

TUB Soundscape Project 2022:
Measurement and Intervention

Project Report:
Auditory Maps as a Measurement Method
and its Application for the Evaluation and
Improvement of auditive Qualities of Study
Rooms

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0. Abstract

Until recently, I was not aware of the great influence of sound on my learning behaviour. But when the Technical University Berlin opened its doors to the students in summer 2022 and a lot of different study places became accessible, the great dependency of the surrounding soundscape on learning behaviour became obvious. In the TUB Soundscape Project: Measurement and Intervention I learned a particularly interesting method to evaluate soundscape qualities: Auditory maps, developed by Dr. Thomas Kusitzky. In the following, I will explain who Thomas Kusitzky is, what his auditory maps are about and how they can be set up. Then, measurement results are shown and possible interventions are presented.

Structure

0. Abstract.....	2
1. Thomas Kusitzky's Auditory Maps.....	3
1.1 Thomas Kusitzky.....	3
1.2 Auditory Maps.....	3
1.2.1 Idea behind Auditory Maps.....	3
1.2.2 Creation of an Auditory Map.....	4
1.3 Performed Measurements with Auditory Maps on the study places of the Technical University Berlin.....	4
1.3.1 Introduction.....	4
1.3.2 Measurement of the Study room next to Café Shila.....	5
1.3.3 Measurement of the Wiwi Library in the main building.....	5
1.3.4 Measurement of the lawn on the opposite side of the main building.....	5
1.4 Possible Interventions.....	5
1.4.1 Study Room next to Café Shila.....	6
1.4.2 WiWi Library in the main building.....	6
1.4.3 Lawn on the opposite Side of the Main Building.....	6

1. Thomas Kusitzky's Auditory Maps

1.1 Thomas Kusitzky

Dr. Thomas Kusitzky is an artist and scientist that made soundscapes of cities to one of his main focuses in art and research since many years. While noise reduction might be familiar to most people, he goes a step further and investigates how city-sound can be designed specifically to make everyday life more versatile and enjoyable. As an expert on city soundscape design, Dr. Thomas Kusitzky had several jobs in academic teaching, worked at many research projects and wrote his dissertation and a book on this topic. Also, he regularly consults in urban planning. His artistic work is also settled in the sector of auditive art. [1],[2]

He realized that especially for consulting, no good tools for communication were existent. When measuring the sound level, one could not determine if the sound was felt as good or bad. An example would be a fountain placed next to a busy street. Although increasing the overall noise level, it is able to make it be perceived more positive. An extensive sound or even video recording would miss the interpretation of the sound of humans. So he developed the auditory maps: A method to capture not only the physical happenings but also the emotions and associations and non-auditive circumstances connected to the interpretation of the sound by a listener.

1.2 Auditory Maps

1.2.1 Idea behind Auditory Maps

When having a first look on an auditory map, one can see words arranged on a sheet of paper in different colors and sizes, forming something that looks like a map (have a look on the appendix). But it is not a map in a geographic sense, mapping sound level to a certain position. It is a map of different words describing the experience of a soundscape. The words are arranged closer to each other when having a stronger connection and are enlarged according to the importance for the listener's experience. It will be described in more detail in section 1.2.2. So numerical and physical aspects are not that important. Instead, the experience is, which especially serves the purpose of evaluating the auditory architecture. So auditory maps are not objective, they are subjective or even intersubjective. This means that something is subjectively felt by multiple persons at the same time. Here, the aim is to improve study place for all students. Thus, the auditory maps are worked out by two people, one expert and one person new to the topic.

In conclusion, the *experience* of a soundscape can be presented with an auditory map and this is used as a basis for communication.

1.2.2 Creation of an Auditory Map

In the following, the creation of an auditory map is explained, according to Thomas Kusitzky's personal instructions:

1. In this case, to make more differentiated measurements, the auditory maps are measured by two people, one expert and one person new to the topic. You both go to a place of interest and stay there for approximately thirty minutes. Briefly write down the most important information such as time, date and location. In case of the study places, size and amount of students should be added.

2. Listen with open eyes and write down all the impressions connected with your auditory experience. What can be written down depends on the communication objective but Thomas Kuszitzky proposes 4 categories of words: **Physical happenings** creating sound (e.g. rain dripping on the floor), **non-auditive circumstances** important for the interpretation of sound (sun is still shining/rainbow), **perceived emotions** and at last, **associations** (fairytale).
3. After/ while listening, you color the words corresponding to the categories defined earlier.
4. Cluster the sounds. Put the words that you connect with each other next to each other. Several zones should emerge on your map, centered around different experiences. All relating experiences can be easily seen in a cluster. Especially when terms overlap a lot, it becomes clear why clustering makes the information more accessible.
5. Weight the importance of the words for your experience by changing their size.

1.3 Performed Measurements with Auditory Maps on the Study Places of the Technical University Berlin

1.3.1 Introduction

Three auditory maps of study places have been created so far. The places chosen for measurements were all of different character and size: The small study room next to Cafe Shila (1), the big WiWi library in the main building (2) and the big lawn on the opposite side of the main building (3). In the following, one can see a rough explanation and interpretation of the three auditory maps that are attached in the appendix.

With the help of Xin Li's work, further students will be examined via questionnaires that evaluate the current situation and the interventions.



Source: [3]

1.3.2 Measurement of the Study Room next to Café Shila

Next to the Café Shila, there is a small study room of approximately 32 m² in size. On Wednesday the 28th of June, 4:40 PM, there were approximately 8 persons in the room. On the first look, the auditory map is divided into a left and right cluster. The things happening outside versus the things happening inside. So in fact, in some cases an auditory map can include a geographic logic, if this is needed for the purpose of communication. In this case, it is important to cluster according to a geographic logic, because then it becomes visible that the study atmosphere inside the room is distracted by the people outside, sitting in the cafe. Loud music and the bad feeling that arises when other people are having fun in visible distance seems to be the main cause of distraction. Although it seems obvious, it is important to remark that the auditory map would be created significantly different by the people sitting outside.

1.3.3 Measurement of the WiWi Library in the Main Building

The next measurement took place in the WiWi library in the main building. The visible space has an approximate area of 200 m² and on Thursday, the 29th of June, 4:50 PM there were 10 persons present. It stands out that, from an auditory perspective, this place seems suitable for learning. The room is extremely quiet and the only sounds heard are sounds usually masked by noise. When concentrating on the sound, they become really obvious but usually, when working/writing and creating slight sound, they fade into the background. So it is questionable if the auditory map is a good measurement method to evaluate the sound quality for these low noise levels. It is remarkable, that most of the words on the auditory map are associations. Hearing these clear, selected sounds and no background noise allows to interpret a lot from the soundscape. For some learning types, this place is too quiet and they become nervous when automatically having to interpret all these clearly hearable noise sources. But in most cases, they should just be overheard and thus nearly no soundscape is perceived. Other problems lie in the visual space but are thus not examined further.

1.3.4 Measurement of the Lawn on the opposite Side of the Main Building

The third measurement took place on the main building's lawn. The place was chosen to also examine the rarely used alternative to learn outside. It has an observable area of approximately 600 m² and was measured on Thursday, the 29th of June at 1:20 PM. The soundscape is inviting to relax or have an unstressed conversation. For some people, it was the choice of a place to learn on this warm summer day. The interpretation of the sounds were strongly influenced by the physical conditions, such as the sunshine, the leaves rustling in the wind and. Also, the noise level was not disturbing, as all of the sound had a natural origin. All in all, it seemed like a good place to study, from an auditory perspective. Nevertheless, the place could not be used to write down things on paper, as there were no tables and also the wind caused paper to easily fly away.

1.4 Possible Interventions

In the following, several interventions are proposed. With the help of Xin Li, their effect will be examined afterwards via questionnaires.

1.4.1 Study Room next to Café Shila

As a lot of student cafes on the campus have a study room next to it (like the WiWi Café, EB104, Shila, ...), the study room next to the Café Shila can be seen as a representative example for the situation of several study places. As pointed out, the strong auditive presence of the people having fun in the nearby cafes hinder the students at their learning progress, especially when the cafes get crowded in the late afternoon. From collected experience, one can say that many students studying in these study rooms go there, in order to be close to a place of distraction and social interaction. But in later hours, they are sometimes annoyed if it gets too loud and they need to focus. A possible intervention would be to hand out hearing protection. They could reduce the noise level if the place gets too loud but they would still be close to a place to have fun. Also, awareness could be spread via posters with critical questions that make the students overthink their current learning situation in an auditory sense. Because another common observation is that students have never thought about how a good soundscape could influence their learning progress. Nature sounds instead of bass lines might keep them more focused. So these posters will make them think about considering to move to another study place according to individual preferences.

1.4.2 WiWi Library in the Main Building

A common observation is that newly enrolled students learn in the silent library, although not knowing which soundscape they might prefer. Some experienced learners reported, that they need a certain sound level in the background to not get bored or distracted and be able to focus for longer. As the library is very silent, awareness could be spread via posters that recommend the students to play nature sounds via headphones. As could be seen from the performed measurements, background noise in form of nature sound may be the most suitable to mask the silence/ scattered outstanding sounds.

1.4.3 Lawn on the opposite Side of the Main Building

As the soundscape outside was perceived as very positive, no intervention should take place. The positivity comes from the natural occurrences and should not be influenced by further artificial interventions, as this could alienate the most natural place on the campus.

Sources

[1]: <https://www.kusitzky.com/zur-person/>

[2]: Presentation by Thomas Kusitzky at TU Berlin

[3]: https://www.chemie.tu-berlin.de/fileadmin/i10/Grafiken/campusplan_TU.jpg

Shila, Wednesday, 28.06.2022, 4:40 PM, 8 Persons on 32 m²

factually discussing
students

Clear explanatory language

whispered hints

Office atmosphere

typing noises

overworked

Unscrewing sounds of bottles

potato chips
sizzling

Hard working students inside

headphones

silent beats

Nervous mood

Beautiful sight through the large
windows

people sitting outside on
ale-benches under a large
tree, in front of the glass
front, drinking beer

conflicting

How can I work when others are
having fun next to me?

whining dog

loud

excited talks

distracting

frequent change of music genre: Techno, Jazza,
Pop. Mood changes with it.

harmonic

Techno club threatening

Hollow bassline from next door

Uncorking sounds

People having fun outside

Wiwi Bib, Thursday, 29.06.2022, 4:50 PM, 10 Persons on 200 m²

Whispered discussions
Very quiet careful
Carefully moved objects
Door creaking
Sporadic high tones, sometimes continuous in periodic intervals
Keyboard and mouse sounds
Chair squeaking
Sounds usually masked by noise
Few people on a lot of space
Big, grey office space
Open plan office from hollywood movies
soulless
unnatural
Fan noises
Squeak
ambulances
sirens
Police cars
Breaking cars
Motor sounds
Sounds from outside reverb
Change between only high frequencies come through and only low frequencies come through
Only unnatural sounds coming from outside

Lawn front of the main building, Thursday, 29.06.2022, 1:20 PM, 15 Persons on 600 m²

A word cloud of sensory observations from a lawn area. The words are arranged in a non-uniform, overlapping manner. The colors of the words correspond to different sensory categories: blue for auditory (sounds), orange for visual (sight), green for tactile/temperature (touch/feel), and red for other observations. The words are of varying sizes, with 'Calming' and 'Enveloping' being the largest.

Individuals or groups of up to 3 people
laughing
chattering
Students reading
Students taking a nap
Tires rolling over the cobblestone
Car horn
Traffic noise in the background
Rustling of the leaves
Sunny
Trees
Park
Shade
Pigeon
Blackbirds
Enveloping
Calming
Warm
Slight breeze
Sometimes a bit cold if the breeze stays for too long
Silent high frequencies of music
Sitting next to Headphone users in the Bus
Girl doing yoga
Music
End of lecture
Fast steps
People hurrying to mensa