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A TALE OF TWO CITIES: SOUNDSCAPE ANALYSIS AND PLANNING

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ABSTRACT

Case studies of soundscape projects in 2 cities are used to demonstrate methods and potential interventions that can be applied in these environments. Both cities had initially described acoustical issues related to loud vehicles and amplified music disturbing residents and evading enforcement policies. Interviews with stakeholder groups including residents, city officials, business owners and others; individually, in small focus groups and in larger public fora; soundwalks at multiple times of day and night; long term and short-term acoustical measurements, and mapping were used to identify itineraries, calendars, taxonomies and acoustical communities involved in the soundscapes of the cities. Conceptual structures, acoustical rooms and sonic niches were identified. Strategic computer model studies were used to explore potential solutions and stimulate dialogue among soundscape participants. Student design projects explored imaginative possibilities for future development. These soundscape elements were transformed into planning interventions to reduce, buffer and mitigate the unwanted sounds, preserve and enhance the desired sounds and adding multi-tiered interventions to expand the social and cultural richness of the cities including infrastructure such as program, verticality, texture and material; administrative development and policies; and operational controls such as continued public engagement and education as methods to move forward.

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1. INTRODUCTION

Case studies in 2 cities are presented to highlight methods, issues and potential solutions for exploring urban soundscapes where people have expressed concerns about the qualities of their sonic environment. Each case study highlights issues and potential solutions that were explored using similar methods. Each city had an urban core with mixed-use activities and zoning classifications of properties. All included entertainment sounds and sounds of loud vehicles traveling on roads as one of the concerns expressed by residents and city officials. The smaller city had a population of 73,000 and one main street that passed through the center of town where most of the entertainment and vehicular activities occurred. The larger city had a population of 184,000 that had an urban core on the north side of a river and then a large area that sprawled to the east to the beach, to the west and also the north with single family residential areas and dispersed commercial activities. Both cities had entertainment districts with special sonic allowances for amplified music activities.

2. METHOD

The general method used was described in Siebein and Siebein (2023) [1]. Specific adjustments were made in both cities in response to local conditions. The goals of the study, methods and evaluation of potential solutions were developed by active engagement of the full range of stakeholders in organized community fora, focus group meetings with groups and conversations with individuals to understand the multiple and often disparate points-of-view

of the acoustical communities that produce and experience the soundscape. Long term and short-term measurements of ambient sounds were made at locations identified by stakeholders representing business owners, residents and city officials as members of a city sponsored Noise Control Advisory Committee guided the study in the larger city. The City Attorneys and other officials guided the study in the smaller city as an exploratory effort to understand the complexity of the soundscape in different areas of the city. Measurements and recordings were also made of sounds during soundwalks taken at multiple times of day and night to help form an acoustical calendar. The itineraries of the soundwalks were identified by the stakeholders and the researchers. Soundwalks were taken with individual stakeholder groups to experience the city from their perspective and to hear their interpretation of symptoms, causes, potential solutions and other issues while simultaneously experiencing the environment. The research team also conducted incognito soundwalks where they took measurements using concealed devices so they could listen and record events without those making the sounds being aware of their presence. They also conducted straightforward documentary soundwalks where team members simultaneously recorded visual and audio recordings while taking interpretive notes and measuring sounds as well. In the larger city the documentation of existing conditions occurred over multiple days and weeks. The documentation occurred over 1 weekend in the smaller city. Data were analyzed based on the specific issues to be explored in each city. Computer models and point source calculations of acoustical levels were built of selected areas to identify source-path-receiver and cause and effect relationships among the variables under study. Interpretations of the data and evaluation of potential acoustical interventions were proposed and evaluated by the stakeholder groups. There were a wide range of potential interventions considered including physical noise buffering or reduction strategies; administrative controls and operational controls.

3. CASE STUDIES

3.1 Case study 1: The smaller city

The smaller city has an historic downtown area that served as its core in the 19th and early 20th centuries. In the mid-twentieth century people began to move out of the central city and created nearby suburbs leaving the downtown less vital than it had been in the past. Then in the 1980's and 90's people and businesses began to move back into the central city. There is one main road that runs north and south that the city center is organized along. Eight acoustical zones along the 3.2 km stretch of the main street that passed through the downtown area were identified by stakeholders and confirmed with soundwalks, acoustical measurements, discussions with citizens and data analysis. The 3 zones in the downtown area had relatively short transitions between them. The other 5 zones had transitions of some length between them where there was vacant land or activities had not yet filled in the space between them. There was a large park with a small amphitheater and a bridge high above a waterfall in the center of the main street that formed an approximate boundary between the more dense urban core and the less dense periphery. Each zone had its own sound sources and architectural and urban character. The loud vehicle sounds which was a major concern of the stakeholders extended for the entire length of the main street, but was a special concern in the zones in the urban core because people would ride through the city and rev their engines to see and be seen and heard by pedestrians walking in this area. One particular concern expressed by stakeholders was the loud sounds of street musicians and street "preachers". Musicians would set up their instruments and a small portable sound system in the entry ways of stores that were closed, in small areas where the sidewalks widened, in public pars or gathering areas and other locations along the main pedestrian path through the city. A street preacher was a person who would have a microphone, amplifier and loudspeaker and would accost people walking on the street sharing messages with them in the same areas as the street musicians. Lines between excessive sound and freedom of speech and expression were difficult to determine. At the present time sound levels of 80 dBA at 25 feet from the source were permitted for the musicians and street preachers in the central business district. Concerns were also expressed about planning for future development including mixed-use, mid- and high-rise projects, amplified entertainment, particularly a national chain live music venue and other lively new activities of many types in close proximity to each other and to existing buildings. Soundwalks were taken during one weekend including Friday evening and night, Saturday morning, afternoon, evening and night and Sunday morning and afternoon when most of the activities of concern typically occurred. "Pools" of sound were identified qualitatively by listening during the soundwalks and by the long- and short-term acoustical measurements in each of the 8 acoustical zones. The sounds were relatively similar in each zone including loud vehicles and normal vehicles on the main street, sounds of people talking as they walked in the pedestrian friendly area, sounds from dining and entertainment venues and the sounds in the plazas and

sidewalks of the street musicians and street preachers. The sound levels varied from one zone to the next due to the physical configuration of the zone such as where people could walk, where the musicians and street preachers could set up, where the entertainment venues were located – on grade, whether they had outside dining or entertainment areas or not, whether there were traffic lights or other traffic control devices where people driving loud cars could stop and rev their engines or open their windows and play loud music out of the cars and other local conditions. The observations and acoustical measurements made during the soundwalks and other acoustical measurements confirmed the observations of the stakeholders that the sounds from the street performers and dining and entertainment establishments each propagated to a relatively small area defined by buildings, the street, and open areas near the sound source location. Interventions to improve both the present and future soundscapes involved recommending urban sonic niches for street performers and preachers so the amplified sounds would not adversely affect pedestrians who were not interested in listening. It also included a suggestion to decrease the distance from the sound source to the point of enforcement because a sound level of 80 dBA at 25 feet translates to a sound level of 95 dBA and higher at the relatively close distances that the loudspeakers of many street performers were to pedestrians passing by. This was a special concern where the performers were located in small islands of landscape that were directly adjacent to crosswalks where pedestrians had to wait for traffic lights to change for periods of time. Reduction of loud vehicular sounds for engines, tailpipes and amplified music were dealt with by enforcement strategies and monitoring devices. Recommendations for linking the planning and zoning requirements with the post construction noise ordinance were also presented. This included soundscape and noise studies for new projects in the study area as well as significant renovation projects or changes in occupancy. This is important for both potential noise generating projects such as restaurants with outdoor dining, entertainment venues, both indoor and outdoor and larger buildings with central utility plants. Proposed interventions included localized noise buffering and reduction strategies for the entertainment establishments, restaurants and residences. The measured sound levels were categorized in 5 general groups: quiet ambient sounds which were the lowest sound levels consisting of breezes blowing through the vegetation, insects, and pauses in road traffic; urban ambient sounds that included the quiet ambient sounds and sounds of normally operating vehicles driving on streets, air-conditioning systems operating and other typical sounds in the city; street performers and street preachers, "light" musical sounds; and musical sounds that were perceived as disturbances. The quantitative differences in overall A-weighted and C-weighted sound levels taken during the soundwalks for each were used to help determine possible sound level limits for different zoning categories and acoustical zones in the city. Mitigation systems based on analysis of each local situation for present and future development were proposed for each specific zone based on local conditions and operating parameters for each sonic condition.

3.2 Case Study 2: The larger city

Case study 2 took place in 8 areas of a larger city with a population of 184,000 people that was having a resurgence of residential construction in its core district as people were moving back into the city from peripheral suburbs and other locations in the northern U.S., Canada and other international locations. This resulted in multiple mixed-use areas that sprung up without prior planning. The result of the spontaneous growth was entertainment establishments and restaurants with indoor and outdoor entertainment and other commercial occupancies in close proximity to newly constructed multi-family residential buildings. In most cases neither the entertainment venues or the residents were built with acoustical strategies that recognized the sonic context in which they were built. Soundwalks at multiple times of day and night identified a complex interweaving of acoustical communities, itineraries and sounds contributing to the multi-faceted soundscape of the city. The 8 areas of the city under investigation had some similar and some local characteristics that allowed similar methods to be used in each but different studies and results to be identified. Long term continuous sound level measurements were made in each of the designated areas. Short term "spot" measurements were also made in each area at different times of day to identify specific acoustic events where they could be isolated from the aural context to the greatest extent possible. Extensive data analysis of site and activity specific measurements were necessary to isolate to a degree the levels, durations and frequency content of the sounds made at any of the establishments from the sounds of the vehicles at each of the source and receiver locations in each area of the city. Interestingly, it was also difficult for city officials to take acoustical measurements for noise ordinance enforcement purposes that could be definitively attributed to any one sound source due to the number and complexity of sound sources especially because city staff were required to take their measurements at grade when receivers were often located on upper floors of multi-family and mixed-use buildings.

The 8 acoustical zones identified by stakeholders made up a heterogeneous fabric of a complex city. Zone 1 was a 6 km stretch of a major thoroughfare that people drive high performance cars and motorcycles up and back on that ran parallel to the beach on one side and rows of multi-story residential buildings on the opposite side. There were also entertainment venues along the main road with activities that faced the residential buildings on the back side. Zone 2 was a main commercial street with shops, restaurants, offices and other mixed-use occupancies interspersed with each other. There were 3 micro areas with specific concerns along this street where individual entertainment venues propagated sounds to a few residences. Zone 3 was a residential area with a nightclub across the street. Interestingly, soundwalks late at night identified a temporary venue set up in the parking lot behind the nightclub as a contributor to the sounds affecting the neighborhood in addition to opening and closing the doors to the nightclub. Zone 4 was in an area with high rise residential buildings interspersed with commercial towers and one entertainment venue on grade. Residents on upper floors of one residential building expressed concerns about the entertainment sounds that when listened to and measured on the street were less than the background noise levels and were not audible. However, the sounds were plainly audible on balconies and inside living units on the upper floors of the residential buildings that the sounds had a direct line of sight to. Zones 5, 6 and 7 were located in or near different entertainment zoning areas. Each zone had distinct sonic attributes and issues noted by the stakeholder groups. Zone 8 was located in a single-family residential area located 5 km away from the central core of the city that faced the rear side of a commercial retail strip on a main road. A small group of residents expressed concerns about sounds propagating from an entertainment venue that propagated through the roof and doors that were sporadically opened for periods of time.

4. CONCLUSIONS

4.1 Summary

Several interesting soundscape intervention strategies were identified in the case studies that became building blocks for future studies in other urban and suburban areas as well as within the soundscapes of individual building projects. These included conceiving of the soundscape of cities as combinations of acoustical zones, each having its own attributes, sound sources, sound paths and architectural context. Additionally, identifying localized conditions of value to stakeholders such as sonic niches; city wide and local area data analysis strategies; the need for multiple types of soundwalks to deal with the unique character of each condition studied; practical difficulties extracting the contributions of individual sounds and their levels in complex urban soundscapes; and the need for multi-faceted solutions to address the needs in each city. This included physical infrastructure improvements in residences and commercial establishments; operational and administrative controls at entertainment venues; changes in zoning and planning ordinances to improve sonic compatibility in each area; the need for pre-construction soundscape analysis for future projects in the cities; and changes in the noise ordinances and enforcement policies to reflect the complexity of issues identified in the study.

4.2 Acoustical zones

Acoustical zones were identified in both cities as the building blocks for the soundscapes of the larger urban environments. These zones were identified by qualitative observations of the stakeholders and confirmed by the soundwalks and acoustical measurements. Acoustical studies of the localized conditions led to potential site-specific strategies for reducing, buffering and mitigating the sounds affecting specific groups of residents in each area. The idea of groups of acoustical zones affected by unique source-path-receiver conditions making up the fabric of a city or town helped identify the importance of local conditions and the possibility of micro scale investigations even in larger urban contexts as being able to contribute to the understanding and design process and quality of urbane living.

4.3 Combinations of stakeholder groups

The projects provided the opportunity to work with different combinations of stakeholder groups so the researchers could get a broad “picture” of the perceptions both of groups and individuals. The organized Noise Control Advisory Committee had structured meetings and appointed members who were representatives of different stakeholder groups. Conversations were official, recorded and documented in meeting minutes of all present. This group had the ability to make recommendations to city staff for adjustments in policies and procedures. The individual members of this group provided access to the researchers to individuals who had “ears on the ground” or who were in touch with specific issues, sound sources, benefits and difficulties in small neighborhood groups in each acoustic zone under study. This group extended to a wider network

of individual residents who provided special insights at the micro scale of niches in the city. It also gave the opportunity to spend time in individual residences to measure, record and hear what the residents heard that city staff did not have access to. Additionally, it allowed the researchers to travel with enforcement officers to understand the issues from their point-of-view as they traveled about the city and responded to calls in the evening, late night and early morning hours. These different types of soundwalks were most informative to round out the impressions gathered by the team on the street. Similar on site soundwalks and one-on-one discussions occurred with focus groups and individual city officials and entertainment and restaurant owners. The broad range of input and feedback on the process and results of the study was invaluable to the team.

4.4 City wide data analysis

Macro scale analysis of city-wide measurements made through soundwalks, long term measurements at fixed locations and measurements of specific acoustic events at individual locations provided ways to use the quantitative data to provide insights into potential applications in ordinances and other municipal regulations. Area specific recommendations were made in recognition of the local variations of uses, distances and physical contexts.

4.5 Verticality and variability

Stakeholder input, acoustical measurements and computer model studies identified verticality as an important concept in addressing the soundscape of the cities. Sound sources and potential receivers in both cities sometimes were located at street level, sometime in the middle of multi-story buildings and sometimes near the upper floors of the buildings. Enforcement actions of city officials and perceptions of business owners tended to address what was happening on grade resulting in mismatches of the perceptions of residential receivers and the business owners and operators. The vertical propagation of sound in architecturally complex environments explored in computer models provided explanations of why concerns expressed by residents were based on actual physical phenomena. Mitigation techniques explored in the 3-dimensional models also offered potential noise reduction strategies that could resolve these issues. Similar analysis identified the usefulness of variable operating acoustical strategies such as moving walls and operable roof enclosures used in several establishments as a prototype for use in other establishments in other areas of the city.

5. REFERENCES.

[1] G.W. Siebein and K.M. Siebein. Architectural Soundscapes: Theories, Methods and Practice. In B. Schulte-Fortkamp and A Fiebig, eds.: *Soundscapes: Humans and their Acoustic Environment.* Springer, 2023.