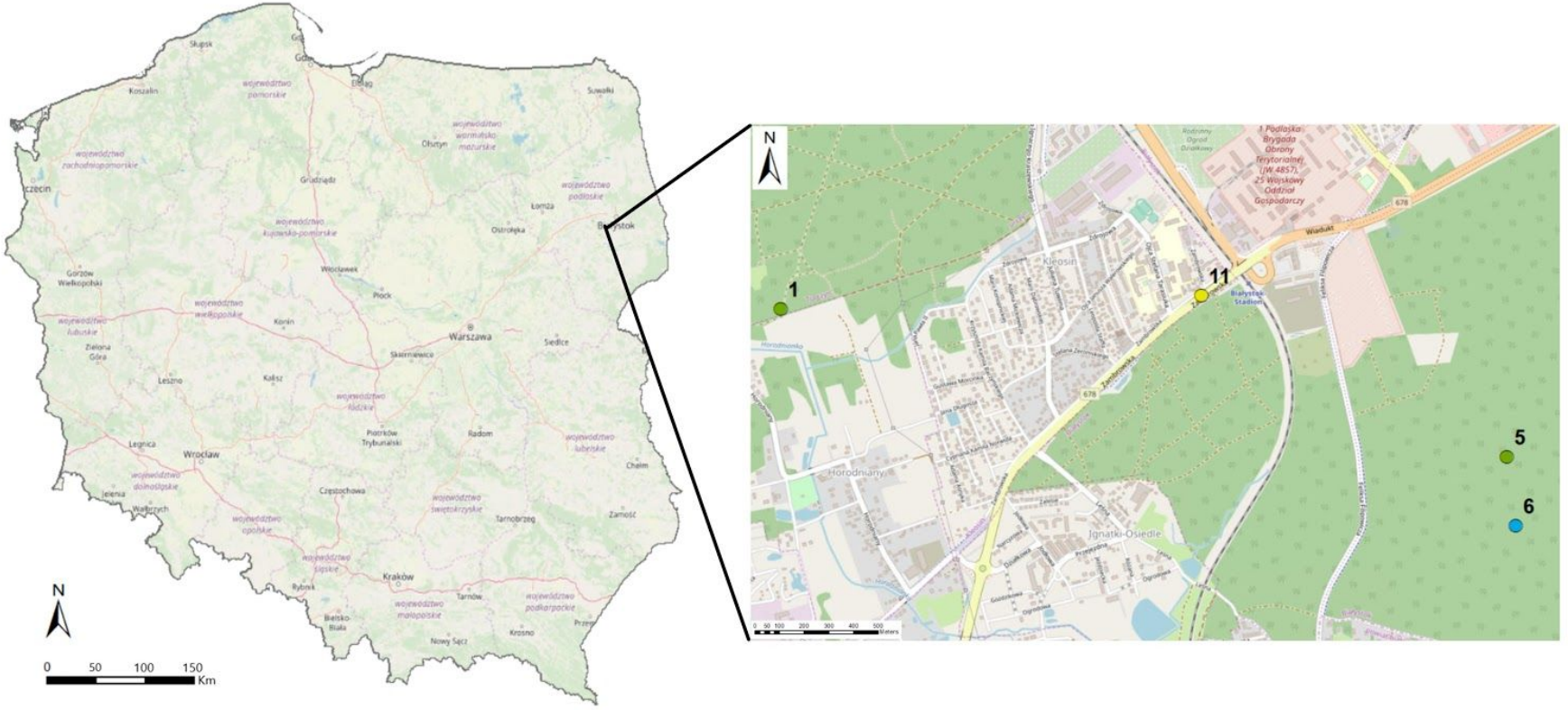

Figure 4: The location of soundscapes 1, 5, 6 and 11. Kleosin, Poland (own work, data source: Worlds Street Map, ESRI).

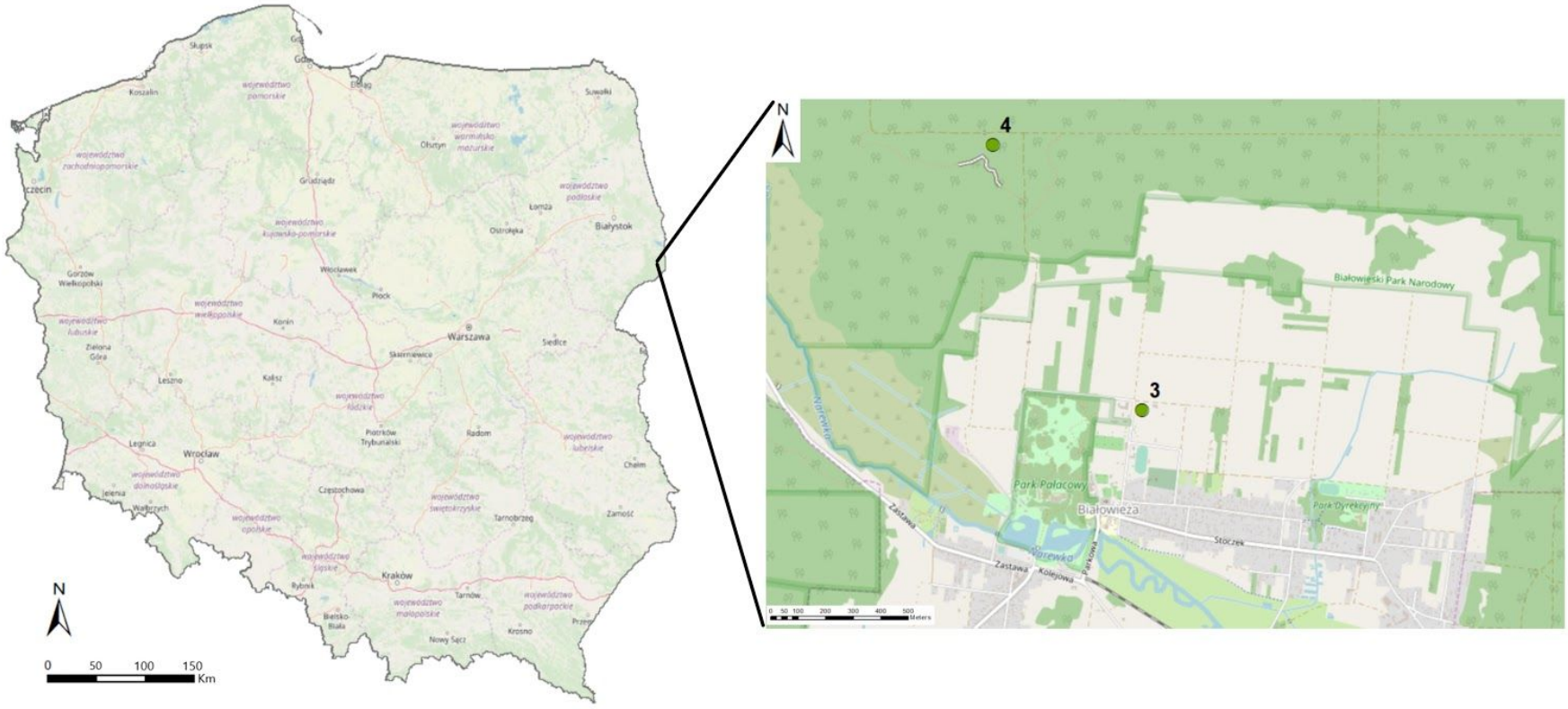

Figure 5: The location of soundscapes 3 and 4. Białowieża, Poland (own work, data source: Worlds Street Map, ESRI).

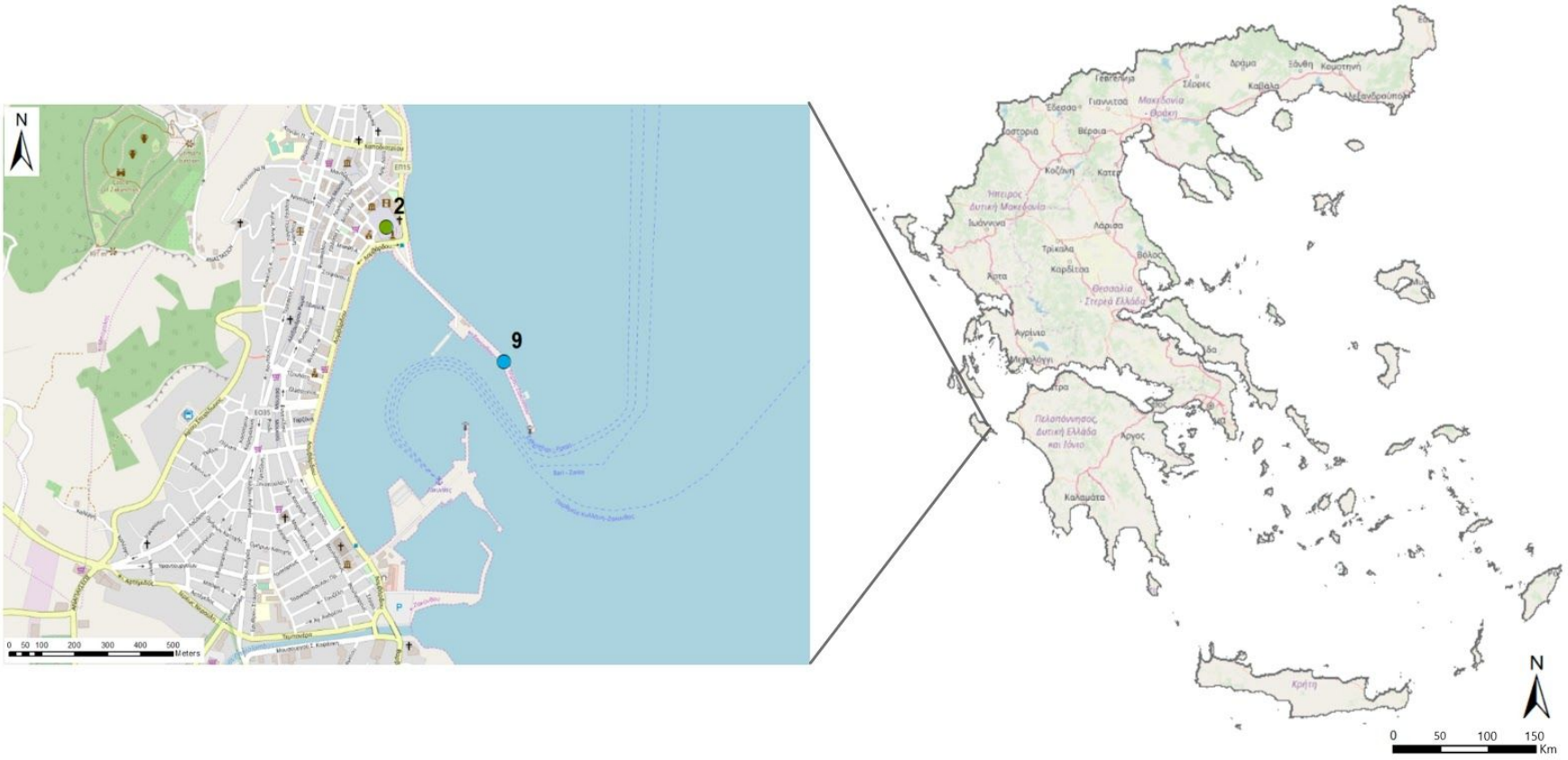

Figure 6: The location of soundscapes 2 and 9. Zakynthos, Greece (own work, data source: Worlds Street Map, ESRI).

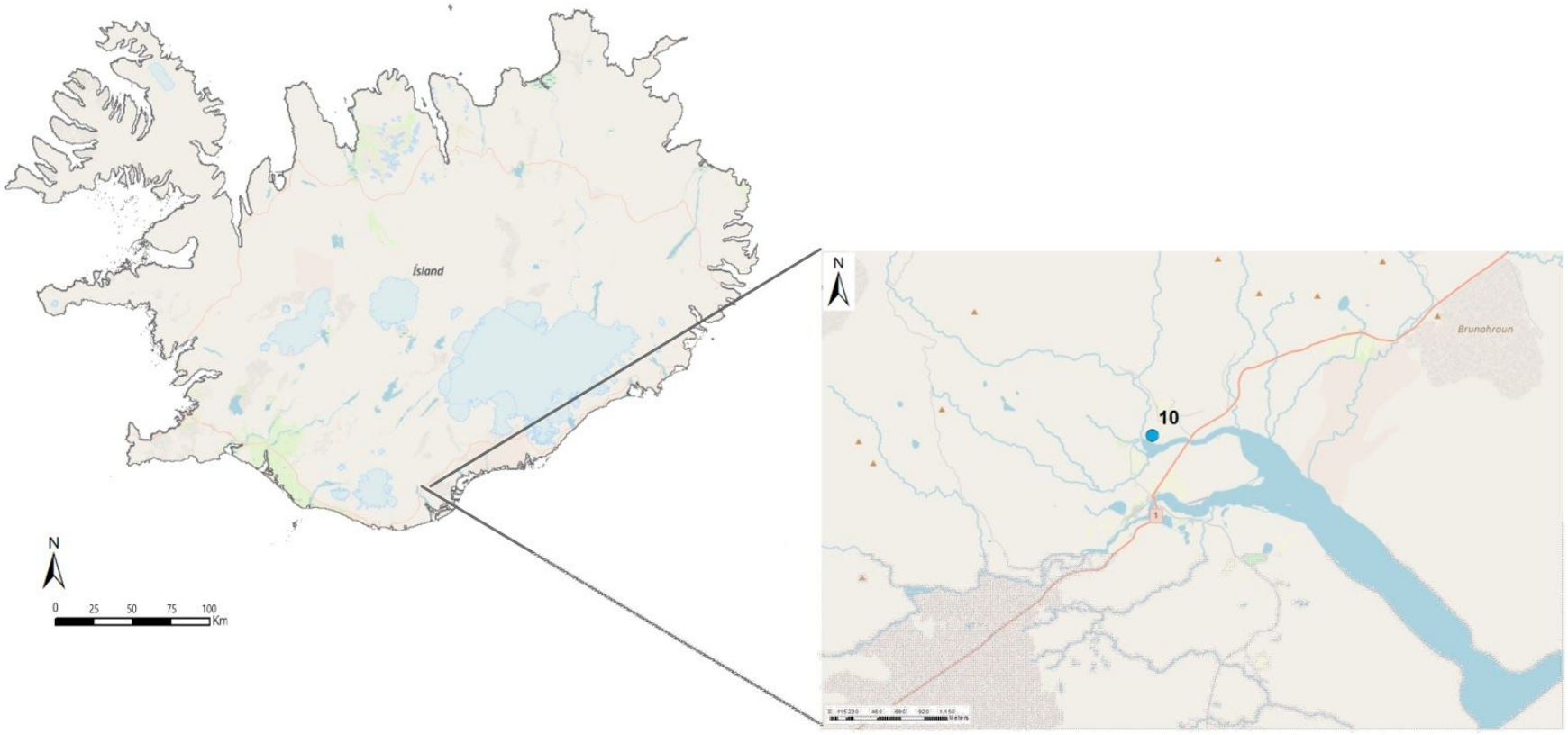

Figure 7: The location of soundscape 10. Fjaðrárgljúfur, Iceland (own work, data source: Worlds Street Map, ESRI).

All of the tracks were converted into an MP4 format using an online converter tool (www.oneimagevideo.com). I added an identical, neutral background in each of them to minimise any bias, and uploaded to YouTube (youtube.com). All of these files were between 18 and 23 seconds long to give participants enough time to listen to the soundscapes properly and in detail. Moreover, before compiling a survey, I decided to randomise the order of the recordings to imitate real-life acoustic conditions, where one experiences a combination of different soundscapes, and to avoid the accumulation of sounds of one type, which could lead to tendentious responses. To do that I used an online random number generator (www.random.org/sequences). Table 2 shows the new sequence I obtained, which will be used in this thesis from now on.

I prepared the online survey on the Google Forms platform. This allowed me to link the questions to the recordings of soundscapes previously uploaded to YouTube. It also assured simplicity of the interface and made the survey easily shareable and accessible for the respondents, without the necessity to register before completing it, as this kind of practice usually leads to the form abandonment (New, n.d.).

The survey contained 33 questions (see Appendix 1). The first 3 ones were standard demographic questions about age, gender and place of residence. Their purpose was to introduce the participants to the survey format. Then the respondents were asked to listen to the recordings in the order presented in Table 2. After each track, the respondents were requested to assess how it made them feel. For this purpose, a list with names of emotional states was provided and the task was to rate each of them on a scale from 1 to 5, where 1 was “not at all” and 5 was “very much” (Figure 8).

Old ID	New ID	Sound theme
11.	1.	Cars passing by
5.	2.	Croaking frogs
10.	3.	Strong wind in an open space
13.	4.	Ringing church bells
9.	5.	Calm waves hitting the shore
2.	6.	Crickets / cicadas
12.	7.	People in a busy tourist spot
8.	8.	Flowing river
4.	9.	Forest fauna
15.	10.	Public transportation
1.	11.	Buzzing insects in a meadow
7.	12.	Light rain hitting the impervious surface
3.	13.	Vocalising countryside livestock
14.	14.	Construction site noises
6.	15.	Calm wind moving leaves

Table 2: The order in which the soundscapes were presented to the respondents. Green background indicates soundscapes of biophonic origin, blue background - geophonic origin and yellow background - anthrophonic soundscapes.

The list included the following feelings: relaxed, stressed, happy, scared, annoyed, energetic, upset, calm and anxious. My motive was to include both positive and negative emotions, as well as both energised and enervated feelings. The selection was thus based on the Thayer's 2-D emotion model, which, in addition to its objectivity and inclusivity, finds its wide use in musical research and hence is a relevant choice for this study (Grekow and Ras, 2009 in Rauch et al., 2009).

Furthermore, the respondents were allowed to describe their feelings using their own words in open-ended questions (Figure 9). While this was expected to provide me with more subjective answers and more data to hypothesise about, I decided to make these questions optional (in contrast to the matrix questions, which were required), as people like to take cognitive shortcuts when completing a survey (Petti, 2009) and so requesting longer written responses could have resulted in an increased abandonment rate. Finally, after reviewing the structure of the questions, the survey was made public and shared on social media.

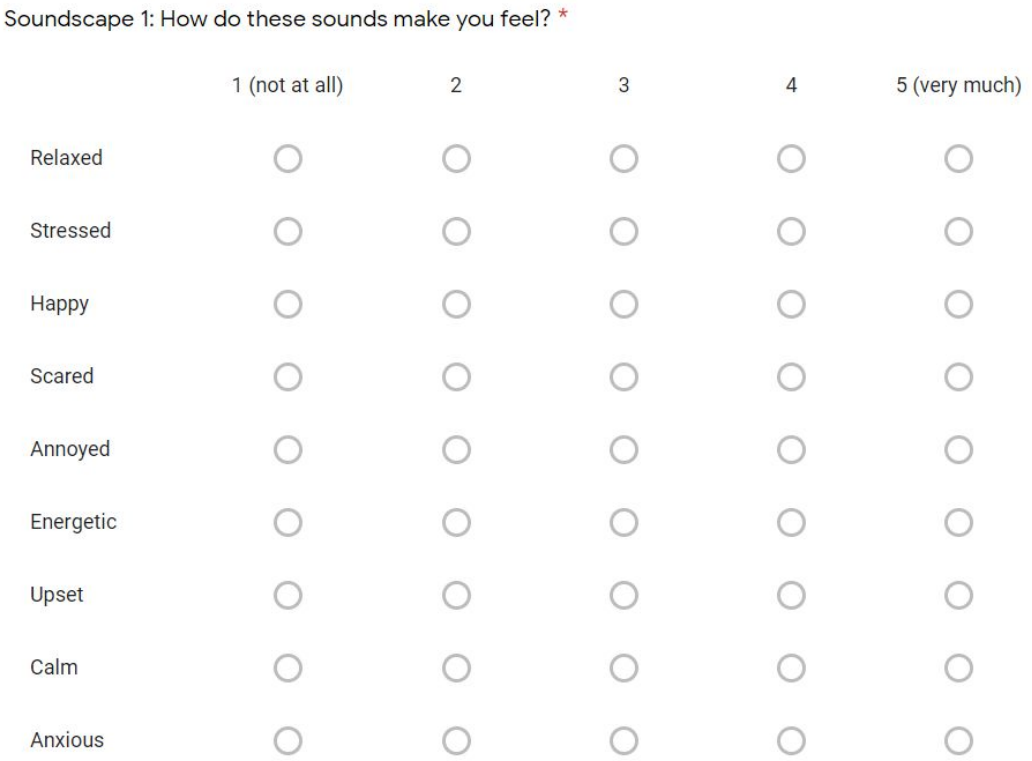

Figure 8: The matrix question.

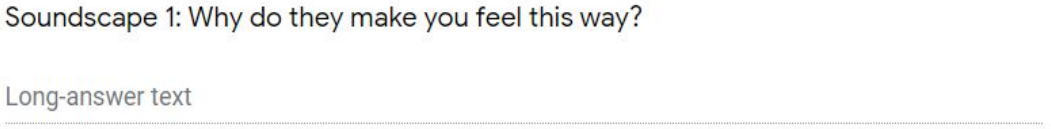

Figure 9: The open-ended question.

5. Results

The survey was completed by 77 respondents in the period between 3 February and 7 March 2020. 31 of them were between 25 and 34 years old, which constituted 40.3% of all responses and was the dominant group (Figure 10). The second-largest group of informants - 19 - was between 18 and 24 years old (24.7% of all submitted questionnaires). The third biggest age group taking part in the study was between 35 and 44 years old (11 people, 14.3% of all respondents). 8 participants in the age between 45 and 54 completed the survey, constituting 10.4% of the subjects. The oldest age groups: 55 - 64 and 65+ were represented by 5 and 3 respondents, making 6.5% and 3.9% of all responses, respectively.

Gender-wise, 42 (54.5%) participants identify as female, 33 (42.9%) as male and 2 (2.6%) as other (Figure 11).

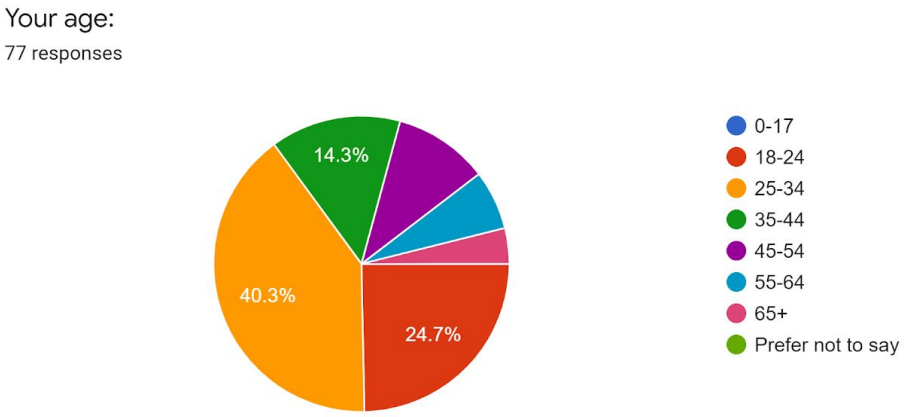

Figure 10: The age distribution among the survey respondents.

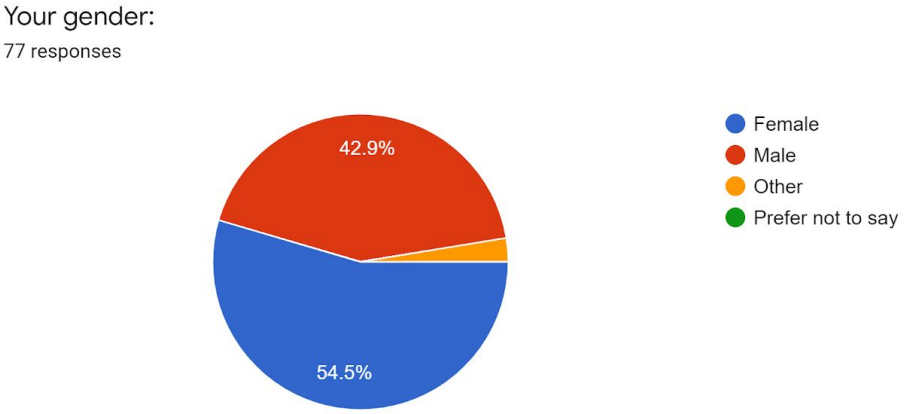

Figure 11: The gender distribution among the survey respondents.

35 respondents (being 45.5% of the entire study group) live in a big city (500 000+ inhabitants) (Figure 12). The second most dominant group was represented by 29 people (37.7%), who live in a medium city (100 001 - 500 000 inhabitants). 8 participants (10.4% of all completed surveys) live in a small city (20 000 - 100 000 dwellers). 3 town inhabitants (between 1 000 and 20 000 people) constituted 3.9% of all respondents. The smallest group (2.6%) was represented by 2 participants who live in a village (up to 1 000 dwellers).

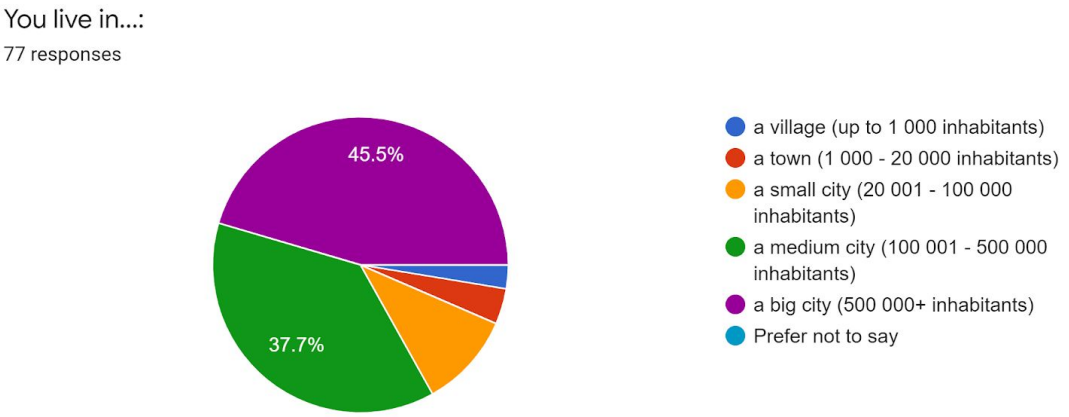

Figure 12: The residency distribution among the survey respondents.

All of the questions above included a “Prefer not to answer” option, yet none of the respondents chose it.

The answers from the matrix questions were plotted on histograms (Figures 13 - 27). By looking at these graphs, one may observe that:

- Responses are most uniform in questions about geophonic soundscapes, being those associated with pleasing sounds of nature. The majority of emotions were assessed as 1 (not at all) by most participants and for some of them answers 4 and 5 were not chosen at all,
- Most differentiated responses were given in questions about anthrophonic soundscapes - those caused by or created by human activity. Although in many cases option “1 - not at all” is dominant, columns representing other choices (mainly 2 and 3) occupy a significant portion of the graphs, too,
- No consistent pattern is visible in the biophonic questions (soundscapes produced by living

organisms). The results obtained from questions about soundscapes 2 (croaking frogs), 6 (crickets) and 9 (forest fauna) show the same uniformity as the responses to geophonic questions with option 1 being dominant, while the responses to soundscapes 11 (buzzing insects) and 13 (sounds of livestock) look similar to those of the anthrophony questions, with all options being visibly noticeable on the graphs,

- Relatively few respondents chose the option “5 - very much” in any of the questions and those who did picked it mostly to describe positive emotions.

5.1 Biophony

The biophonic questions gave very intriguing outcomes. Responses to soundscapes 2 (croaking frogs), 6 (crickets) and 9 (forest fauna) followed a similar trend as those to the geophonic soundscapes: the overwhelming dominance of option “1 - not at all” chosen to rate the following emotions: “stressed”, “scared”, “annoyed”, “upset” and “anxious” and almost equally distributed responses under “relaxed”, “happy” and “calm”, with the option “5 - very much” being prevailing amongst the responses to these feelings in the question about soundscape 6. On the other hand, the reactions to the soundscapes 11 (buzzing insects) and 13 (sounds of livestock) were much more diverse, comparable to the pattern present in the answers to the anthrophonic questions. Although option 1 is dominant in the majority of cases, all of them occupy significant portions of the graphs. Moreover, option 3 is very conspicuous, which might be a result of the respondents' mixed feelings after listening to these soundscapes.

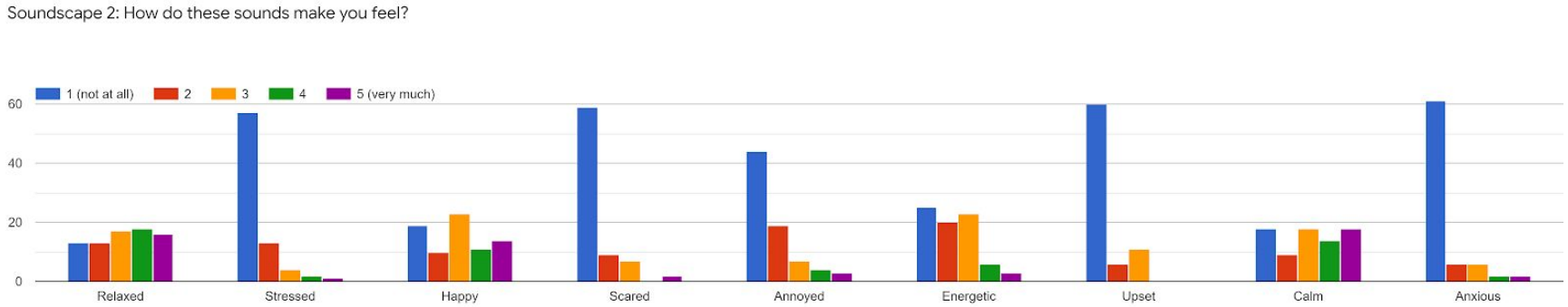

Figure 13: Graph presenting the distribution of responses to soundscape 2.

5.1.1 Soundscape 2

Soundscape 2 is a recording of vocalising organisms on a forest clearing. Multiple croaking frogs constitute the keynote sound, but a tweeting bird may also be noticed. This track is rather irregular.

After hearing this soundscape, the respondents assessed it in the following way (Figure 13):

“Relaxed” was rated as 1 - not at all by 13 (17%) respondents, as 2 by 13 (17%) respondents, as 3 by 17 (22%) respondents, as 4 by 18 (23%) respondents and as 5 - very much by 16 (21%) respondents.

“Stressed” was rated as 1 - not at all by 57 (74%) respondents, as 2 by 13 (17%) respondents, as 3 by 4 (5%) respondents, as 4 by 2 (3%) respondents and as 5 - very much by 1 (1%) respondent.

“Happy” was rated as 1 - not at all by 19 (25%) respondents, as 2 by 10 (13%) respondents, as 3 by 23 (30%) respondents, as 4 by 11 (14%) respondents and as 5 - very much by 14 (18%) respondents.

“Scared” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 9 (12%) respondents, as 3 by 7 (9%) respondents and as 5 - very much by 2 (3%) respondents.
“Annoyed” was rated as 1 - not at all by 44 (57%) respondents, as 2 by 19 (25%) respondents, as 3 by 7 (9%) respondents, as 4 by 4 (5%) respondents and as 5 - very much by 3 (4%) respondents.
“Energetic” was rated as 1 - not at all by 25 (32%) respondents, as 2 by 20 (26%) respondents, as 3 by 23 (30%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 3 (4%) respondents.
“Upset” was rated as 1 - not at all by 60 (78%) respondents, as 2 by 6 (8%) respondents and as 3 by 11 (14%) respondents.
“Calm” was rated as 1 - not at all by 18 (23%) respondents, as 2 by 9 (12%) respondents, as 3 by 18 (23%) respondents, as 4 by 14 (18%) respondents and as 5 - very much by 18 (23%) respondents.
“Anxious” was rated as 1 - not at all by 61 (79%) respondents, as 2 by 6 (8%) respondents, as 3 by 6 (8%) respondents, as 4 by 2 (3%) respondents and as 5 - very much by 2 (3%) respondents.

Option 1 is the dominant response to all negative emotions (“stressed”, “scared”, “annoyed”, “upset”, “anxious”) under this soundscape. It is also prevailing among the responses to “energetic”, although not as significantly because option 2 and 3 were selected almost as many times (20 and 23 compared to 25 participants who chose option 1). Positive emotions - “relaxed”, “happy” and “calm” - generated nearly equally distributed answers.

Numerous participants pointed out that this soundscape is relaxing and calming because it is composed of natural sounds. Some of the answers also refer to summertime as an association with this soundscape and a reason for its positive reception. Nevertheless, few respondents claimed the track was too intensive and too noisy to enjoy.

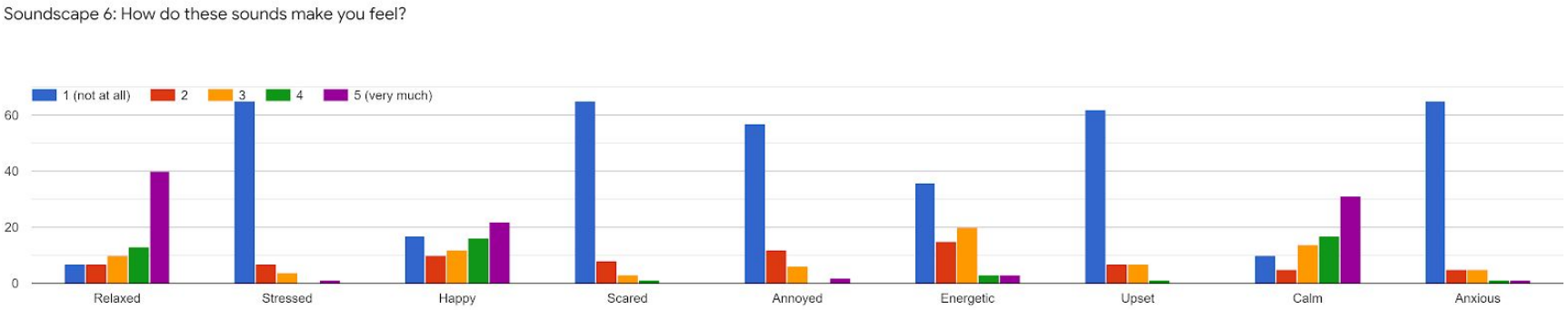

Figure 14: Graph presenting the distribution of responses to soundscape 6.

5.1.2 Soundscape 6

Soundscape 6 is a record of chirping crickets and cicadas, which make the keynote sound, on a hot summer night. A very distant bird's peep might be picked up. The sound is very uniform, soft and monotone.

After hearing this soundscape, the respondents assessed it in the following way (Figure 14):

"Relaxed" was rated as 1 - not at all by 7 (9%) respondents, as 2 by 7 (9%) respondents, as 3 by 10 (13%) respondents, as 4 by 13 (17%) respondents and as 5 - very much by 40 (52%) respondents.

"Stressed" was rated as 1 - not at all by 65 (84%) respondents, as 2 by 7 (9%) respondents, as 3 by 4 (5%) respondents and as 5 - very much by 1 (1%) respondent.

"Happy" was rated as 1 - not at all by 17 (22%) respondents, as 2 by 10 (13%) respondents, as 3 by 12 (16%) respondents, as 4 by 16 (21%) respondents and as 5 - very much by 22 (29%) respondents.

"Scared" was rated as 1 - not at all by 65 (84%) respondents, as 2 by 8 (10%) respondents, as 3 by 3 (4%) respondents and as 4 by 1 (1%) respondent.

“Annoyed” was rated as 1 - not at all by 57 (74%) respondents, as 2 by 12 (16%) respondents, as 3 by 6 (8%) respondents and as 5 - very much by 2 (3%) respondents.
“Energetic” was rated as 1 - not at all by 36 (47%) respondents, as 2 by 15 (19%) respondents, as 3 by 20 (26%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 3 (4%) respondents.
“Upset” was rated as 1 - not at all by 62 (81%) respondents, as 2 by 7 (9%) respondents, as 3 by 7 (9%) respondents and as 4 by 1 (1%) respondent.
“Calm” was rated as 1 - not at all by 10 (13%) respondents, as 2 by 5 (6%) respondents, as 3 by 14 (18%) respondents, as 4 by 17 (22%) respondents and as 5 - very much by 31 (40%) respondents.
“Anxious” was rated as 1 - not at all by 65 (84%) respondents, as 2 by 5 (6%) respondents, as 3 by 5 (6%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.

The respondents rated all the negative feelings as 1 almost unanimously. It is also a prevailing option among the responses to “energetic”, however, bars representing options 2 and 3 are similarly significant. It appears that the participants felt mostly relaxed, happy and calm after hearing this soundscape, as option 5 is dominant in these sections (especially among the responses to “relaxed”, where it was selected more times than all the other options combined).

As in the previous soundscape, the participants repeatedly stated it was the natural origin of the sounds that was relaxing and calming. Phrases like “the sound of the night”, “it reminds me of summer evenings” and “chill out sounds” are prevailing amongst the answers to the open-ended question. On the other hand, several respondents declared that it was this relationship with the night and darkness that made them feel uncomfortable and anxious.

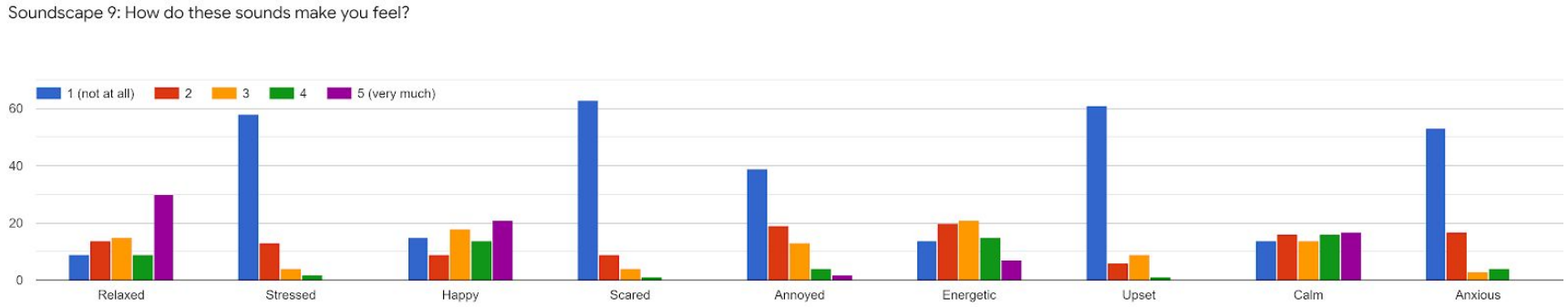

Figure 15: Graph presenting the distribution of responses to soundscape 9.

5.1.3 Soundscape 9

Soundscape 9 is a recording of forest fauna. One may easily catch the local sound signals, such as chirps, twitters and hoots made by various birds. A swarm of buzzing insects is also audible. The track is fairly intensive due to the high pitch of the birds' sounds.

After hearing this soundscape, the respondents assessed it in the following way (Figure 15):

"Relaxed" was rated as 1 - not at all by 9 (12%) respondents, as 2 by 14 (18%) respondents, as 3 by 15 (19%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 30 (39%) respondents.

"Stressed" was rated as 1 - not at all by 58 (75%) respondents, as 2 by 13 (17%) respondents, as 3 by 4 (5%) respondents and as 4 by 2 (3%) respondents.

"Happy" was rated as 1 - not at all by 15 (19%) respondents, as 2 by 9 (12%) respondents, as 3 by 18 (23%) respondents, as 4 by 14 (18%) respondents and as 5 - very much by 21 (27%) respondents.

"Scared" was rated as 1 - not at all by 63 (82%) respondents, as 2 by 9 (12%) respondents, as 3 by 4 (5%) respondents and as 4 by 1 (1%) respondent.

“Annoyed” was rated as 1 - not at all by 39 (51%) respondents, as 2 by 19 (25%) respondents, as 3 by 13 (17%) respondents, as 4 by 4 (5%) respondents and as 5 - very much by 2 (3%) respondents.
“Energetic” was rated as 1 - not at all by 14 (18%) respondents, as 2 by 20 (26%) respondents, as 3 by 21 (27%) respondents, as 4 by 15 (19%) respondents and as 5 - very much by 7 (9%) respondents.
“Upset” was rated as 1 - not at all by 61 (79%) respondents, as 2 by 6 (8%) respondents, as 3 by 9 (12%) respondents and as 4 by 1 (1%) respondent.
“Calm” was rated as 1 - not at all by 14 (18%) respondents, as 2 by 16 (21%) respondents, as 3 by 14 (18%) respondents, as 4 by 16 (21%) respondents and as 5 - very much by 17 (22%) respondents.
“Anxious” was rated as 1 - not at all by 53 (69%) respondents, as 2 by 17 (22%) respondents, as 3 by 3 (4%) respondents and as 4 by 4 (5%) respondents.

Likewise the previous soundscape, this one was assessed as positive, with the option “5 - very much” being dominant under the “relaxed”, “happy” and “calm” sections. The difference is that this one seems to have energised the survey participants a bit more, as option 3 is dominant in this section. The majority of respondents rated the remaining emotions as 1.

The written responses are mixed here. Part of the answers includes descriptions of natural sites and how they make their authors feel relaxed and happy. Many participants, however, indicated that the loudest bird was very irritating and annoying. Furthermore, they suggested that the high pitch of the track made it hard to enjoy the sounds.

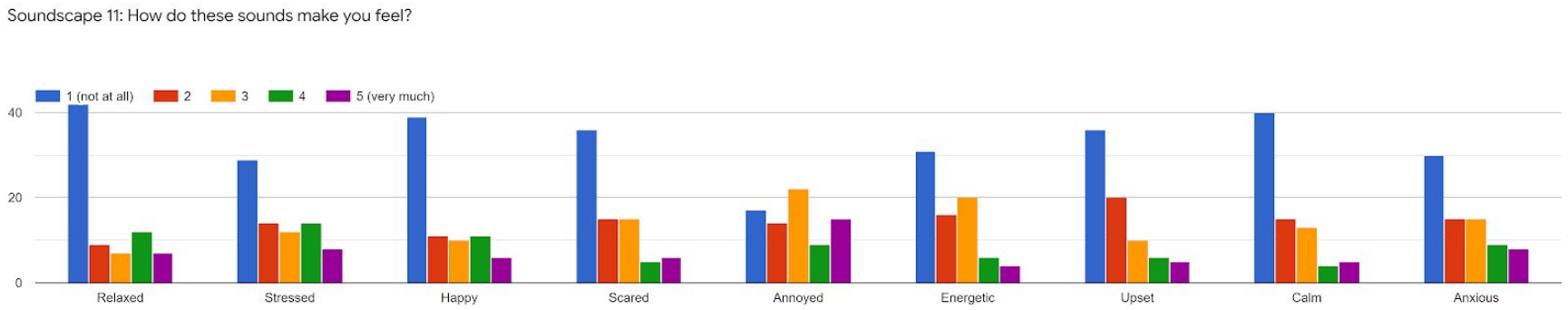

Figure 16: Graph presenting the distribution of responses to soundscape 11.

5.1.4 Soundscape 11

Soundscape 11 is a recording of sounds from a meadow. The keynote sound of the track is the buzzing insect swarm, but there is also a sound signal in the form of a peeping bird in the background. The soundscape is not very loud, but extremely intensive.

After hearing this soundscape, the respondents assessed it in the following way (Figure 16):

“Relaxed” was rated as 1 - not at all by 42 (55%) respondents, as 2 by 9 (12%) respondents, as 3 by 7 (9%) respondents, as 4 by 12 (16%) respondents and as 5 - very much by 7 (9%) respondents.

“Stressed” was rated as 1 - not at all by 29 (38%) respondents, as 2 by 14 (18%) respondents, as 3 by 12 (16%) respondents, as 4 by 14 (18%) respondents and as 5 - very much by 8 (10%) respondents.

“Happy” was rated as 1 - not at all by 39 (51%) respondents, as 2 by 11 (14%) respondents, as 3 by 10 (13%) respondents, as 4 by 11 (14%) respondents and as 5 - very much by 6 (8%) respondents.

“Scared” was rated as 1 - not at all by 36 (47%) respondents, as 2 by 15 (19%) respondents, as 3 by 15

(19%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 6 (8%) respondents.

“Annoyed” was rated as 1 - not at all by 17 (22%) respondents, as 2 by 14 (18%) respondents, as 3 by 22 (29%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 15 (19%) respondents.

“Energetic” was rated as 1 - not at all by 31 (40%) respondents, as 2 by 16 (21%) respondents, as 3 by 20 (26%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 4 (5%) respondents.

“Upset” was rated as 1 - not at all by 36 (47%) respondents, as 2 by 20 (26%) respondents, as 3 by 10 (13%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 5 (6%) respondents.

“Calm” was rated as 1 - not at all by 40 (52%) respondents, as 2 by 15 (19%) respondents, as 3 by 13 (17%) respondents, as 4 by 4 (5%) respondents and as 5 - very much by 5 (6%) respondents.

“Anxious” was rated as 1 - not at all by 30 (39%) respondents, as 2 by 15 (19%) respondents, as 3 by 15 (19%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 8 (10%) respondents.

The results are very diverse here: even though 1 is the dominant rating for almost every emotion (except for “annoyed”), it does not have a big advantage over the other options. In each section options between 2 and 5 are distributed almost uniformly. Interestingly, “annoyed” was assessed mostly as 3.

The most common answer was the aversion to all kinds of insects, especially flies, mosquitoes and wasps. Not only was the buzzing sound unpleasant and annoying, but also many participants admitted that they immediately thought of getting bitten while listening to this track, and that discouraged them from rating it positively.

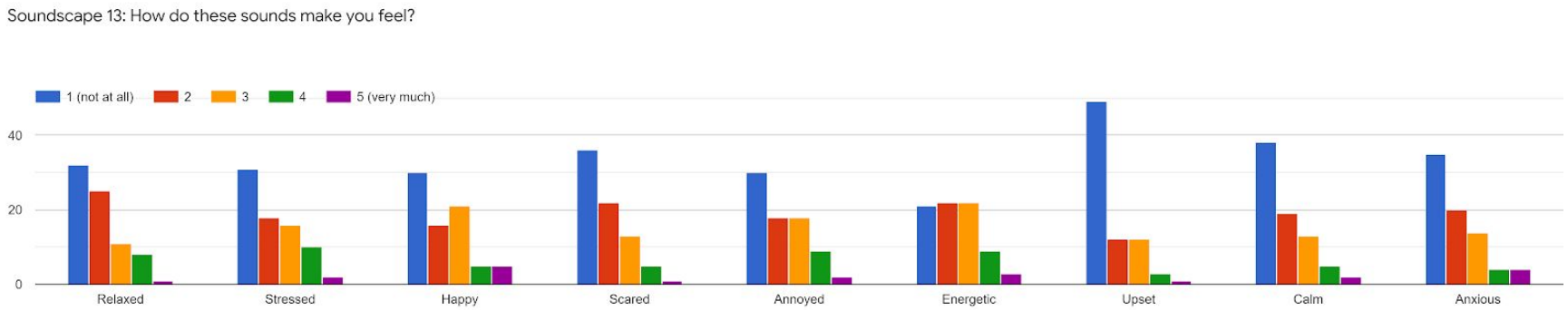

Figure 17: Graph presenting the distribution of responses to soundscape 13.

5.1.5 Soundscape 13

Soundscape 13 is a record of vocalising livestock on a countryside farm. A variety of sound signals produced by animals might be heard here: a group of barking dogs (both very loudly and in the background), clucking hens, distant grunting pigs and a single, very ear-splitting duck quack. The soundscape is very heterogeneous and non-uniform.

After hearing this soundscape, the respondents assessed it in the following way (Figure 17):

“Relaxed” was rated as 1 - not at all by 32 (42%) respondents, as 2 by 25 (32%) respondents, as 3 by 11 (14%) respondents, as 4 by 8 (10%) respondents and as 5 - very much by 1 (1%) respondents.

“Stressed” was rated as 1 - not at all by 31 (40%) respondents, as 2 by 18 (23%) respondents, as 3 by 16 (21%) respondents, as 4 by 10 (13%) respondents and as 5 - very much by 2 (3%) respondents.

“Happy” was rated as 1 - not at all by 30 (39%) respondents, as 2 by 16 (21%) respondents, as 3 by 21 (27%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 5 (6%) respondents.

“Scared” was rated as 1 - not at all by 36 (47%) respondents, as 2 by 22 (29%) respondents, as 3 by 13

(17%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 1 (1%) respondents.

“Annoyed” was rated as 1 - not at all by 30 (39%) respondents, as 2 by 18 (23%) respondents, as 3 by 18 (23%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 2 (3%) respondents.

“Energetic” was rated as 1 - not at all by 21 (27%) respondents, as 2 by 22 (29%) respondents, as 3 by 22 (29%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 3 (4%) respondents.

“Upset” was rated as 1 - not at all by 49 (64%) respondents, as 2 by 12 (16%) respondents, as 3 by 12 (16%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 1 (1%) respondent.

“Calm” was rated as 1 - not at all by 38 (49%) respondents, as 2 by 19 (25%) respondents, as 3 by 13 (17%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 2 (3%) respondents.

“Anxious” was rated as 1 - not at all by 35 (45%) respondents, as 2 by 20 (26%) respondents, as 3 by 14 (18%) respondents, as 4 by 4 (5%) respondents and as 5 - very much by 4 (5%) respondents.

Although options 2 and 3 were chosen multiple times by the informants, the option “1 - not at all” is the most popular in each section, with 30 or more responses. The only exception here is “energetic”, which generated almost equally distributed responses to options 1, 2 and 3 (21, 22 and 22, accordingly).

The respondents focused mostly on the dogs in their answers, saying that the concentrated barking gave them the impression of a potentially dangerous situation. Although many of them claimed they enjoyed sounds of nature and liked animals in general, it appears that such a high intensity of animal sounds was “a bit too much”.

5.2 Geophony

Questions about geophonic soundscapes generated most uniform responses. After hearing each of these soundscapes the majority of participants rated most of the listed emotions as 1 and the remaining part of the responses is divided between 2 and 3, with the answer “5 - very much” having been barely chosen. However, 4 exceptions from this pattern might be seen on the graphs:

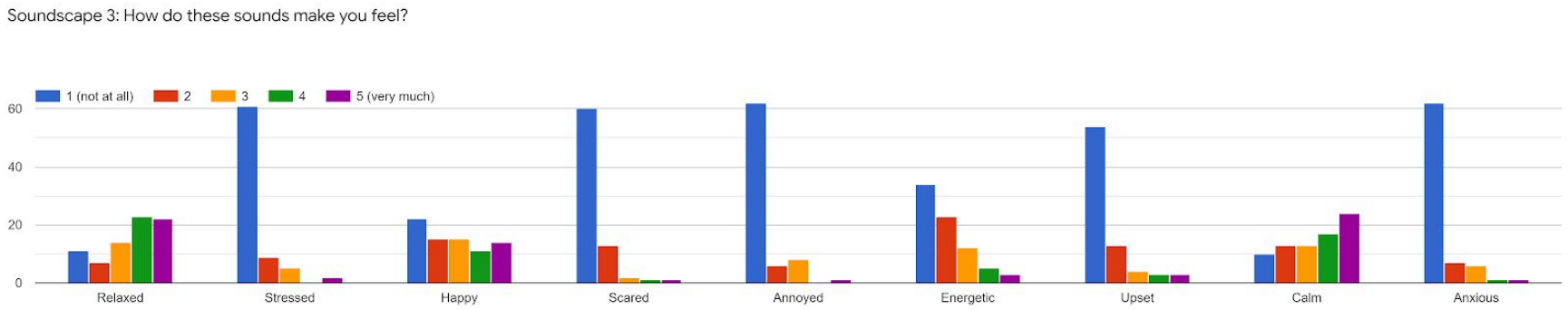

Figure 18: Graph presenting the distribution of responses to soundscape 3.

responses to “relaxed”, “happy”, “energetic” and “calm”, regardless of the soundscape, appear to be more equally distributed. Furthermore, in the question about soundscape 5, the option 5 dominates within the ratings of these feelings.

5.2.1 Soundscape 3

Soundscape 3 is a recording of strong wind gusts, whooshing in a vast open space. It is quite intensive and loud, but steady, as the wind does not break up from passing through or around any obstacles. Nothing else might be heard in this track, as the wind is a dominant keynote sound in such open areas.

After hearing this soundscape, the respondents assessed it in the following way (Figure 18):

“Relaxed” was rated as 1 - not at all by 11 (14%) respondents, as 2 by 7 (9%) respondents, as 3 by 14 (18%) respondents, as 4 by 23 (30%) respondents and as 5 - very much by 22 (29%) respondents.

“Stressed” was rated as 1 - not at all by 61 (79%) respondents, as 2 by 9 (12%) respondents, as 3 by 5 (6%) respondents and as 5 - very much by 2 (3%) respondents.

“Happy” was rated as 1 - not at all by 22 (29%) respondents, as 2 by 15 (19%) respondents, as 3 by 15 (19%) respondents, as 4 by 11 (14%) respondents and as 5 - very much by 14 (18%) respondents.
“Scared” was rated as 1 - not at all by 60 (78%) respondents, as 2 by 13 (17%) respondents, as 3 by 2 (3%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.
“Annoyed” was rated as 1 - not at all by 62 (81%) respondents, as 2 by 6 (8%) respondents, as 3 by 8 (10%) respondents and as 5 - very much by 1 (1%) respondent.
“Energetic” was rated as 1 - not at all by 34 (44%) respondents, as 2 by 23 (30%) respondents, as 3 by 12 (16%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 3 (4%) respondents.
“Upset” was rated as 1 - not at all by 54 (70%) respondents, as 2 by 13 (17%) respondents, as 3 by 4 (5%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 3 (4%) respondents.
“Calm” was rated as 1 - not at all by 10 (13%) respondents, as 2 by 13 (17%) respondents, as 3 by 13 (17%) respondents, as 4 by 17 (22%) respondents and as 5 - very much by 24 (31%) respondents.
“Anxious” was rated as 1 - not at all by 62 (81%) respondents, as 2 by 7 (9%) respondents, as 3 by 6 (8%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.

According to the participants, this soundscape made them feel relaxed and calm, as 45 of them responded to “relaxed” with either 4 or 5 and 41 of them responded to “calm” with either 4 or 5. Responses to “happy” are more equally distributed, with between 11 and 22 answers under each option. In the remaining cases - “stressed”, “scared”, “annoyed”, “energetic”, “upset”, “anxious” - option 1 is visibly dominant.

Interestingly, it seems that several respondents mistook this soundscape for the strong sea waves hitting the coast as multiple answers to the open-ended question contain phrases such as “sea is my home”, “(I like) the sound of the waves” or “(it) reminds of the ocean/ the beach” (Appendix 2). Other frequent answers include comfortable/ white noise and steadiness as an explanation for the positive reception of the soundscape. Some people also indicated that they

like to fall asleep to this kind of sounds, so hearing this track comforted them.

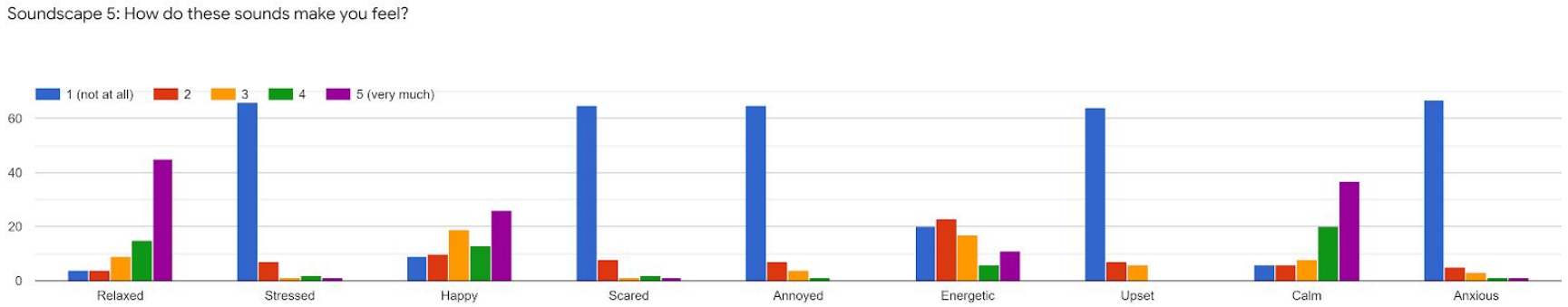

Figure 19: Graph presenting the distribution of responses to soundscape 5.

5.2.2 Soundscape 5

Soundscape 5 is a recording of calm waves, splashing the breakwater in almost windless conditions - a classic keynote sound in coastal areas. A wave hitting the shore might be heard approximately every 5 seconds. The track is very rhythmic and soft.

After hearing this soundscape, the respondents assessed it in the following way (Figure 19):

“Relaxed” was rated as 1 - not at all by 4 (5%) respondents, as 2 by 4 (5%) respondents, as 3 by 9 (12%) respondents, as 4 by 15 (19%) respondents and as 5 - very much by 45 (58%) respondents.

“Stressed” was rated as 1 - not at all by 66 (86%) respondents, as 2 by 7 (9%) respondents, as 3 by 1 (1%)

respondent, as 4 by 2 (3%) respondents and as 5 - very much by 1 (1%) respondent.
“Happy” was rated as 1 - not at all by 9 (12%) respondents, as 2 by 10 (13%) respondents, as 3 by 19 (25%) respondents, as 4 by 13 (17%) respondents and as 5 - very much by 26 (34%) respondents.
“Scared” was rated as 1 - not at all by 65 (84%) respondents, as 2 by 8 (10%) respondents, as 3 by 1 (1%) respondent, as 4 by 2 (3%) respondents and as 5 - very much by 1 (1%) respondent.
“Annoyed” was rated as 1 - not at all by 65 (84%) respondents, as 2 by 7 (9%) respondents, as 3 by 4 (5%) respondents and as 4 by 1 (1%) respondent.
“Energetic” was rated as 1 - not at all by 20 (26%) respondents, as 2 by 23 (30%) respondents, as 3 by 17 (22%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 11 (14%) respondents.
“Upset” was rated as 1 - not at all by 64 (83%) respondents, as 2 by 7 (9%) respondents and as 3 by 6 (8%) respondents.
“Calm” was rated as 1 - not at all by 6 (8%) respondents, as 2 by 6 (8%) respondents, as 3 by 8 (10%) respondents, as 4 by 20 (26%) respondents and as 5 - very much by 37 (48%) respondents.
“Anxious” was rated as 1 - not at all by 67 (87%) respondents, as 2 by 5 (6%) respondents, as 3 by 3 (4%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.

Similarly to the previous soundscape, this one was assessed as positive, with the option “5 - very much” being dominant under the “relaxed”, “happy” and “calm” sections (chosen by 45, 26 and 37 participants, respectively). The remaining emotions did not have any significant impact on the respondents, as the majority of them rated these feelings as 1.

According to the open-ended question answers, this soundscape was well received because it reminded the respondents of natural environments and holidays on a beach, where one can walk along the shore and relax. Few participants, however, said that this soundscape made them feel anxious and scared because of their inability to swim.

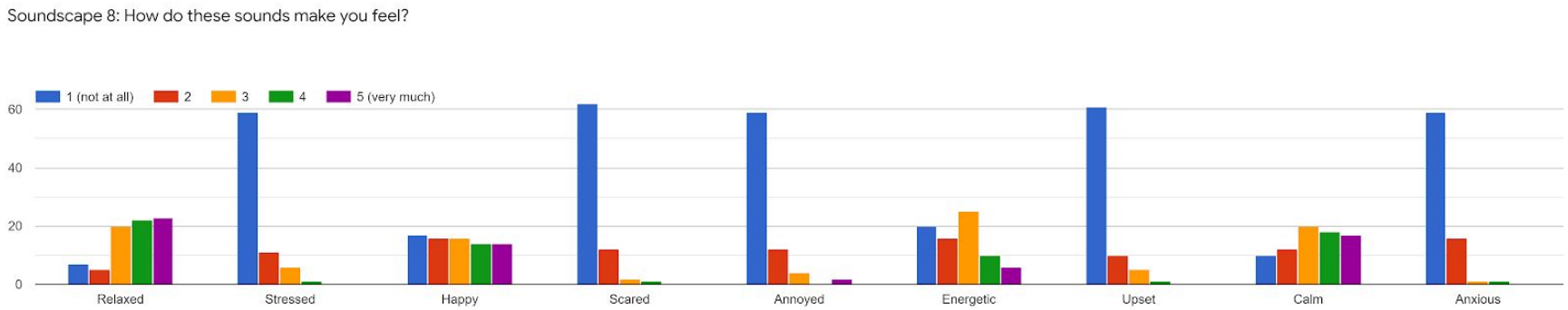

Figure 20: Graph presenting the distribution of responses to soundscape 8.

5.2.3 Soundscape 8

Soundscape 8 is a recording of a flowing river. Water is sloshing at a constant pace while breaking down against boulders and other small obstacles on the riverbed. The sound is riotous and strong.

After hearing this soundscape, the respondents assessed it in the following way (Figure 20):

“Relaxed” was rated as 1 - not at all by 7 (9%) respondents, as 2 by 5 (6%) respondents, as 3 by 20 (26%) respondents, as 4 by 22 (29%) respondents and as 5 - very much by 23 (30%) respondents.

“Stressed” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 11 (14%) respondents, as 3 by 6 (8%) respondents and as 4 by 1 (1%) respondent.

“Happy” was rated as 1 - not at all by 17 (22%) respondents, as 2 by 16 (21%) respondents, as 3 by 16 (21%) respondents, as 4 by 14 (18%) respondents and as 5 - very much by 14 (18%) respondents.

“Scared” was rated as 1 - not at all by 62 (81%) respondents, as 2 by 12 (16%) respondents, as 3 by 2 (3%) respondents and as 4 by 1 (1%) respondent.

“Annoyed” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 12 (16%) respondents, as 3 by 4 (5%) respondents and as 5 - very much by 2 (3%) respondents.
“Energetic” was rated as 1 - not at all by 20 (26%) respondents, as 2 by 16 (21%) respondents, as 3 by 25 (32%) respondents, as 4 by 10 (13%) respondents and as 5 - very much by 6 (8%) respondents.
“Upset” was rated as 1 - not at all by 61 (79%) respondents, as 2 by 10 (13%) respondents, as 3 by 5 (6%) respondents and as 4 by 1 (1%) respondent.
“Calm” was rated as 1 - not at all by 10 (13%) respondents, as 2 by 12 (16%) respondents, as 3 by 20 (26%) respondents, as 4 by 18 (23%) respondents and as 5 - very much by 17 (22%) respondents.
“Anxious” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 16 (21%) respondents, as 3 by 1 (1%) respondent and as 4 by 1 (1%) respondent.

The main feelings that accompanied the respondents while listening to this track were “relaxed” and “calm”, as 45 and 35 people marked them as either 4 or 5, accordingly. Responses to “happy” are almost equally distributed, with each option gaining between 14 and 17 submissions. The dominant answer to “energetic” is 3, while “stressed”, “scared”, “annoyed”, “upset” and “anxious” were mostly rated as 1, excluding about 10 “2s” and about 5 “3s” under each of them.

Multiple participants confused this soundscape with rain. Many answers claim that their authors enjoy the sound of flowing water. Nature is another explanation that appears repeatedly in the responses and some of the participants even declared that hearing this soundscape stimulated their other senses.

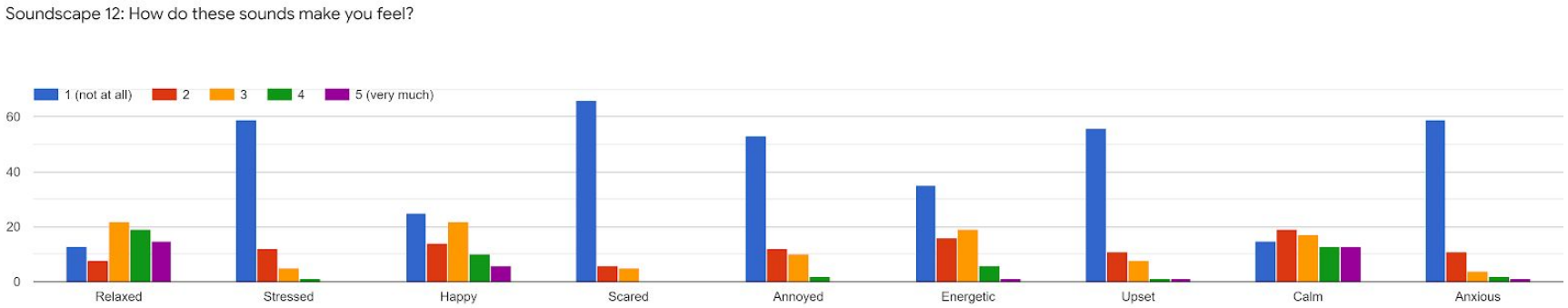

Figure 21: Graph presenting the distribution of responses to soundscape 12.

5.2.4 Soundscape 12

Soundscape 12 is a record of rain in an urban area. Raindrops are splattering and loudly pattering on the impervious surface. The water discharge from a nearby gutter may be clearly heard as well.

After hearing this soundscape, the respondents assessed it in the following way (Figure 21):

“Relaxed” was rated as 1 - not at all by 13 (17%) respondents, as 2 by 8 (10%) respondents, as 3 by 22 (29%) respondents, as 4 by 19 (25%) respondents and as 5 - very much by 15 (19%) respondents.

“Stressed” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 12 (16%) respondents, as 3 by 5 (6%) respondents and as 4 by 1 (1%) respondent.

“Happy” was rated as 1 - not at all by 25 (32%) respondents, as 2 by 14 (18%) respondents, as 3 by 22

(29%) respondents, as 4 by 10 (13%) respondents and as 5 - very much by 6 (8%) respondents.

“Scared” was rated as 1 - not at all by 66 (86%) respondents, as 2 by 6 (8%) respondents and as 3 by 5 (6%) respondents.

“Annoyed” was rated as 1 - not at all by 53 (69%) respondents, as 2 by 12 (16%) respondents, as 3 by 10 (13%) respondents and as 4 by 2 (3%) respondents.

“Energetic” was rated as 1 - not at all by 35 (45%) respondents, as 2 by 16 (21%) respondents, as 3 by 19 (25%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 1 (1%) respondent.

“Upset” was rated as 1 - not at all by 56 (73%) respondents, as 2 by 11 (14%) respondents, as 3 by 8 (10%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.

“Calm” was rated as 1 - not at all by 15 (19%) respondents, as 2 by 19 (25%) respondents, as 3 by 17 (22%) respondents, as 4 by 13 (17%) respondents and as 5 - very much by 13 (17%) respondents.

“Anxious” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 11 (14%) respondents, as 3 by 4 (5%) respondents, as 4 by 2 (3%) respondents and as 5 - very much by 1 (1%) respondent.

No prevailing emotion is visible here. “Relaxed” and “happy” were mostly rated as 3, and each option under “calm” was chosen between 13 and 19 times, providing almost uniformly spread bars on the graph. Likewise the previous soundscape, option 1 is dominant in the cases of “stressed”, “scared”, “annoyed”, “upset” and “anxious”, with few “2s” and “3s”. This is also true for “energetic”, except the share of participants who responded to this emotion with option 2 or 3 is much bigger (16 and 19, respectively).

Many respondents indicated that they find this soundscape pleasant as long as they can stay in, warm and cosy. Similarly as in the previous one, several participants affirmed that the sound of flowing water relaxed them. On the other hand, few answers suggest that the track is too loud and too irregular to enjoy.

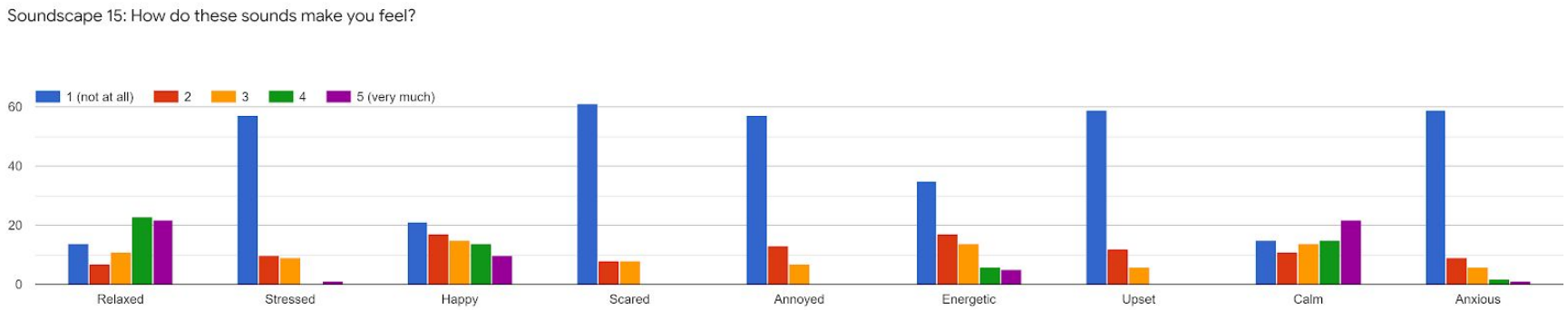

Figure 22: Graph presenting the distribution of responses to soundscape 15.

5.2.5 Soundscape 15

Soundscape 15 is a recording of wind in a forest. The dominant sound is the movement of rustling leaves in the canopy. The wind whistling between the trunks might be heard in the background. The track is quiet and uniform.

After hearing this soundscape, the respondents assessed it in the following way (Figure 22):

“Relaxed” was rated as 1 - not at all by 14 (18%) respondents, as 2 by 7 (9%) respondents, as 3 by 11 (14%) respondents, as 4 by 23 (30%) respondents and as 5 - very much by 22 (29%) respondents.

“Stressed” was rated as 1 - not at all by 57 (74%) respondents, as 2 by 10 (13%) respondents, as 3 by 9 (12%) respondents and as 5 - very much by 1 (1%) respondent.

“Happy” was rated as 1 - not at all by 21 (27%) respondents, as 2 by 17 (22%) respondents, as 3 by 15 (19%) respondents, as 4 by 14 (18%) respondents and as 5 - very much by 10 (13%) respondents.

“Scared” was rated as 1 - not at all by 61 (79%) respondents, as 2 by 8 (10%) respondents and as 3 by 8 (10%) respondents.
“Annoyed” was rated as 1 - not at all by 57 (74%) respondents, as 2 by 13 (17%) respondents and as 3 by 7 (9%) respondents.
“Energetic” was rated as 1 - not at all by 35 (45%) respondents, as 2 by 17 (22%) respondents, as 3 by 14 (18%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 5 (6%) respondents.
“Upset” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 12 (16%) respondents and as 3 by 6 (8%) respondents.
“Calm” was rated as 1 - not at all by 15 (19%) respondents, as 2 by 11 (14%) respondents, as 3 by 14 (18%) respondents, as 4 by 15 (19%) respondents and as 5 - very much by 22 (29%) respondents.
“Anxious” was rated as 1 - not at all by 59 (77%) respondents, as 2 by 9 (12%) respondents, as 3 by 6 (8%) respondents, as 4 by 2 (3%) respondents and as 5 - very much by 1 (1%) respondent.

Listening to this soundscape made the respondents feel relaxed and calm: the former one was rated as 4 or 5 by 45 people and in the latter case the same rating was given by 37 people (the option “5 - very much” is prevailing with 22 participants who selected it). Although the option “1 - not at all” was the most popular choice while rating “happy” and “energetic” (picked by 21 and 35 people, respectively), it is not conspicuously dominant there and columns representing other options are significant, too - in contrast to the remaining, negative feelings, which were rated as 1 by the vast majority.

Many participants explained they liked this soundscape due to its neutrality and softness. Some of them also said that it was relaxing because it was gentle and quiet. Interestingly, few answers refer to cooking activities as something this soundscape is associated with.

5.3 Anthrophony

Anthrophonic soundscapes provided the most diverse responses. In almost every question each of the options from 1 to 5 was chosen by multiple participants to rate the emotions (on the contrary to the geophonic soundscapes, where the respondents were mostly unanimous in assessing their feelings). In all of the anthrophonic soundscapes “stressed” and “annoyed” are where the answer distribution is leaning towards the “5 - very much” end of the scale. In terms of the remaining emotions: “relaxed”, “happy”, “scared”, “energetic”, “upset”, “calm” and “anxious”, the option “1 - not at all” is dominant, however, not as vastly as in the geophonic questions, as options 2 and 3 are also very popular.

5.3.1 Soundscape 1

Soundscape 1 is a recording of various vehicles passing by on a 4 lane express road - a typical keynote sound in urban areas. The cars are going at great speed and so the intensity and volume are very high. Screeching tyres, as well as roaring engines, might be heard.

After hearing this soundscape, the respondents assessed it in the following way (Figure 23):
“Relaxed” was rated as 1 - not at all by 54 (70%) respondents, as 2 by 11 (14%) respondents, as 3 by 10 (13%) respondents and as 4 by 2 (3%) respondents.
“Stressed” was rated as 1 - not at all by 21 (27%) respondents, as 2 by 20 (26%) respondents, as 3 by 21

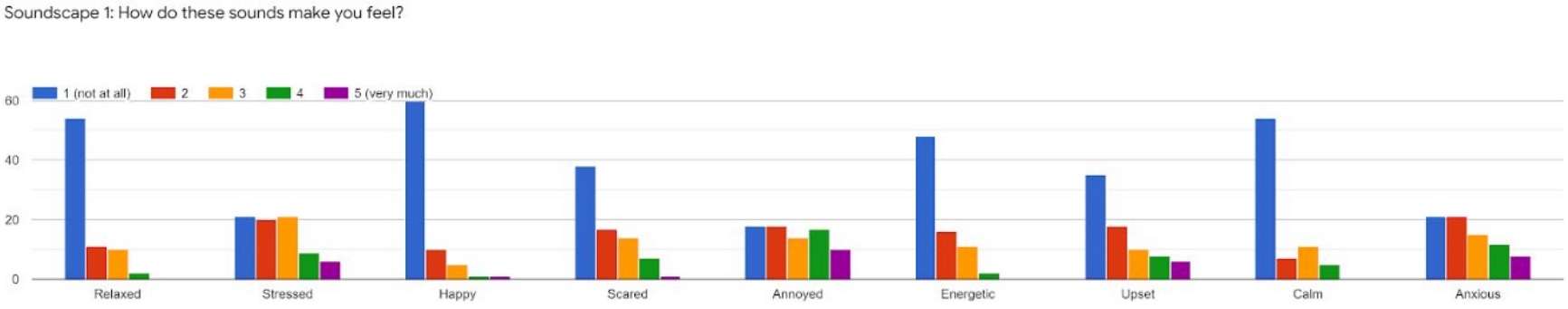

Figure 23: Graph presenting the distribution of responses to soundscape 1.

(27%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 6 (8%) respondents.

“Happy” was rated as 1 - not at all by 60 (78%) respondents, as 2 by 10 (13%) respondents, as 3 by 5 (6%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.

“Scared” was rated as 1 - not at all by 38 (49%) respondents, as 2 by 17 (22%) respondents, as 3 by 14 (18%) respondents, as 4 by 7 (9%) respondents and as 5 - very much by 1 (1%) respondent.

“Annoyed” was rated as 1 - not at all by 18 (23%) respondents, as 2 by 18 (23%) respondents, as 3 by 14 (18%) respondents, as 4 by 17 (22%) respondents and as 5 - very much by 10 (13%) respondents.

“Energetic” was rated as 1 - not at all by 48 (62%) respondents, as 2 by 16 (21%) respondents, as 3 by 11 (14%) respondents and as 4 by 2 (3%) respondents.

“Upset” was rated as 1 - not at all by 35 (45%) respondents, as 2 by 18 (23%) respondents, as 3 by 10 (13%) respondents, as 4 by 8 (10%) respondents and as 5 - very much by 6 (8%) respondents.

“Calm” was rated as 1 - not at all by 54 (70%) respondents, as 2 by 7 (9%) respondents, as 3 by 11 (14%) respondents and as 4 by 5 (6%) respondents.

“Anxious” was rated as 1 - not at all by 21 (27%) respondents, as 2 by 21 (27%) respondents, as 3 by 15 (19%) respondents, as 4 by 12 (16%) respondents and as 5 - very much by 8 (10%) respondents.

Although the option “1 - not at all” is dominant amongst responses to the following feelings: “relaxed”, “happy”, “calm”, “scared”, “energetic” and “upset”, other options (especially 2 and 3) were also chosen multiple times, particularly to rate the last 3 of the mentioned emotions. In the remaining cases - “stressed”, “annoyed” and “anxious” - none of the numbers is prevailing.

Majority of participants described this soundscape as loud, chaotic and stressful. They expressed their dislike for polluted cities, traffic and noise repeatedly as an explanation for the bad reception of this soundscape. Nevertheless, some of the respondents claimed they were used to the sounds of big cities, and therefore they were indifferent to this soundscape.

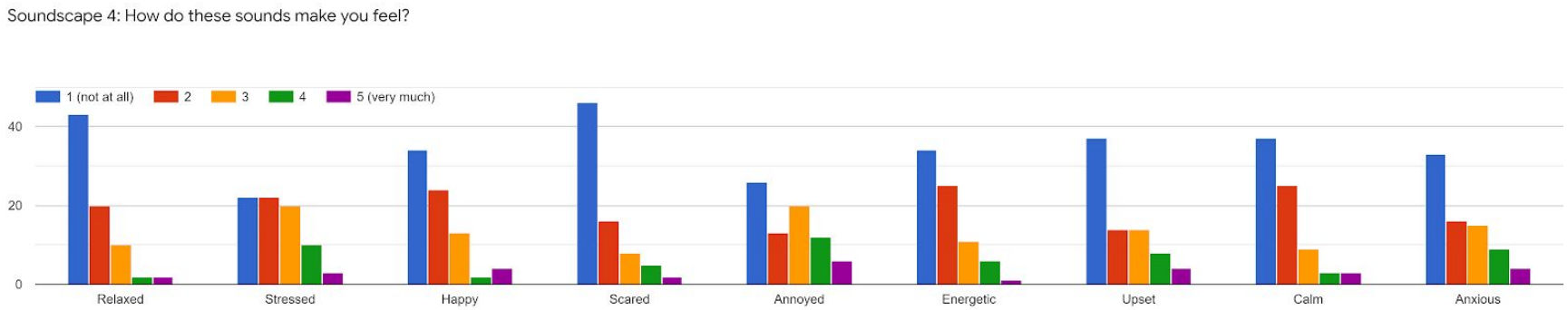

Figure 24: Graph presenting the distribution of responses to soundscape 4.

5.3.2 Soundscape 4

Soundscape 4 is a record of the Prague Old Town area. The track is dominated by a sound signal in the form of 2 huge ringing church bells, but the keynote sounds composed of chatter, people walking on cobblestones and the sound of a distant beat might be heard, too. This soundscape is an intensive and piercing cacophony.

After hearing this soundscape, the respondents assessed it in the following way (Figure 24):

“Relaxed” was rated as 1 - not at all by 43 (56%) respondents, as 2 by 20 (26%) respondents, as 3 by 10 (13%) respondents, as 4 by 2 (3%) respondents and as 5 - very much by 2 (3%) respondents.

“Stressed” was rated as 1 - not at all by 22 (29%) respondents, as 2 by 22 (29%) respondents, as 3 by 20 (26%) respondents, as 4 by 10 (13%) respondents and as 5 - very much by 3 (4%) respondents.

“Happy” was rated as 1 - not at all by 34 (44%) respondents, as 2 by 24 (31%) respondents, as 3 by 13 (17%) respondents, as 4 by 2 (3%) respondents and as 5 - very much by 4 (5%) respondents.

“Scared” was rated as 1 - not at all by 46 (60%) respondents, as 2 by 16 (21%) respondents, as 3 by 8 (10%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 2 (3%) respondents.
“Annoyed” was rated as 1 - not at all by 26 (34%) respondents, as 2 by 13 (17%) respondents, as 3 by 20 (26%) respondents, as 4 by 12 (16%) respondents and as 5 - very much by 6 (8%) respondents.
“Energetic” was rated as 1 - not at all by 34 (44%) respondents, as 2 by 25 (32%) respondents, as 3 by 11 (14%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 1 (1%) respondent.
“Upset” was rated as 1 - not at all by 37 (48%) respondents, as 2 by 14 (18%) respondents, as 3 by 14 (18%) respondents, as 4 by 8 (10%) respondents and as 5 - very much by 4 (5%) respondents.
“Calm” was rated as 1 - not at all by 37 (48%) respondents, as 2 by 25 (32%) respondents, as 3 by 9 (12%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 3 (4%) respondents.
“Anxious” was rated as 1 - not at all by 33 (43%) respondents, as 2 by 16 (21%) respondents, as 3 by 15 (19%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 4 (5%) respondents.

The outcomes are very non-uniform here: even though 1 is the dominant rating for almost every emotion (except for “stressed”), it does not have such a big advantage over the other options. Options 2 and 3 are very popular; that may be seen especially in the “stressed” case, where the first 3 options were chosen between 20 and 22 times.

The written responses are mixed. Part of the respondents received this soundscape positively, saying it reminded them of their hometowns, special occasions and holidays. At the same time, others described it as too loud and disturbing, because the bells created an impression of something bad happening or an emergency, and the uproarious human voices implied a crowded, busy place.

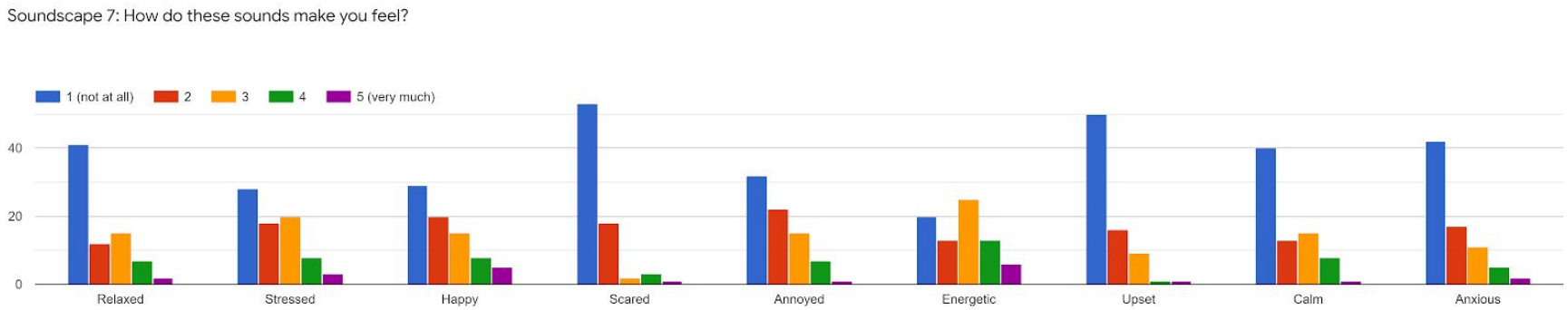

Figure 25: Graph presenting the distribution of responses to soundscape 7.

5.3.3 Soundscape 7

Soundscape 7 is a recording of the crowd on the Charles Bridge in Prague. The keynote sounds here are a combination of various human sounds: conversations in different languages, coughing and footsteps on a cobblestone street. A musician playing the guitar might be picked up in the background.

After hearing this soundscape, the respondents assessed it in the following way (Figure 25):

“Relaxed” was rated as 1 - not at all by 41 (53%) respondents, as 2 by 12 (16%) respondents, as 3 by 15 (19%) respondents, as 4 by 7 (9%) respondents and as 5 - very much by 2 (3%) respondents.

“Stressed” was rated as 1 - not at all by 28 (36%) respondents, as 2 by 18 (23%) respondents, as 3 by 20 (26%) respondents, as 4 by 8 (10%) respondents and as 5 - very much by 3 (4%) respondents.

“Happy” was rated as 1 - not at all by 29 (38%) respondents, as 2 by 20 (26%) respondents, as 3 by 15 (19%) respondents, as 4 by 8 (10%) respondents and as 5 - very much by 5 (6%) respondents.

“Scared” was rated as 1 - not at all by 53 (69%) respondents, as 2 by 18 (23%) respondents, as 3 by 2 (3%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 1 (1%) respondent.
“Annoyed” was rated as 1 - not at all by 32 (42%) respondents, as 2 by 22 (29%) respondents, as 3 by 15 (19%) respondents, as 4 by 7 (9%) respondents and as 5 - very much by 1 (1%) respondent.
“Energetic” was rated as 1 - not at all by 20 (26%) respondents, as 2 by 13 (17%) respondents, as 3 by 25 (32%) respondents, as 4 by 13 (17%) respondents and as 5 - very much by 6 (8%) respondents.
“Upset” was rated as 1 - not at all by 50 (65%) respondents, as 2 by 16 (21%) respondents, as 3 by 9 (12%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.
“Calm” was rated as 1 - not at all by 40 (52%) respondents, as 2 by 13 (17%) respondents, as 3 by 15 (19%) respondents, as 4 by 8 (10%) respondents and as 5 - very much by 1 (1%) respondent.
“Anxious” was rated as 1 - not at all by 42 (55%) respondents, as 2 by 17 (22%) respondents, as 3 by 11 (14%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 2 (3%) respondents.

With 40 or more respondents having chosen it, option 1 is immensely dominant in the “relaxed”, “scared”, “upset”, “calm” and “anxious” sections. It is also prevailing in the cases of “stressed”, “happy” and “annoyed”, but here other options occupy a significant part of the histograms. “Energetic” is the only differently shaped graph with option 3 being the highest bar, chosen by 25 respondents.

Again, this soundscape aroused different responses. Some of the participants declared this track energised and even motivated them, as it reminded them of running errands in the town and meeting with friends. On the other hand, part of the responses suggested that their authors would feel overwhelmed and claustrophobic in such a place.

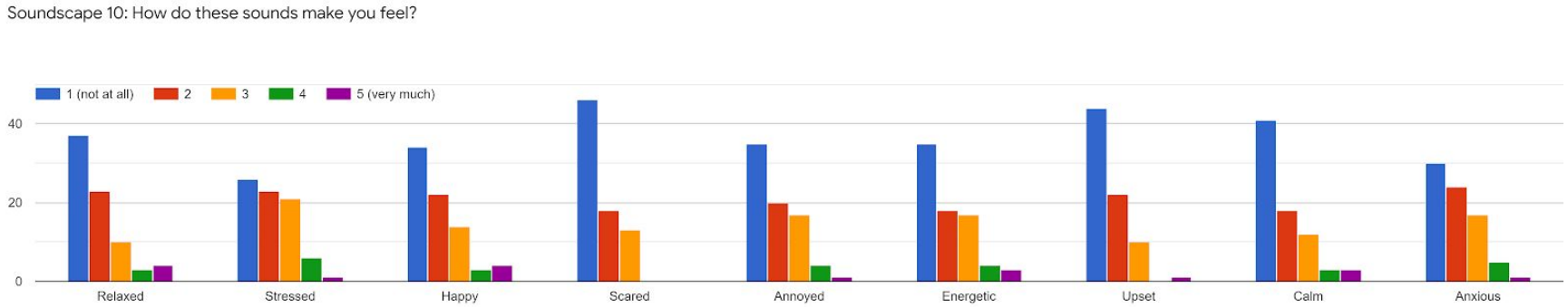

Figure 26: Graph presenting the distribution of responses to soundscape 10.

5.3.4 Soundscape 10

Soundscape 10 is a recording of the subway that is slowing down. The brakes are screeching, the sound increases and becomes louder and more intensive as the metro approaches the station.

After hearing this soundscape, the respondents assessed it in the following way (Figure 26):
“Relaxed” was rated as 1 - not at all by 37 (48%) respondents, as 2 by 23 (30%) respondents, as 3 by 10 (13%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 4 (5%) respondents.
“Stressed” was rated as 1 - not at all by 26 (34%) respondents, as 2 by 23 (30%) respondents, as 3 by 21 (27%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 1 (1%) respondent.
“Happy” was rated as 1 - not at all by 34 (44%) respondents, as 2 by 22 (29%) respondents, as 3 by 14 (18%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 4 (5%) respondents.

“Scared” was rated as 1 - not at all by 46 (60%) respondents, as 2 by 18 (23%) respondents and as 3 by 13 (17%) respondents.
“Annoyed” was rated as 1 - not at all by 35 (45%) respondents, as 2 by 20 (26%) respondents, as 3 by 17 (22%) respondents, as 4 by 4 (5%) respondents and as 5 - very much by 1 (1%) respondent.
“Energetic” was rated as 1 - not at all by 35 (45%) respondents, as 2 by 18 (23%) respondents, as 3 by 17 (22%) respondents, as 4 by 4 (5%) respondents and as 5 - very much by 3 (4%) respondents.
“Upset” was rated as 1 - not at all by 44 (57%) respondents, as 2 by 22 (29%) respondents, as 3 by 10 (13%) respondents and as 5 - very much by 1 (1%) respondent.
“Calm” was rated as 1 - not at all by 41 (53%) respondents, as 2 by 18 (23%) respondents, as 3 by 12 (16%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 3 (4%) respondents.
“Anxious” was rated as 1 - not at all by 30 (39%) respondents, as 2 by 24 (31%) respondents, as 3 by 17 (22%) respondents, as 4 by 5 (6%) respondents and as 5 - very much by 1 (1%) respondent.

Although options 2 and 3 were chosen multiple times by the informants while assessing their feelings towards this soundscape, the option “1 - not at all” is the most popular in each section, with 30 or more responses. The only exception here is “stressed”, which generated almost equally distributed responses to options 1, 2 and 3 (26, 23 and 21, accordingly).

According to the written answers, it appears that this soundscape did not evoke as many emotions as its connotations. Most participants found it stressful not because of its high pitch, but because they associated it with rushing through the morning commute, being on a tight schedule or getting lost in public communication.

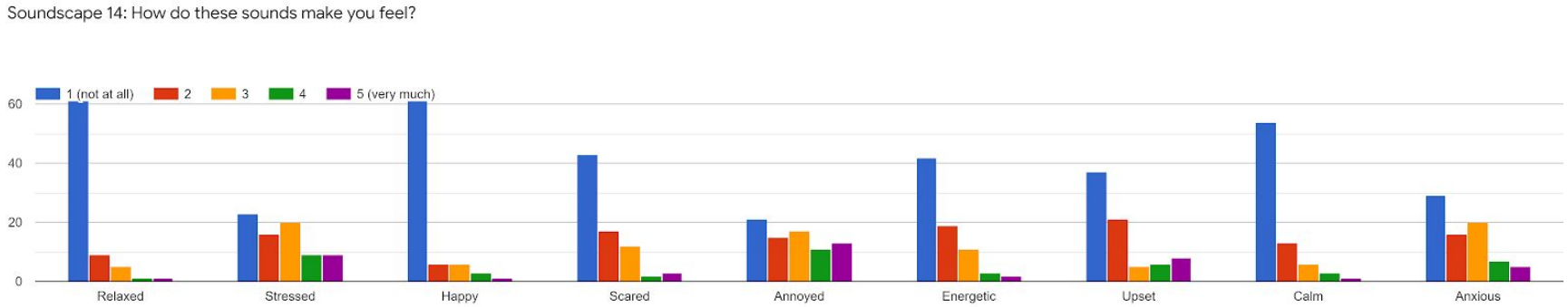

Figure 27: Graph presenting the distribution of responses to soundscape 14.

5.3.5 Soundscape 14

Soundscape 14 is a record of the sound signals from a construction site produced by a working wheel loader. One may hear a roaring engine, very loud beeping when the vehicle is moving and the humming arm machinery.

After hearing this soundscape, the respondents assessed it in the following way (Figure 27):

“Relaxed” was rated as 1 - not at all by 61 (79%) respondents, as 2 by 9 (12%) respondents, as 3 by 5 (6%) respondents, as 4 by 1 (1%) respondent and as 5 - very much by 1 (1%) respondent.

“Stressed” was rated as 1 - not at all by 23 (30%) respondents, as 2 by 16 (21%) respondents, as 3 by 20 (26%) respondents, as 4 by 9 (12%) respondents and as 5 - very much by 9 (12%) respondents.

“Happy” was rated as 1 - not at all by 61 (79%) respondents, as 2 by 6 (8%) respondents, as 3 by 6 (8%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 1 (1%) respondent.

“Scared” was rated as 1 - not at all by 43 (56%) respondents, as 2 by 17 (22%) respondents, as 3 by 12

(16%) respondents, as 4 by 2 (3%) respondents and as 5 - very much by 3 (4%) respondents.

“Annoyed” was rated as 1 - not at all by 21 (27%) respondents, as 2 by 15 (19%) respondents, as 3 by 17 (22%) respondents, as 4 by 11 (14%) respondents and as 5 - very much by 13 (17%) respondents.

“Energetic” was rated as 1 - not at all by 42 (55%) respondents, as 2 by 19 (25%) respondents, as 3 by 11 (14%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 2 (3%) respondents.

“Upset” was rated as 1 - not at all by 37 (48%) respondents, as 2 by 21 (27%) respondents, as 3 by 5 (6%) respondents, as 4 by 6 (8%) respondents and as 5 - very much by 8 (10%) respondents.

“Calm” was rated as 1 - not at all by 54 (70%) respondents, as 2 by 13 (17%) respondents, as 3 by 6 (8%) respondents, as 4 by 3 (4%) respondents and as 5 - very much by 1 (1%) respondent.

“Anxious” was rated as 1 - not at all by 29 (38%) respondents, as 2 by 16 (21%) respondents, as 3 by 20 (26%) respondents, as 4 by 7 (9%) respondents and as 5 - very much by 5 (6%) respondents.

This soundscape clearly did not evoke positive feelings, as “relaxed”, “happy” and “calm” were all rated as 1 by the vast majority of respondents. This option is also dominant among the responses to “scared”, “energetic”, “upset” and “anxious”, but other options were chosen several times in these sections, too. It appears that stress and annoyance were the most widely experienced by the participants while listening to this soundscape because these emotions produced non-uniform responses, including multiple 4s and 5s.

This soundscape was mostly found as stressing and annoying due to its alarming undertone. The participants indicated that the soundscape put them in a state of constant vigilance, suggesting that this kind of beeping sounds are usually heard in dangerous places. A few respondents also mentioned that the soundscape brought back negative memories from the past when they had been regularly woken up by similar signals.

6. Discussion

6.1 Analysis of the results

6.1.1 General trends

The first pattern to observe is the advantage of the geophysically induced soundscapes over all others. The sounds produced by living organisms (both people and animals) were not as well-received but were still more approved than the sounds generated by the man-made machinery and objects. The likely explanation for this trend lies in the way human brains interpret sounds: as threats and non-threats. Calm and stable sounds are tuned out, while sudden noises, immediately reaching peak loudness, trigger the brain's so-called threat-activated vigilance system (Hadhazy, 2016), which is a likely reason why soundscapes containing this kind of noises (e.g. the beeping wheel loader and the church bells) induced negative mood changes among the study participants.

Another feature of the histograms that catches the eye is their tendency to lean towards the “1” end of the scale and the significant dominance of the option “1 - not at all” amongst the answers. The respondents rarely chose the option “5 - very much”, and if so, they selected it mainly for the positive emotions (relaxed, happy and calm). Overall, the strongest feelings that aroused after listening to the provided soundscapes were positive. This is because positive emotions are naturally evoked, on the contrary to the negative, which are always caused by something (society, prejudice etc.) (Awdhesh, 2017). Therefore, a single soundscape without a context usually does not provoke very powerful negative feelings. However, that does not explain what happens if one is exposed to several various soundscapes over a short period. Would the emotions accumulate in such a case?

Looking at the distribution of responses with regards to the order of soundscapes in the survey, it is safe to assume that indeed emotions tend to get stronger after listening to different soundscapes. This is shown by an increase in the number of participants who chose options other than 1 to rate their feelings after hearing the first 9 soundscapes. In

other words, starting from the soundscape 10, more respondents began assessing the strength of their emotions as 2 or more when compared to the previous questions.

6.1.2 Biophony

This might be the reason why the first 3 biophonic soundscapes (no. 2 - croaking frogs, 6 - crickets and 9 - forest fauna) generated responses similar to those in the geophonic questions (more uniform answers, with 1 being the dominant option and positive emotions being rated higher), in contrast to the remaining 2 biophonic soundscapes (insects and countryside animals) that were positioned later in the survey - which produced more differentiated answers. One explanation may be that by the time the respondents reached the questions about these 2 soundscapes, they had already been influenced by listening to other soundscapes and thus their emotions were more powerful.

Another possible solution might be found in the origins of these soundscapes. The soundscapes 2, 6 and 9 were recorded in entirely natural environments, while the soundscapes 11 and 13 were captured around rural human habitats. The respondents may have subconsciously associated these 2 latter soundscapes with humans (especially soundscape 13, the written responses to which included phrases like “village”, “ranch” and “zoo” - the names of spaces constructed by humans) and hence became affected by them to a greater extent and in less positive ways.

6.1.3 Geophony

Despite small differences in the distribution of responses between individual cases, geophonic soundscapes received the best reception. Especially the sounds of flowing water - waves and river - were assessed as immensely calming and relaxing. This trend finds its explanation in psychology. The literature suggests several reasons as to why we find the sounds of water so pleasant. The first one is the already mentioned interpretation of threats. The soundscapes containing the sounds of flowing

water were constant, soothing and very stable in terms of intensity, perceived as non-threats and hence the participants considered them enjoyable. Furthermore, scientists suggest that the rhythm of waves and tides might synchronise with the rhythm of neuronal transmissions in our brains, encouraging a more peaceful pace of thought (Brown, 2017). Finally, some evolutionary psychologists believe that human brains are deeply encoded with an attraction to water because of our aquatic ancestors and the way life evolved around water (Krill, 2017). All of these theories are reflected in the survey results.

6.1.4 Anthrophony

The responses to anthrophonic soundscapes were non-uniform and distributed between all 5 options. However, the option “5 - very much” was hardly ever chosen while rating the positive emotions. This indicates that although anthrophonic soundscapes are only responsible for moderately intense emotions, they cause mostly stress and irritation.

Overall, soundscapes containing recordings of man-made machinery received the most negative assessment. Such a result corresponds to the findings obtained by Dubois et al. (2006), whose intention was to examine the linguistic properties of urban soundscapes. According to the researchers at Brighton and Sussex Medical School, this is because brain activity changes upon various sounds. While listening to artificial sounds, the brain focus of attention is similar to states observed in depression, PTSD and anxiety (Gould van Praag et al., 2017). To put it more simply, the brain’s vibrations harmonise with the vibrations coming from the sounds. Artificial sounds do not have natural vibrations and hence do not support the brain’s natural operations (Griffiths, 2017). This justifies the negative feedback on the man-made soundscapes.

6.2 Potential applications of the results in the context of urban planning

The thesis has provided solid findings, some of which may contribute to the development of future urban planning techniques and strategies.

First of all, this thesis lies in line with the psychological theories about the importance of the sounds of water for human well-being. Water sounds relax the brain. Planners within the new urbanism movement are fully aware of the significance of green zones in the cities. Most of us recognise the calming effect of backyards or small gardens attached to our houses. Blue spaces, however, seem to be marginalised, even though studies show that the proximity to water is generally desired and could be beneficial health-wise (Smedley, 2013). This offers great room for improvement in urbanism. Future planners should pay more attention to incorporating water features into projects: ponds in parks, fountains on squares and urban streams should be permanently brought into the canons of design. Moreover, cities should provide calm, quiet zones, where dwellers could hear and enjoy the sounds of the water bodies without any noise disruptions, the acoustic properties of which would be as close to the natural geophonic soundscapes as possible. Introducing more blue areas would be profitable for the human inhabitants, but in addition to that, it would immensely enhance biodiversity and serve ecological purposes.

Another conclusion coming from this research is that the accumulation of different soundscapes causes the intensification of emotions. Given that it was mostly anthrophonic soundscapes responsible for negative emotions, it might be a good idea to try and muffle the urban sounds wherever it is possible. Mitigation of transport noises is already a common practice in urban planning (Bliemer et al., 2016) due to the physical health issues they may cause. The results of the survey show that the accumulation of sonic sensations might also be risky for emotional health. Urban planners should, therefore, focus even more on “muting” cities or their parts in order to ameliorate potentially harmful soundscapes. For instance, the sound of a moving subway train (soundscape 10) caused a significant number of respondents to feel stressed and annoyed. Even though these emotions only arose to a limited extent, it could have been avoided if the metro station had been designed differently. Many stations worldwide are equipped with platform screen doors, which help to prevent accidents and improve climate control (Intelligent Transport, 2007). With some re-engineering, they could also serve an additional purpose: to enclose the

train sounds within tunnels and hence minimise the intensity of sounds reaching the passengers.

Thirdly, the thesis revealed that soundscapes play a role in shaping the place identity. As Pohl (2001) states, the place identity answers the question “Where am I?”. The respondents immediately recognised the church bells and associated this sound with a historical area, similarly as they connected the sounds of chickens and ducks with the countryside. Although the place identity is typically referred to as a visual concept and an image of the place (Kalandides, 2011), the results prove that soundscapes (and especially soundmarks, being the sounds unique to particular areas) may perform this function just as well. These iconic sounds, therefore, deserve special attention in urban design decisions and should be incorporated into the urban fabric on a bigger scale.

Last but not least, soundscapes that included audible human voices brought mixed reactions: some of the responses were positive and their authors stated they enjoy being around people, some others were negative, as the participants claimed they feel anxious and stressed in the crowds. This brings attention to the importance of silence and isolation in urban spaces. Future cities should be able to offer easily accessible quiet zones outside of people’s private homes, where everyone could recharge after being exposed to a busy urban environment and crowds. Moreover, these preferences should be taken into consideration when planning new settlements, so that housing options in future cities would cater to everyone’s needs.

6.3 Suggestions for future research

6.3.1 Areas to improve

Although this research produced satisfactory results and led to drawing several valuable conclusions, few aspects could have been done differently to improve the outcomes. Firstly, the soundscapes were captured using a simple mobile phone and an action camera. These devices provided a surprisingly high quality of recordings, however, better, more professional equipment surely would have enhanced the study. Furthermore, it could have allowed changing the intensity and volume of sounds, which, as a

result, would have been interesting variables to test. Does soundscapes intensity influence emotions? Does it impact on the way the soundscapes are perceived and if yes, to what extent? These questions would have been posed if I had had access to suitable technology. What is more, the online survey engine imposed some restrictions in terms of expressing the emotions, which might have culminated in slightly imprecise outcomes. If the research was going to be repeated, more emphasis should be put on the differentiation of the informants. The vast majority of respondents (93.6%) live in urban areas, which makes it purposeless and arduous to review the results in the context of demography and find any connections between the participants' place of residence and their feelings towards certain soundscapes. Finally, a second, control group of participants should be introduced. These respondents would be given the same questions, but in a different order, to examine if the accumulation of soundscapes is truly responsible for the intensification of emotions.

6.3.2 Ideas for the follow-up research topics

This thesis might constitute a sufficient basis for future research within the topic of soundscapes. With option "1 - not at all" dominating a vast majority of histograms, it is safe to say that a soundscape alone does not evoke sorely strong feelings. Nevertheless, the results suggest that a combination of soundscapes affects the recipient's mood. What if this experience was extended with other senses? In future research, the participants could be subjected to broader tests that, in addition to listening to soundscapes, would include other stimuli (e.g. photos, smells etc.). It would also be spellbinding to analyse how people's emotions alter over time. The survey was conducted in winter when the availability of the soundscapes in nature was restricted. Some of the most positively assessed soundscapes were associated with summer: words like "holidays", "beach" and "good weather" were very common among the written responses. Would the reception of these soundscapes be as good if the survey was carried out in summer? Are the respondents really attracted to these "vacation" sounds or was it the longing for holiday and high temperatures that impacted on their feelings? In other

words, it may be worthy to continue the study over a longer period to monitor seasonal changes in the participants' reactions.

In the question about soundscape 4, several respondents mentioned the church bells as the major emotion trigger - not because of the sound itself, but because of its religious connotations. Similarly, the soundscape containing the buzzing bees track was stressful for some participants due to their fear of insects. Is it only the physical properties of a soundscape that evokes feelings, or does its denotation play a role too? What are the most common psychological factors that make people dislike certain soundscapes? This could be another topic to investigate in the future.

7. Conclusion

To sum up this thesis, I will repeat my hypothesis and try to assess it from here: anthrophonic soundscapes impact on humans negatively, while soundscapes created by nature affect people in positive ways.

The presence of sounds within landscapes was largely ignored by urban planners and landscape architects throughout the years (unless it occurred in the form of noise and was brought to their attention as a nuisance). Only in recent years, this topic gained some interest, which developed the concept of soundscapes. Although the literature suggests several definitions, “soundscapes” might generally be described as combinations of sounds unique to a given environment and subject to the listener’s perception. Depending on the origin of the sound, soundscapes are classified as biophonic (sounds of vocalising organisms), geophonic (geophysically induced sounds) and anthrophonic (sounds of humans and man-made objects). Soundscapes might be applied in a variety of disciplines: acoustics, psychology and design. However, the available research on soundscapes is not very extensive. This thesis attempts to contribute to this matter through the following aims and objectives:

- To find out to what extent soundscapes affect mood and well-being,
- To characterise how respondents’ feelings change after being exposed to a series of soundscapes,
- To determine how people react to each kind of soundscapes (biophony, geophony and anthrophony).

The results produced in this study are sufficient enough to answer these questions, therefore it might be concluded that the thesis goals have been achieved.

The findings indicate that a single soundscape without a context usually does not provoke very powerful feelings. Nonetheless, it seems that emotions tend to get stronger when the recipient is exposed to a series of different soundscapes. What is more, geophysical soundscapes receive the best reception and are often referred to as “calming”, “relaxing” and “pleasant”. Biophonical soundscapes get mixed feedback, which might be caused

by their connotations. When it comes to anthrophony, soundscapes containing audible human voices generate varied responses (some being positive, as their authors enjoy being around people, others being negative due to social anxiety and fear of crowds), while soundscapes with predominantly artificial sounds are almost unanimously considered stressful and annoying. For these reasons, my hypothesis is only partially true. Some anthrophonic soundscapes do impact on humans negatively and some natural soundscapes affect people in positive ways, however, it appears that between them there is an entire spectre of soundscapes which are perceived in a non-binary way. Furthermore, the thesis revealed numerous additional factors that might be responsible for experiencing soundscapes, such as the intensity and volume of sounds, personal preferences, stimulation of other senses, seasonal changes and prejudice. These aspects could be tested in potential follow-up research in the future. Finally, the results can support the development of urban planning strategies. Recommended solutions include the introduction of flowing water features and quiet zones into cities as well as “muting” artificial sounds and incorporation of soundmarks.

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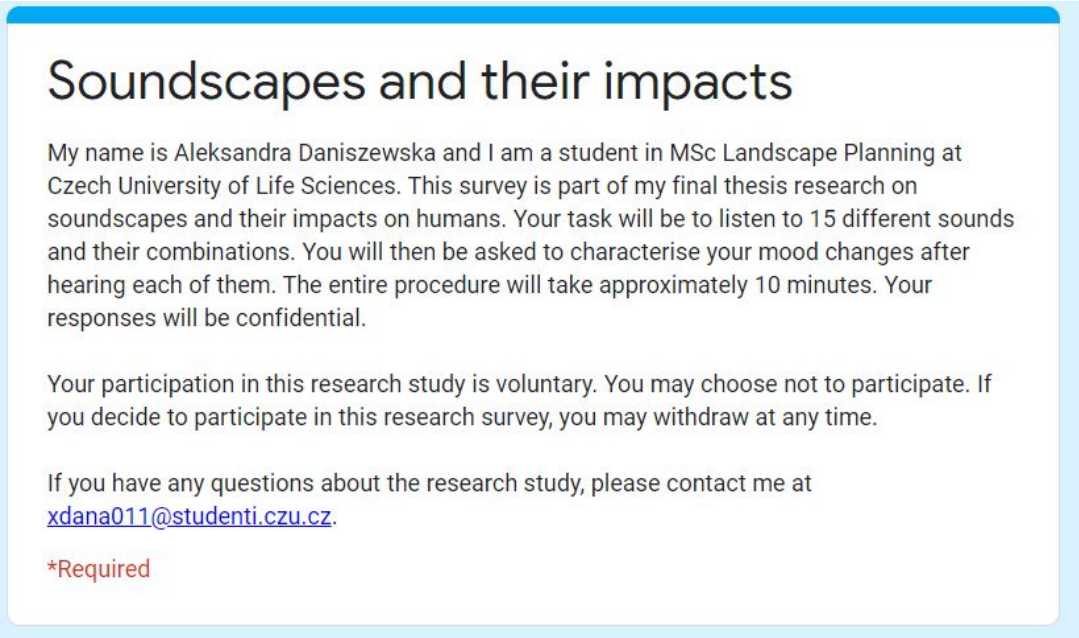
9. List of figures

10. List of tables

11. Appendices

Appendix 1: The survey contents.



Soundscapes and their impacts

My name is Aleksandra Daniszewska and I am a student in MSc Landscape Planning at Czech University of Life Sciences. This survey is part of my final thesis research on soundscapes and their impacts on humans. Your task will be to listen to 15 different sounds and their combinations. You will then be asked to characterise your mood changes after hearing each of them. The entire procedure will take approximately 10 minutes. Your responses will be confidential.

Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time.

If you have any questions about the research study, please contact me at xdana011@studenti.czu.cz.

*Required

Your age: *

- 0-17
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+
- Prefer not to say

Your gender: *

- Female
- Male
- Other
- Prefer not to say

You live in...: *

- ○ a village (up to 1 000 inhabitants)
- ○ a town (1 000 - 20 000 inhabitants)
- ○ a small city (20 001 - 100 000 inhabitants)
- ○ a medium city (100 001 - 500 000 inhabitants)
- ○ a big city (500 000+ inhabitants)
- ○ Prefer not to say

Please listen to the tracks below. After hearing each of them try to assess how you feel and how each of the listed emotions corresponds to your mood by rating them on a scale 1-5.

Soundscape 1

Soundscape 1: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 1: Why do they make you feel this way?

Your answer

Soundscape 2

Soundscape 2: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 2: Why do they make you feel this way?

Your answer

Soundscape 3

Soundscape 3: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 3: Why do they make you feel this way?

Your answer

Soundscape 4

Soundscape 4: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 4: Why do they make you feel this way?

Your answer

Soundscape 5

Soundscape 5: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 5: Why do they make you feel this way?

Your answer

Soundscape 6

Soundscape 6: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 6: Why do they make you feel this way?

Your answer

Soundscape 7

Soundscape 7: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 7: Why do they make you feel this way?

Your answer

Soundscape 8

Soundscape 8: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 8: Why do they make you feel this way?

Your answer

Soundscape 9

Soundscape 9: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 9: Why do they make you feel this way?

Your answer

Soundscape 10

Soundscape 10: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 10: Why do they make you feel this way?

Your answer

Soundscape 11

Soundscape 11: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 11: Why do they make you feel this way?

Your answer

Soundscape 12

Soundscape 12: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 12: Why do they make you feel this way?

Your answer

Soundscape13

Soundscape 13: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 13: Why do they make you feel this way?

Your answer

Soundscape 14

Soundscape 14: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 14: Why do they make you feel this way?

Your answer

Soundscape 15

Soundscape 15: How do these sounds make you feel? *

	1 (not at all)	2	3	4	5 (very much)
Relaxed	○	○	○	○	○
Stressed	○	○	○	○	○
Happy	○	○	○	○	○
Scared	○	○	○	○	○
Annoyed	○	○	○	○	○
Energetic	○	○	○	○	○
Upset	○	○	○	○	○
Calm	○	○	○	○	○
Anxious	○	○	○	○	○

Soundscape 15: Why do they make you feel this way?

Your answer

Thank you for taking your time to complete the survey. Your response is very important to me!

Submit