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DEFINING URBAN SOUNDSCAPE DESIGN MEANS AND TOOLS

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ABSTRACT

In the context of urban planning, the aspect of environmental noise is at the forefront of public and political debates. Previous concepts in environmental noise management focused primarily on the physical characteristics of sounds.

Nonetheless, urban sound is more than just physical parameters; it is important for our everyday experiences and social interaction. Urban sound can have a positive effect on well-being, promote orientation and help to strengthen social and cultural ties. In this context, a comprehensive approach is needed to appropriately design sound in urban environments.

This contribution uses examples to analyze which are the decisive conditions for the auditory experience in a specific urban context. From this, means and tools for urban soundscape design are derived, which can be assigned to the following three groups: sound events, sound propagation and the expectations of the residents.

The inclusion of these means and tools in urban planning can make a significant contribution to the development of high-quality urban places and situations and to the expansion of conventional noise control policies. Not only the city dwellers, but also municipalities, authorities and investors benefit from such comprehensive urban soundscape design.

Keywords: urban soundscape design, design means and tools, acoustic quality, noise control

1. INTRODUCTION

In current administrative practice, the sound in the city is predominantly addressed with conventional noise concepts as part of urban planning. In practice, this means that noise emissions are determined and compared with sound level limits providing a variety of noise control concepts that aim to reduce or limit these level values [1].

However, looking at noise pollution solely from the physical level falls far short of the mark. Studies show that non-acoustic moderators, for example *Trust/Acceptance*, *Expectations* or the *Orientation of outdoor areas*, have a significant influence on noise annoyance [2] and that a reduction of the sound level values does not necessarily lead to an improvement in acoustic quality [3]. Even more, sound can have positive effects on our health and social interaction [4-5].

How urban places sound in detail depends on the respective framework, which includes the urban planning and the different activities of the residents [6]. Therefore, it is important to consider urban sound from the beginning of the planning stage.

Targeted urban soundscape design can improve the quality of life. In this context, a comprehensive approach is needed to adequately design sound in the urban environment.

2. ANALYSES

In order to understand how the acoustic quality is determined by the framework conditions set by the built environment, three elements are defined for the analysis:

Sound Events: Sound events can either be introduced directly, for example by installing a rushing fountain or art interventions, or they can be made possible through a specific framework – for instance by enabling communication by creating attractive places to stay.

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Sound Propagation: Through specific design of the built environment acoustic effects can be optimized due to physical effects such as absorption, reflection, scattering or diffraction.

Expectations: Expectations of the sound result from what the appearance and purpose of the respective environment suggests. Depending on the situation these expectations can be raised, confirmed or counteracted.

In the following section, four examples of German urban settings are presented, and the sound environment will be analyzed based on these elements. It should be noted that all these examples have a similar function as places to stay and social exchange.

2.1 Example 1: Nürnberger Platz, Berlin

Nürnberger Platz is centrally located in the west of Berlin. After its destruction in the Second World War, it was rebuilt in the spirit of post-war modernism. Tall, solitary buildings dominate the visual appearance. With a multi-lane road running across the square, the design is based on the concept of a car-friendly city.



Figure 1. Nürnberger Platz, Berlin.

Sound Events: The sound environment is dominated by the traffic – the vehicles generate a permanent background noise, the passing cars nearby come to the forefront of the acoustic scenery occasionally. Sounds of humans are barely audible. Occasionally, birds can be perceived during quiet periods. The sounds create an unpleasant monotonous and deserted atmosphere, the square does not invite to stay longer.

Sound Propagation: The high, resoundingly hard building facades reflect the traffic noise back onto the square, amplifying it.

Expectations: With its stores, restaurants and green spaces, Nürnberger Platz looks like an urban place to stay. But the square fails to fulfill these expectations; street noises dominate, and sounds intended to contribute to relaxation are absent. The square is rarely frequented, and the shops in the neighboring buildings also appear dated.

2.2 Example 2: Prager Platz, Berlin

Prager Platz is located in the same quarter as Nürnberger Platz. Also destroyed in the Second World War, this square was only rebuilt in the 1980s in line with its historical design. The original traffic circle was retained, but the northern section was completely closed for cars.



Figure 2. Prager Platz, Berlin.

Sound Events: The sound environment is dominated by a mix of human and natural sounds. Especially the voices and actions of the people, the birds and water sound of the fountain generate a diverse lively atmosphere. Traffic noise is only noticeable from a distance, from the cars driving on the cobblestones on the south side.

Sound Propagation: The buildings on the square form a circular development that is closed except for the outgoing roads. This protects the space from outside noise. At the same time, the positive sounds in the square are amplified by the reflections.

Expectations: The square is surrounded by numerous shops and restaurants, each with terraces facing the square. There are spacious areas for pedestrians to move around and meet people. The square also offers numerous recreational opportunities, particularly park benches and outdoor dining areas. The soundscape fulfills the expectations of a lively, urban place to spend time. Prager Platz is always well frequented.





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2.3 Example 3: Maaßenstraße, Berlin

Maaßenstraße, located between Nollendorf- and Winterfeldplatz in Berlin-Schöneberg, is based on a shared-space model concept. The idea behind this concept is the mutual consideration of each road user with the goal to improve road safety including more pedestrian movement and bicycle traffic.



Figure 3. Maaßenstraße, Berlin.

Sound Events: The sound environment is dominated by the sounds of human interaction (playing children and communication of the visitors). Although the noise of passing cars is also clearly perceptible, it is less prominent. In addition, natural sound elements, such as birds or the rustling of leaves, contribute slightly to the acoustic experience. The sounds create a lively and pleasant atmosphere, with a feeling of relaxation, comfort, and safety.

Sound Propagation: The buildings along Maaßenstraße are aligned parallel, and to the south the space opens towards Winterfeldplatz. The urban structure creates a protected area where noises from outside are shielded. Immediately next to the recreational area there are outdoor seating areas of restaurants. The guests' communication and the sounds of the pedestrians are reflected on the building facade and are therefore more noticeable in the recreational area.

Expectations: Most people visit the place for their daily shopping and meeting with friends expecting a lively vibrant atmosphere. The soundscape fulfills these expectations, with a differentiated sound environment (temporal and spatial) confirming the visual impression and function of the place set by the contextual framework. The sound experience is diverse, the passing cars and walking

sound of pedestrians create an auditive connection with the urban street environment, the communication sounds are responsible for its lively character.

2.4 Example 4: Walter-Benjamin-Platz, Berlin

Walter-Benjamin-Platz is located not far from the famous Kurfürstendamm in the west of Berlin. It is closed to road traffic and completely sealed. In terms of size, it corresponds almost exactly to the southern section of Maaßenstraße.



Figure 4. Walter-Benjamin-Platz, Berlin.

Sound Events: The soundscape is dominated by the sound of a fountain at the head of the square. Although the rush of water masks the noise from the neighboring streets, it also drowns out most of the other sounds in the square. However, the sounds of human activity are also few and far between, as there are not enough attractive places to stay. The soundscape is monotonous and without a lot of variety in temporal and spectral characteristic; it's unspecific and overloaded.

Sound Propagation: The many reflective surfaces and the closed facades amplify the noise of the water fountain so that it fills and dominates the entire space.

Expectations: The square should serve as a sheltered, protected area away from the busy road for relaxation and meeting. The overloaded exhausting sound environment does not fulfill these expectations. Communication is almost impossible due to the dominating loud rushing mix of water and traffic noise. Staying at the site for an extended period is tiring, and relaxation and recovery cannot occur.





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3. DESIGN

The examples show that the three elements *Sound Events*, *Sound Propagation* and *Expectations* are not a coincidence. Rather, these depend on the framework conditions created by urban planning. In this context, the elements can be understood and used as design means and tools which can be integrated into planning processes in different phases at different times.

Urban planning

The essential conditions for acoustic quality are already set at the urban planning level [7]. By defining zones of different uses or the building structure, initial decisions are made regarding sound events, sound propagation and expectations.

Landscape architecture

The choice of greenery [8], the path material [9] or the installation of water elements [10] evoke sound events which can be introduced directly or indirectly (setting conditions for sound events). Sound propagation can be optimized by the choice of surface materials or the topography. The visual impression of the landscape in turn has a significant influence on the resulting expectations of the users.

Building architecture

Analogous to the design of the landscape, the building architecture shapes the visual impression of places and expectations. In addition, the architecture provides further opportunities to improve the acoustic quality in the adjacent open spaces through the design of the buildings (choice of building material, façade design, building position) and the specific distribution of uses on a smaller scale.

It is important to note that most planning decisions have an impact on sound, whether consciously intended or not. In this context, an overarching goal should be defined that serves as a guideline throughout the planning process.

The integration of urban soundscape design in planning processes can be divided into three phases.

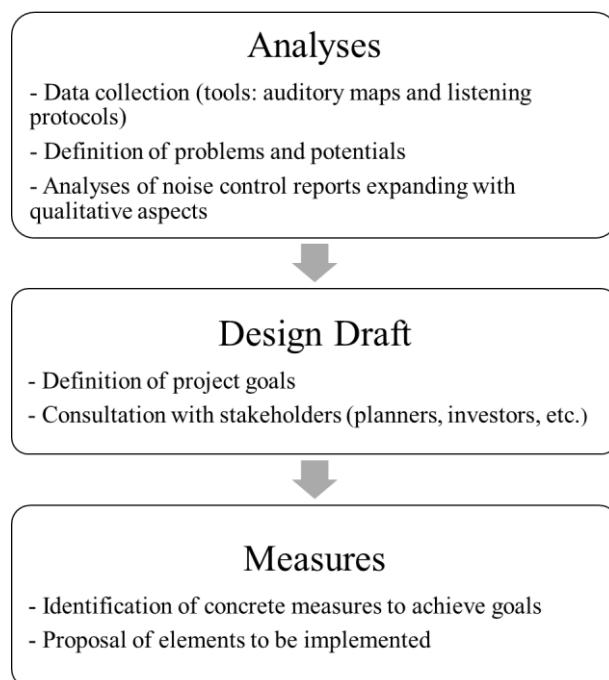


Figure 5. Flow chart illustrating the phases of integrating the urban design tools into planning processes.

For effective solutions, urban sound must be considered at an early planning stage.

4. DISCUSSION

One of the main challenges working in noise control at the administrative level is that, until now, investigations must be carried out strictly in accordance with the legal framework. The implementation of noise control concepts is established and largely defined in urban planning. The soundscape ISO standardization [14-16] sets a supporting framework to implement new concepts on a political level, but also has its limits. Most projects start at an early planning stage where no data can be collected, and analysis of the acoustic environment is not possible. In this context, it is important to draw on the experience of similar urban situations to be able to consult stakeholders on the desired acoustic experience and to ensure that the measures presented can be understood by stakeholders and, therefore, can be implemented in the planning process.





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In this context, it is essential to create awareness of urban soundscape and to highlight the benefits of conscious design. This can make a significant contribution to developing high-quality urban places and situations; it can prevent possible noise conflicts and avoid costs for later noise control measures.

In the future, it will be important to find new ways of presenting urban soundscape design means and simulating its influence on the acoustic experience. In this case, auralization tools and software become more and more important. It will be exciting to see what possibilities AI will provide regarding the representation of future acoustic situations and how conventional noise control concepts will change in this context.

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