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*A Case Study of Parc du Portugal (Montreal, Canada)*

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## Chapter 5

# Activity as a Mediator Between Users and Their Auditory Environment in an Urban Pocket Park: A Case Study of Parc du Portugal (Montreal, Canada)

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### **ABSTRACT**

*Sound is receiving increasing attention in urban planning and design due to its effects on human health and quality of life. Soundscape researchers have sought ecologically valid measures to describe and explain the complex relationship between people and their auditory environments, largely employing laboratory studies and neglecting the active role of activity. This chapter proposes a situated cognition approach to study the relationship between context, use of space, and the ways in which users describe and evaluate sounds and their auditory environments in an urban pocket park. It draws on empirical data gathered in Parc du Portugal in Montreal, Canada using a mixed-methods research design that integrates ethnographic observations, on-site questionnaires, and behavioral mapping using a geo-spatial app to offer a situated understanding of the human auditory experience in its full complexity, with an emphasis on the mediating role of activity on the user-auditory environment relationship.*

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## INTRODUCTION

Studies with an urban focus, embedded in a large variety of scientific or applied disciplines, attempt to research, understand and ultimately contribute to improving urban life, particularly in a public context. In doing so, they attempt to disentangle the complexity of the multisensory urban experience and how the experience is shaped by and shapes individuals' and groups' actions in and perceptions of urban public spaces. Researching this complexity and offering multi-dimensional descriptions of the user-environment relationship requires interdisciplinary perspectives that integrate scientific knowledge as well as methods and techniques from both object and human-centred approaches.

To adequately understand the urban experience in context and to also gather meaningful insight that can support the design and transformation of urban spaces, scientists must strive to account for ecological validity concerns in their on-site research and generate insight that city-makers should integrate in their everyday projects for meaningful urban plans and designs. Ecological validity refers to the importance of studying human perception in a way that mimics people's everyday, real-life experiences, by accounting for and integrating "contextual and environmental cues" (Guastavino, 2005, p. 334) that can affect the ways in which people interact with their environment. It cannot be achieved in a laboratory setting, which divorces users from the contexts they are embedded in and exposes them to a controlled set of stimulations, limiting their agency and reducing the urban experience to simplistic causal relationships (i.e. the user influences the environment or the environment influences the user). Furthermore, it fails to account for the context-dependent ways in which users *choose to use and engage with* their environment, through different sensory modalities, in their everyday life. Comparatively, *in situ* studies ("in the wild") can focus on complex notions of activities and situated descriptions and evaluations of their environment, in context (see e.g. Herranz-Pascual et al. 2017).

This chapter situates the *auditory* dimension of the urban experience at the centre of the discussion, as it a key, yet understudied aspect of urban life. While the focus is on sound, the authors do not wish to over-emphasize audition compared to other sensory stimulations, as doing so would only reinforce a mono-sensory tradition; the purpose is rather to build on extensive knowledge on the importance of audition and sound in navigating and shaping urban spaces. The work described here advocates a shift from a visual sense-oriented investigation and transformation of public spaces to acknowledging and integrating the auditory dimension in academic and practice-related discourses, (Cerwén et al. 2017, Bild, Coler et al. 2016). In this context, this chapter investigates the relationship between the ways in which users use and engage with an urban pocket park and the ways in which they evaluate and describe their auditory environments. Soundscape researchers have sought ecologically valid ways of studying the relationship between users of public and private spaces and their auditory environment, but have only recently begun to consider the role of activity in *mediating* this relationship i.e. as the explanatory link between users and their environments (Herranz-Pascual et al. 2010, Bild, Coler et al. 2015, Aletta, Lepore et al. 2016, Steffens, Steele & Guastavino 2017, *inter alios*). Furthermore, while there is a growing body of knowledge on the influence of certain categories of sounds (e.g. "natural" sounds, traffic sounds) over users' evaluation of their public spaces, the complex relationship between engagement with public spaces and users' description and evaluation of their auditory environments in those spaces has not been systematically explored on-site. This is an essential gap because one does not exist or perceive *in vacuo*, untouched by one's environment or the others present in it, or even more, outside of one's own activities, needs, or expectations. Users' experiences of spaces, particularly their auditory experiences, are situated in a setting influenced by psychological, sociological and linguistic factors

(Bruner 1990, Dubois 2000), takes place in context (Brown et al. 2016) and are mediated by one's use and engagement with space and time.

Given the multisensory nature of the urban experience (Palipane, 2017), this chapter focuses on understanding the context in which users engage with their environment, from a spatial and temporal perspective, as well as how audition interacts with the other senses (e.g. vision) and the ways in which that may shape users' engagement with a public space. The study selects an urban park as a study site, particularly due to the demonstrated environmental and noise reduction benefits as well as the overall ecosystem services provided by urban green areas to urban dwellers (Dickinson & Hobbs 2017). The focus on parks is narrowed by looking at *pocket parks* – small urban parks that due to their size and location may offer their users a vastly different experience than squares or larger urban parks (Peschardt et al., 2012; Nordh & Østby, 2013).

The chapter aims to offer a methodological contribution with theoretical implications, as it develops and tests an innovative methodology that addresses the added value of a mixed-methods approach incorporating spatial-temporal patterns of the use of space to study the relationship between users of public spaces and their auditory environment on-site. To this end, the methodology combines ethnographic and systematic observations of the park, its amenities, its users and its acoustic environment; mapping of activities performed in the park; and on-site questionnaires with users of the park, focused on their overall and their auditory experience of and in the park. It also offers a theoretical contribution by adding to existing knowledge on situated approaches that strive to integrate users' activities as a key variable in the user-auditory environment relationship in a public space setting. The chapter thus proposes to include activity as a mediating variable in analysing the user-auditory relationship and to broaden the toolkit to research this relationship.

## **BACKGROUND**

The sensory experience in the urban built environment has been addressed extensively, particularly in architectural discussions with a phenomenological focus (viz. Bild, Coler et al. 2016, Palipane 2017 for brief reviews). Practitioners and theoreticians alike have been emphasizing the urgency of shifting from a sensory approach that focuses on one modality at a time, towards a multisensory approach with regard to designing and understanding spaces that would better mirror the ways in which people engage with their environments. In these discussions, the auditory experience has surfaced as a dimension of the urban experience that is not only understudied, but also insufficiently understood. Despite extensive knowledge on its historical relationship with technology, culture, society as a whole, health, etc. (Thompson 2002, Bijsterveld 2008, Andringa et al. 2013, van Kamp et al. 2016), sound has only recently, and timidly, been addressed as an integrative part of public and private life and considered in processes of urban transformation or design. Similarly, geographers have emphasized the under-representation of audition and sound (compared to the visual sense) in understanding users' processes of engagement with and production of space (viz. Revill 2016 for a review). Despite insights from numerous disciplines (including sociology, anthropology, psychology, linguistics, history), comprehending the complexity of the auditory experience and finding tools and methods to study the relationship between users of space and their auditory environment in an ecologically valid manner remains problematic or partially unresolved. The following sub-sections elaborate two aspects: the link between the auditory experience and public space, and the multidisciplinary approach needed to research the auditory experience in a public space context.

## **Public Space and Audition**

Understanding the user-auditory environment relationship in an urban public space setting where politics, society and economy meet and shape everyday urban life (Neal 2010) is of particular interest for researchers and practitioners alike. Theoretically speaking, public spaces should be designed and managed in such a way that they are accessible and open to users of the public space who wish to perform an(y) activity the space can encourage through its amenities, without being discriminated against or excluded based on e.g. socio-economic status, race or gender. The auditory dimension of the urban public space experience was researched either with a focus on large parks and urban green spaces, or, to a smaller extent, on urban squares and urban streets. Studies regarding parks documented the potential positive effects of users' auditory environments on their health in relation to restoration (Payne 2013, van Kamp et al. 2016), mood (see Steele, Tarlao et al. 2016 for a review), and need for quietness (Booi & van den Berg 2012), while squares and streets have been researched also in relation to restoration (Lindal & Hartig 2013) and acoustic comfort (Yang & Kang 2005). In both types of studies, an important overall insight was the strong relationship between visual and acoustic characteristics of a space and how the relationship can influence users' evaluations of sounds and auditory environments, particularly in relation to the perception of quietness and restoration (Pheasant et al. 2010, Lindal & Hartig 2013).

In this body of work, there are two gaps identified: first, the aforementioned studies do not include aspects of use of and engagement with the public space, largely neglecting the nature of users' activities that could for example be associated with restoration, and how the ability to perform their activities could affect users' evaluations of their auditory environments. Second, these studies dealt with a limited range of urban public spaces, both in terms of size and of materials (e.g. large urban parks or urban squares), disregarding other more common smaller spaces – such as *pocket parks* – found around cities in Europe and North America. This raises the question whether the findings for larger parks apply for pocket parks also, given that the acoustic environment of the latter is more likely to be influenced by the surrounding urban life (Steele, Tarlao et al. 2016).

## **Multidisciplinary Approaches to Researching the Auditory Experience**

Taking sound research out of the laboratory and into the field, particularly when gathering human evaluations, requires multidisciplinary conceptual frameworks and methods to study perception in context and in relation to activity. Soundscape researchers have been critical of the dominance of acoustic approaches in the research literature regarding the relationship between users of spaces and their environments (Dubois et al. 2014). In particular, they criticize the focus on acoustic measurements of environments (e.g. the decibel – dB – and associated quantities – Leq, dBA, Lden) rather than how people perceive it. In urban contexts this has led to the development of acoustic models that, for example, guide the creation of noise maps that inform local and regional noise regulations, without an explicit focus on who (if anyone) is e.g. disturbed or what actually happens in the city. Such models are rigid and cannot (and do not even aim to) offer a complete description of urban spaces from an auditory perspective, despite the vast number of available measures and indicators (e.g. Botteldooren et al. 2006) and strategies proposed (EC 2002, Wang & Kang 2011, *inter alios*). While useful for legal purposes, where established decibel limits apply, these models cannot allow for the integration of contextual elements and do not offer insight on e.g. why users engage with their public spaces. Relying exclusively on sound pressure levels or proximity to a busy avenue with intense traffic can portray a misleading image of the appropriateness of

the park for the area or its patterns of use. Newer (psycho) acoustic models, although based on physical data, use additional perceptual modelling to analyse the acquired data (Yu & Kang 2009, viz. Kang, Schulte-Fortkamp et al. 2016, and Kang, Aletta et al. 2016); others shift the focus to perceptual modelling, namely understanding the key factors that can help characterize users' perception and evaluation of their auditory environments (viz. Axelsson et al. 2010, 2012).

This chapter shows, for example, that, despite the dominance of cars and traffic during lunchtime, users overwhelmingly evaluate their auditory environment as appropriate for their activities and their activity as "easy to perform" in their auditory environment, a finding that could not have been predicted by acoustic measurements. Thus, given the complexity of the auditory experience, studies aiming to research the user-auditory environment relationship must rely on knowledge and tools from multiple disciplines that can support a multi-layered, ecologically valid representation of everyday life and thus further steps are being taken to develop even more integrative perceptual models. No standardized analyses, models, or measures yet exist that integrate quantitative and qualitative aspects of auditory evaluations of spaces, though this study and other recent studies are inching toward that feasibility.

Various tentative models treading the middle ground between exclusively acoustic and exclusively perceptual models have been proposed in initiatives in the past decade. Such models aimed to combine, to various extents, contextual, behavioural and perceptual data to understand the auditory experience (Herranz-Pascual et al. 2010, Jennings & Cain 2013, Bild, Coler et al. 2016, Aletta, Kang et al. 2016, *inter alios*), sometimes with the explicit aim to further contribute to the improvement of the urban auditory experience. Large-scale intra-European projects like QUADMAP (link, Aspuru, García, Bartalucci et al. 2016a) and CITI-SENSE (link, Aspuru, García, Herranz et al. 2016b) and smaller scale North American projects like the Musikiosk (Steele et al. 2015, Bild, Steele et al. 2016) have attempted to describe and analyse the auditory experience in a holistic manner. They developed methodologies to collect, on-site, (quasi) simultaneous data on the evaluation of users' auditory environments, contextual insights on how the space is being used, as well as on its physical properties through sound recordings, measurements and land use information, and then to process the resulting dataset in an integrated manner (e.g. Filipan et al. 2017, Herranz-Pascual et al. 2017). While some of these models proposed integrating an activity component (Jennings & Cain 2013) and some, a spatial-temporal dimension (see Liu et al. 2014), this process of integration lacked, in the authors' opinion, a geographical space-time component that considered users' activities in relation to *how*, *where* and *when* spaces are being used and how that related to users' evaluation of their auditory environments, in context. In this chapter, the authors expand on Brown et al.'s definition of context, "as a generic term that includes all other nonacoustic components of the place (even including people's experience and memory" (2016, p. 10), referring to context as the observable (including audible) aspects of the park. Context includes not only the physical elements of the space, but also ethnographic data on the profile of regular and non-regular users (e.g. how they engage with others) and other details in the use of space that cannot be captured using systematic behavioural mapping.

The geographical perspective has mostly been used to visualize the auditory experience or the acoustic environment as evaluated by the user (e.g. creating social-media based maps Aiello et al. 2016), measured by acoustic sensors (e.g. noise maps – Vogiatzis & Remy 2014), or a combination of the two, usually moderated by the researcher (Ge et al. 2009, Liu et al. 2013). However, the resulting maps fail to offer a convincing spatial-temporal representation that highlights the detailed interplay between types of sound and users' descriptions and evaluations, given spatial and temporal constraints. This chapter introduces the idea of supplementing spatial visualization with information on human behaviour, adding an activity layer that shows how users' auditory environments can influence and can be influenced by how spaces

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are being used in space and time. This contribution can offer insights on the relationship between use of space and users' auditory environments to urban planners and designers aiming to improve the urban auditory experience and design spaces that are used and enjoyed by their users.

## METHODOLOGY

This chapter recognises the complexity of the user-auditory environment relationship in a public space, on-site, (thus, necessarily in context), with an emphasis on users' activities. It puts forward a mixed-method approach integrating three intertwining layers of description and analysis of the user-auditory environment relationship: the context, the use of the park, and users' description and evaluation of the auditory environment. This research builds on previous models (context-person-activity – Lercher & Schulte-Fortkamp 2003, and person-place-activity – Herranz-Pascual et al. 2010) that laid the groundwork for a multi-layered study of the auditory experience.

While the effect of sound pressure levels over perceptions and evaluations of sounds and auditory environments is well documented (see Yang & Kang 2007, Shepherd et al. 2013, Licitra et al. 2014, *inter alios*), and while acoustic indicators were collected in association with this study, they are not reported in this manuscript as the quantities are not related to the present findings. Comparatively, less is known about *users* and their engagement with and evaluation of their auditory environment. Through the chosen approach, the authors demonstrate the value of the information collected through a human-centred approach, which could be integrated by planners, designers and other decision-makers in their everyday practices.

The mixed-methods approach is thus centred on a research protocol structured around three building blocks, described in detail in the next three sections: 1) the context, 2) the use of the park, and 3) user-centred descriptions and evaluations of sounds and their auditory environments. It is based on the assumption that integrating a variety of data can help paint a more realistic “auditory portrait” of a research site.

The protocol that includes the data collection strategy is detailed in Table 1 below, with additional information on data processing strategies; the collection methods as well as how they were employed in the case study (Parc du Portugal) are described in Table 2 and Table 3. Of note here is that the resulting

Table 1. Data collection and analysis protocol

	Data Collection (Temporal Focus)	Data Analysis (Temporal Focus)
<b>Context</b>	<ul style="list-style-type: none"> <li>• Ethnographic observations (on-site amenity mapping, field notes, researchers' descriptions of their auditory environments)</li> <li>• Questionnaires (respondents' evaluations of the park)</li> </ul>	<ul style="list-style-type: none"> <li>• GIS-based processing of spatial data (amenity mapping)</li> <li>• Discourse analysis of written data</li> </ul>
<b>Use of space</b>	<ul style="list-style-type: none"> <li>• Ethnographic observation</li> <li>• Behavioural mapping</li> <li>• Questionnaires (activities, reasons for using park, frequency)</li> </ul>	<ul style="list-style-type: none"> <li>• GIS-based processing of spatial-temporal data on park use</li> <li>• Discourse analysis of written data</li> </ul>
<b>Description and evaluation of the auditory environment</b>	Questionnaires (auditory environment description, sound enumeration, auditory environment and sound evaluation)	Discourse analysis of written data

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data collection and processing protocol is replicable in different public space settings (e.g. larger parks, squares, urban streets) and can be combined with other methods, particularly focused on collecting e.g. data on sound pressure levels or other (psycho)acoustic parameters.

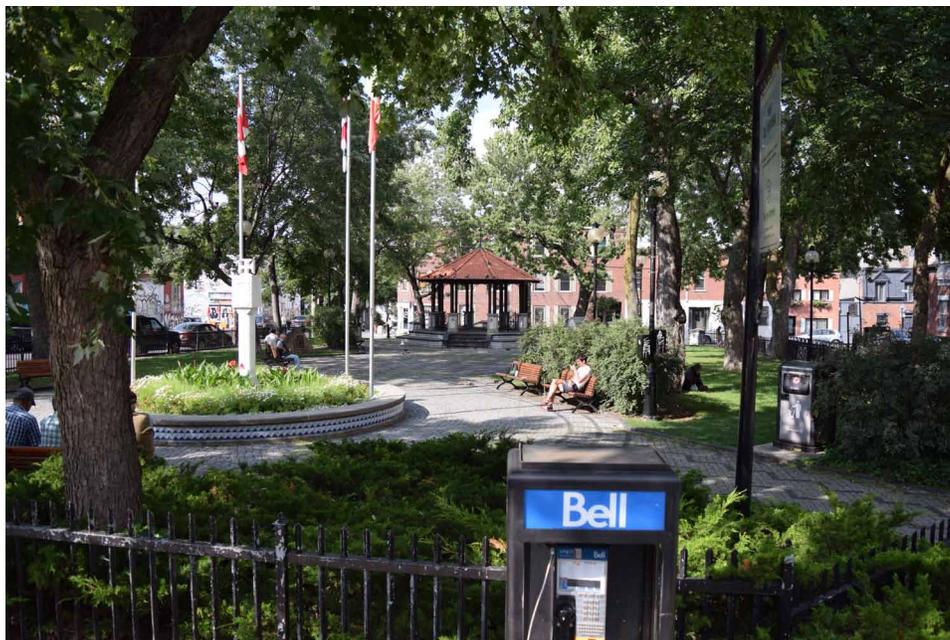
### **Case Study: Behavioural and Auditory Public Space Characterization (Parc du Portugal)**

The chapter draws on a study conducted in Parc du Portugal (Figure 1), an urban pocket park in Montreal (Canada), from July to September 2015.

The data analysis strategy was tested previously in a pilot study performed by the authors in a larger park in Montreal, also in the summer of 2015 (Steele, Bild, Tarlao et al. 2016). The three methods of data collection were used within the same or consecutive data collection sessions. Given the temporal nature of sounds and of the auditory experience in general, as well as the observed strong temporal patterns of use of the park, the analyses were focused on specific time frames in different moments of the day and of the week (namely lunchtime during the week and evening during the weekend), thus reducing the collected data to a smaller dataset.

The data collection methods described as part of the research protocol have been developed to be directly integrated (e.g. marking the questionnaire respondents as part of the behavioural mapping process), but they can also be used separately. The ethnographic observations (*Data Collection: Field Observations*, section “i”) are completed at the same time as the behavioural mapping and the questionnaire collection, to ensure suitable temporal comparisons and to allow researchers to situate users’ observed patterns of behaviour as well as their written responses on their auditory environments, in a context.

*Figure 1. Parc du Portugal. Photo credit: (Cynthia Tarlao)*



## Data Collection: Field Observation

Field observation, as a method for gathering qualitative data typically used in social sciences, is a technique where the researcher/a research team systematically observes a space to gain direct understanding of the dynamics of the space in its natural context. It is a widely used method for researching patterns of use of public spaces, and it is employed both by scientists (usually in social sciences) and professionals, including urban planning, design and architecture practitioners (Whyte 1980, Gehl 2011, Ostermann 2009, Goličnik & Thompson 2010). The methods used in this case study were nonparticipant observation techniques, allowing researchers to observe the natural dynamics of the space while minimizing their own interference (Liu & Maitlis 2010).

### i. Ethnographic Observation

The research in Parc du Portugal gathered ethnographic observations of the park throughout the entire behavioural and questionnaire data collection, to capture the context in which the use, the description and evaluation of the park (and users' auditory environments) are taking place. This involved mapping the amenities of the park, taking field notes, photographs and audio-recordings, as well as informal discussions with regular users of the park.

### ii. Behavioural Mapping

The main method of systematic field observation in the Parc du Portugal research was *behavioural mapping*, to document how users of the park move in space and time, use it and interact with its amenities (Ostermann & Timpf 2009, Ostermann 2010, Cosco et al. 2010, Goličnik & Thompson 2010). The behavioural mapping was supported by a Geographic Information Systems (GIS)-based mapping application, developed for a location-enabled mobile device such as a tablet or smartphone. The application was developed specifically for the purpose of this project with the help of external experts, and is currently unavailable to the general public. Such an automated way of mapping produces digital, geo-referenced data in a virtual space in real-time, which can be further transformed and analysed within a GIS after pre-processing steps (e.g. using a MATLAB-based algorithm to adjust the geo-referenced database output of the application for use within a GIS).

In Parc du Portugal, trained collectors recorded:

- Geo-referenced spatial and temporal data on users' engagement with the space, including users' trajectories during their park visits,
- Demographic data, including observed user characteristics (e.g. age, gender) and use of headphones, and
- Behavioural data i.e. (a) observed activity (using free-format, yet converging, labels e.g. sitting, standing), (b) use of amenities (e.g. sitting on bench), and (c) level of social interaction in their activity (solitary or socially interactive: pair, small group or large group) (see also Steele, Bild, Tarlao et al. 2016).

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The labels and categories for the collected data were established by the research team based on previous studies (e.g. Ostermann 2010). Given that environmental conditions may influence users' perceptions and evaluations, they were also documented at the beginning of each observation session, as in-app comments (e.g. 30 degrees Celsius, sunny). The behavioural mapping, completed as part of 21 distinct hour-long observation sessions, covered 533 separate park visits, resulting in 533 unique observations referring to individuals, pairs or groups of users, engaged in lingering activities in the park (amounting up to more than 1,000 different users observed).

### **Questionnaires**

Questionnaires are extensively used in sound-related research as a structured data collection instrument to study people's impressions, opinions or perceptions of the acoustic environment (Guastavino et al. 2005, Zhang & Kang 2007, Yu & Kang 2008, Bild et al. 2015, *inter alios*).

In Parc du Portugal, questionnaires aimed at gaining insight into the ways in which users describe, evaluate and relate to their environment in general, and their sounds and auditory environment in particular. The design of the questionnaires drew on previous studies that developed protocols to aid in assessing users' perceived quality of the auditory environment, their mood and their noise sensitivity, and it was previously discussed elsewhere in detail (Steele, Tarlao, Bild et al. 2016). The questionnaires combined open-ended and closed-ended questions with Likert scales and had four distinct parts, covering: situational factors (including self-reported activities and frequency in using the park), description and evaluation of sounds and the overall auditory environment, psychological factors (including mood, extraversion and noise sensitivity) and demographic factors (including age, gender) (Steele, Tarlao et al. 2016).

For this book chapter, questions capturing situational factors, the description of sounds and auditory environments and users' evaluation of the latter in relation to their activity were selected (see Table 2).

#### **i. Recruitment of Respondents**

The recruitment of respondents was done on a random basis, approaching users that were observed to be lingering in the park; passers-by were not approached as they were not considered park "users" in this study. Willing users were invited by researchers to complete the questionnaire; given the bilingual nature of Montreal, the questionnaire was available both in English and French and users could choose for either. Recurrent users completed the questionnaire only once and a particular group of such users (Portuguese elderly) opted out from completing the questionnaire, despite repeated invitations. Users having completed the questionnaire will be referred to as "respondents" in the sections covering the analysis of questionnaires.

During 23 data collection sessions under similar environmental conditions (dry, with clear skies or slightly overcast, average temperature over 20 degrees Celsius), 156 bilingual questionnaires (English or French) were completed on-site. There is partial overlap between the collected questionnaires and the collected observation data, but due to methodological constraints it was not always possible to complete parallel data collection. This does not affect the analysis, which is focused on analysing patterns of use and sound evaluation and description from a temporal perspective i.e. based on time of day and week.

The following section provides the conceptual description of the three building blocks as well as how the data was analysed and integrated.

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Table 2. Selected questions from the questionnaire

Question	Type of Answer
<i>Park perception</i>	
Why this park?	Open-ended
In your opinion, what are the main activities that take place in this park?	Open-ended
<i>Self-reported activity</i>	
What are you doing in the park today?	Open-ended
<i>Auditory environment description</i>	
How would you describe the soundscape in the park at this moment?	Open-ended
<i>Auditory environment evaluation (in relation to activity)</i>	
The soundscape I hear is appropriate for my activity.	Likert scale (1 “Completely agree”-7 “Completely disagree”)
It’s easy to do what I want while I’m in this soundscape.	Likert scale (1-“Completely agree”-7 “Completely disagree”)
<i>Sound enumeration &amp; evaluation</i>	
Can you list some sounds that you hear here in the park that are: <b>pleasant</b>	Open-ended
Can you list some sounds that you hear here in the park that are: <b>unpleasant</b>	Open-ended
Can you list some sounds that you hear here in the park that are: <b>neutral</b>	Open-ended

### 1. Context

To characterize the context, the chapter utilizes:

- Geo-spatial data to visualise the layout of the park, its surroundings and physical amenities,
- Annotated sound recordings and field notes, and
- Observations on use of park amenities, recurrent users and their relationship with the space (see Figure 2).

As the focus is on audition, this includes information on the use of headphones in the park. The authors focused on integrating a temporal dimension to the analysis, so the aforementioned data are supplemented with information from one part of the questionnaire dataset, specifically the 75 questionnaires collected during lunchtime (during the week) and in the evening (during the weekend).

Geo-spatial data on park amenities were processed within the GIS to produce a spatial account of the context. Free responses to the open-ended questions referring to the two questions on *park perception* (see Table 4) were subjected to discourse analysis techniques; comparisons were made between the answers of respondents engaged in activities with different levels of social interaction, as well as the answers provided for the two different time frames. Together, they support both a researcher-driven and

Figure 2. Basemap displaying the amenities of Parc du Portugal. Source: Arrondissement du Plateau-Mont-Royal. Background layer: Esri World Topographic Map (“Topo” basemap)<sup>1</sup>



user-driven characterization of sounds and the auditory environment in various moments of the day and week, producing written descriptions of auditory environment exemplars that can aid readers of this chapter in “imagining” the park acoustically in the given physical context.

## 2. Use of Space

The authors applied the methodology to analyse the *use of space* based on both observed and self-reported user behaviour. From the observation points acquired through behavioural mapping, the chapter utilizes those that were collected during lunchtime during the week (159 points) and evening during the weekend (77 points), further split according to the level of social interaction of the activities performed (i.e. solitary vs. socially interactive). This led to four analysis units (socially interactive activities – lunchtime week, social interactive activities – evening weekend, solitary activities – lunchtime week, and solitary activities – evening weekend), processed into layered maps of observation points and trajectories of park use for each spatial unit, using a regular grid of 2 x 2 meters. Density maps were generated to examine patterns of occupancy and trajectories during different time frames as well as potential relationships between activity types and spatial or temporal aspects of use.

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Respondents' self-reported labels for their activities in the space complemented the behavioural mapping. The answers to the question on *park use* in the questionnaire (see Table 4) were subjected to the same discourse analysis techniques and comparisons as above. The resulting categories of activities are not discrete.

### 3. Description and Evaluation of the Auditory Environment

The analysis draws on the answers to the open-ended question on respondents' *auditory environment description* (see Table 2) as well as to the Likert-scale based statements on *auditory environment evaluation* in relation to respondents' activities. Regarding the description, this served to identify potential relationships between users' descriptions, the time of day and week when they were questioned and / or the level of social interaction of the activity they were performing at the time. The enumerations provided in the responses to the three questions on *sound evaluation* were also compared. For comparisons involving scale ratings, significance tests are presented.

## **FINDINGS**

### 1. Context

#### a. **Parc du Portugal: A "Social Park"**

Parc du Portugal, is, as the name suggests, a park situated in the heart of the Montreal Portuguese community. It is frequently used by groups of Canadian elderly people who identify with the Portuguese-immigrant-influenced history of the park and its position within the aforementioned community, and who see Parc du Portugal as a "social park" (Steele, Tarlao et al. 2016). It is a park whose location and amenities were perceived by respondents to aid with levels of stress, restoration and improvement of mood, among others (Ibid.). Situated next to a busy street, it offers a place for users in transit to pause or a destination for those looking for a place to have drinks, meet with friends or have lunch. It has been consistently used throughout the day, particularly during lunchtime and, to a slightly lesser extent, in the evening. The park was observed as being appropriate for users engaged in both socially interactive and solitary activities and also of all ages. Headphone use among public space users was observed to be low at all times of the day and of the week and among users of all ages, with less than 5% of observed users making use of headphones while using the park. Readers interested in the comprehensive ethnographic profile of the park are referred to Bild, Steele et al. (2016).

The researcher-centred auditory observations of the park indicated two distinct auditory profiles, one during lunchtime and a second one in the evening during the weekend. The lunchtime auditory environment was dominated by a constant presence of traffic-related sounds (including the sounds of cars and frequent buses), due to it being bordered by rue St. Laurent, a busy commercial artery, and other three smaller streets with less circulation. On the side closer to St. Laurent, a relatively large group of recurrent users – elderly people – usually occupied the benches a few hours every day, laughing and conversing. Despite the park being intensely used by solitary users or users in pairs and small groups, their voices were sometimes drowned out by traffic. Occasional sounds included those of lorries stocking nearby business and pigeons cooing, as well as a public bicycle sharing system stand in use (for a detailed overview of the auditory profile of the park, see Steele, Tarlao et al. 2016). In the evening

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during the weekend, the traffic was less intense but remained a dominant sound; the music from bars and restaurants nearby was also clearly audible. Given the relative “quietness” of St. Laurent during the evening hours, compared to its patterns of use during the day, the sounds of users were more audible, including the sounds of conversations, laughter, steps and occasionally music.

#### **b. Respondents’ Reasons for Using the Park**

The majority of questioned respondents, irrespective of the time frame, cited the geographical location of the park as the most important reason for it being used. It was described as a space that is “on the way” to respondents’ final destination, specifically close to their workplace, home, the city centre or to restaurants or bars that respondents intended on heading towards later or where they came from. The self-reported reasons for using the park were consistent with the patterns emerging from behavioural mapping (see below, Figure 3): most respondents accessed and exit the park on the two exits towards the busy and commercial rue St.-Laurent, where most of the above mentioned destinations were most likely be found.

A comparatively smaller number of lunch respondents referred to the fact that the park offered a mix of sun and shade, seating amenities and trees. Despite the dominance of the pragmatic rationale behind the intense observed patterns of use of the park, respondents, especially the socially interactive ones, also included more personal reasons that influenced their choice in using the park. This was related to how they perceived the pleasantness of the park (which could also be associated with the previous knowledge of the respondents on the park). It was described as “charming”, “beautiful”, “cute” and “lovely”. These assessments related to the perceived use of the park, which differed. Overall, the park was perceived as a social park, where one come to relax / “chill”, sit, rest, relax, meet neighbourhood people and/or others (with a particular focus on the very active Portuguese community). It was also hyperlocal (embedded in a community whose main focus is the members of the community themselves), with respondents who could see their apartments from the park. Socially interactive respondents present during evenings were more outspoken about the perceived sociability of the park, perceiving it as being used for drinking, conversations, “chilling” and socializing, among others. This evaluation was expected due to the nature of their own activities and potentially the acknowledgment of their own role in the auditory scene, compared to that of solitary respondents. The relatively famous musical history of the park (due to organized concerts, karaoke days, markets, etc.) was also mentioned, most likely by respondents already familiar with the park.

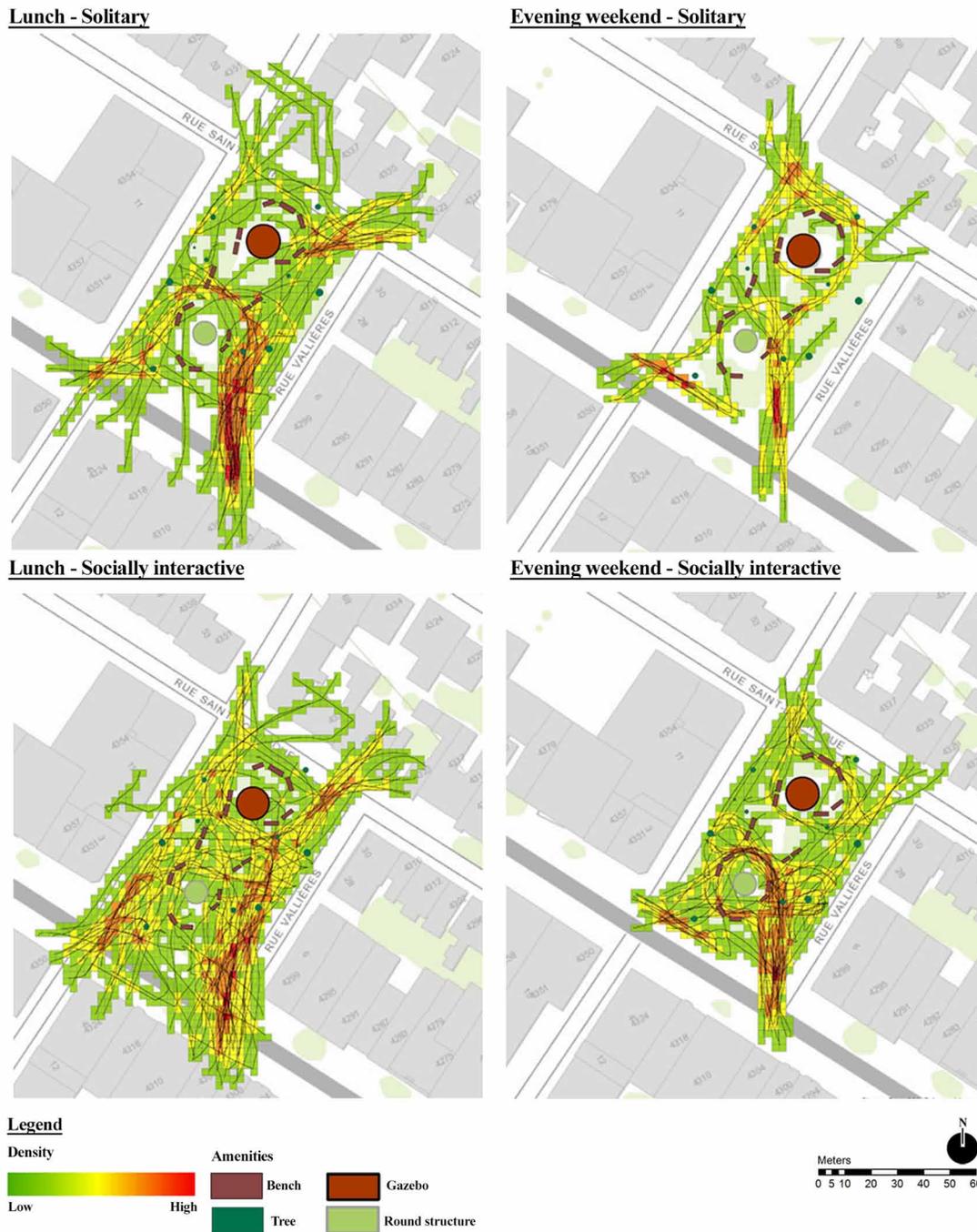
## **2. Use of the park**

### **a. Observed Patterns of use of the Park**

The density maps of use of the space graphically represented in Figure 3 indicate that the park was relatively homogenously used, with the amenities in its southern part being slightly preferred, both during lunchtime (left) and in the evening in weekends (right). The park was used more by users engaged in socially interactive activities (below) than solitary users (above) within the same time frame. The fact that the exits towards (and entrances from) St. Laurent were the more frequently used did not come as a surprise due to the nature of the busy boulevard. On St. Laurent one could find both the businesses employing users having their lunch in the park during lunchtime and the bars, restaurants and clubs where users observed in the park during the evening in the weekend were likely to head towards after

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Figure 3. Patterns of use of Parc du Portugal per activity type and timeframe. Background layer: Esri World Topographic Map (“Topo” basemap)<sup>2</sup>



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spending time in the park. As expected, the park was more heavily used during lunchtime (when users tended to use its seating amenities but also sit on the grass), but it remained frequently used during the evening in the weekend, including by solitary users. This could be the case because of it being accessible and visible (despite the greenery), offering sufficient lighting and also being close to a well-stocked “depanneur” (licensed alcohol vendor) on its NW exit. Many traversing St-Laurent would also enter the park to light a cigarette, check a map, take a phone call, or physically rest on a bench making the small detour into the park. Those entering from the neighbourhood side were likely to be passing it as a “welcome”, green shortcut.

### **b. Respondents’ Self-Reported Activities**

For lunchtime respondents, the differences in self-reported activities between those performing solitary and socially interactive activities were subtle. The most frequently described activity for both types of lunchtime respondents were unsurprisingly eating-related, followed by “taking a break” and “with partner”. Solitary respondents also referred extensively to “relaxing”, only once mentioned by those performing socially interactive activities. Comparatively, for evening solitary respondents, “relaxing” and “eating” were the main activities, whereas for socially interactive respondents, “having a drink”, “being with friends”, “talking” and “eating” were the most referred to activities, with “taking a break” and “relaxing” mentioned less often. The proportions are significant, as demonstrated by inspection of the data. The responses are consistent with previous research on activities usually performed in such parks, particularly in relation to restoration / relaxation as well as sociability (Nordh & Østby 2013). They are also consistent with both the expectations of dominant activities to take place during each time frame, as well as with solitary respondents’ preference for more contemplative activities, compared to more dynamic ones for respondents performing socially interactive activities, particularly during the evening. The findings are confirmed by the data collected through behavioural mapping, especially for the evening dataset, where a smaller number of solitary respondents were questioned due to the limited availability of these respondents in the space.

### **3. Respondents’ Description and Evaluation of Their Auditory Environment**

The third layer of inquiry concerns the respondents’ description of sounds and their auditory environment and their evaluation of sounds in terms of pleasantness as well as their auditory environments in relation to their activity. This analysis is based on open-ended data collected in the questionnaire.

#### **a. Respondents’ Auditory Environment Descriptions**

There were no observable differences among the free-format descriptions of either solitary vs. socially interactive respondents or lunchtime vs. evening respondents. Descriptions were dominated by either holistic labels alone, e.g. “quiet”, “peaceful”, “relative quiet as regards its central location”, or by holistic descriptions in which one or more sounds are emergent, e.g. “calm (except the cars on St. Laurent)”<sup>3</sup>. The holistic descriptions refer to positive evaluations related to quietness, calm or pleasantness, usually through the use of adjectives: “soothing”, “pleasant”, “comfortable”, “calm”, “relaxing”. A few exceptions relate to negative holistic evaluations, using adjectives (“noisy”) or nouns (“noise”): “there is too much noise coming from traffic (St. Laurent)”<sup>4</sup>. The emergent sounds (sources or actions) differ between

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lunchtime and evening respondents; that is reflected also in the sounds mentioned as pleasant, unpleasant or neutral (see section 3.b. below). For lunchtime respondents, the emerging sources are those of St. Laurent, associated with unpleasant sounds e.g. “the cars of the St. Laurent”, and “birds”, described in one case as a counterbalancing factor to the sound of cars (“a bit noisy because of St. Laurent. The cars are too noisy, but the birds are pleasant”<sup>25</sup>). For evening respondents, only the sounds of other people (“discussions”, “passers-by talking”) and cars / traffic are equally mentioned as emergent.

**b. Respondents’ Enumeration and Evaluation of Sounds**

When asked to enumerate and evaluate the sounds that they heard as “pleasant”, “unpleasant” or “neutral”, there was no noticeable distinction, for the same time frame, between those performing solitary activities and those performing socially interactive activities. Differences emerged rather between the two analysed time frames, particularly in relation to the sounds evaluated as pleasant and neutral (see Table 3).

Lunchtime respondents referred to cars and trucks (or other car-related sounds like honking) as being the most unpleasant sounds they heard, and to the so-called “natural” sounds in their auditory environments (birds, wind and the subsequent “wind through the leaves of trees”) as the most pleasant. Similarly, while the park was observed to be used most intensely during lunchtime, for the same time frame, conversations of others (including more generic labels like “the sounds of other people”) were evaluated as being neutral. Comparatively, for those questioned in the park during the evening in the weekend, the most pleasant sounds were conversations – for solitary respondents and conversations, music (from the bars on St. Laurent or own), laughter (specifically labelled as such) and birds – for those performing socially interactive activities. All evening respondents referred to cars as the most unpleasant sounds and to cars and conversations as neutral. The “natural sounds” vs. “traffic sounds” distinction is consistent with findings in soundscape literature (Guastavino 2006, *inter alios*).

While there is a clear-cut distinction between the sounds most frequently referred to as pleasant, unpleasant and neutral for lunchtime respondents, those questioned during the evening were less uniform about their evaluations. This could be due to personal and situational factors (e.g. relaxation in the evening) as well as partially due to acoustical phenomena, e.g. potentially because the mixture of sounds made certain sources more or less neutral/negative in the absence of heavy evening traffic circulation. While cars were consistently evaluated as the most unpleasant sounds (unsurprisingly so, due to the proximity to St. Laurent) during both time frames, evening respondents also referred to them as neutral, potentially due to the fact that the traffic winds down in the evening).

*Table 3. Sounds enumerated and evaluated as “pleasant”, “unpleasant” or “neutral”, per activity type and timeframe*

		<b>Pleasant Sounds</b>	<b>Unpleasant Sounds</b>	<b>Neutral Sounds</b>
Lunchtime during the week	Solitary	Birds, the wind and the wind through the leaves	Cars	Conversations
	Socially interactive	Birds, the wind and the wind through the leaves	Cars	Conversations
Evening during the weekend	Solitary	Conversations	Insufficient responses	Insufficient responses
	Socially interactive	Conversations, music, laughter, birds	Cars	Cars, conversations

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c. Respondents’ Perceived Appropriateness of Their Auditory Environments for Their Activity

The analysis focused on users’ ratings in relation to the perceived appropriateness of their auditory environments for their activity as well as the perceived ease of performing the activity they wanted, also in relation to their auditory environment (see Table 4 for questions). Overall, respondents found their auditory environments appropriate in relation to their activity; the mean for all participants was 5.70 (of 7). The mean for appropriateness rating was slightly higher than that for ease of performing an activity rating, which was 5.04 (of 7). Solitary respondents (M = 5.25, SD = 1.68, N = 48) reported overall slightly lower values than the socially interactive respondents (M = 5.85, SD = 1.57, N = 145) for the appropriateness rating (t = 2.25, p = .026). Solitary vs. socially interactive ratings for ease of activity were not significantly different, but the median values for both ratings remain constant for both categories of lunchtime respondents and for evening solitary respondents. The socially interactive evening respondents of the park seemed to have the highest satisfaction with the auditory environment in relation to their activity, as they had the highest averages for ratings both for appropriateness and ease of performing an activity. Nearly achieving significance (t = 1.87, p = .067), ease of activity was rated higher for those who were performing socially interactive activities on the weekend evenings (M = 5.69, SD = 1.37, N = 29) versus weekday lunchtime respondents (M = 4.94, SD = 1.26, N = 18). Other tests did not achieve significance; nevertheless, they are presented in the table of means (Table 4) below.

A higher proportion of the lunchtime users found the appropriateness of their auditory environments for their activity below the mid-scale value (4 on a 1-7 scale). An in-depth analysis of the other answers of these respondents did not show any particular pattern that might relate their apparent dissatisfaction to the type of activity, type of description or evaluation of sounds in terms of pleasantness.

**CONCLUDING DISCUSSION**

The aim of this chapter was to develop and apply a mixed methods approach to study the auditory dimension of the urban public space experience, with a particular focus on the effect of users’ activities on their relationship with their auditory environments. It addressed two theoretical and methodological

*Table 4. Table of means for appropriateness and “It’s easy to do what I want” ratings, per activity and timeframe*

Timeframe	Rating	Activity – Level of Social Interaction	Mean
Lunchtime during the week	Appropriateness rating	Solitary	5.33
		Socially interactive	5.95
	“It’s easy to do what I want” rating	Solitary	4.79
		Socially interactive	4.74
Evening during the weekend	Appropriateness rating	Solitary	5.17
		Socially interactive	6.17
	“It’s easy to do what I want” rating	Solitary	5.00
		Socially interactive	5.53

gaps: the limited attention paid to researching the role of activity in users' experience of their auditory environments and the subsequent limited number of on-site studies of users' auditory environments that integrated an activity approach. This research thus aimed to offer mainly a methodological contribution, with theoretical implications, by using the empirical data collected through an innovative integrative mixed-methods research design to further the study of situated approaches to the user-auditory environment relationship in a public space context, particularly in relation to activity as a mediating variable in the aforementioned relationship. The implications of the findings were also considered for public space planning and design professionals.

## **Methodological Reflection**

The study proposed an extension to existing sound-related methodologies/toolkits by integrating behavioural mapping and other activity- and observation-centred methods in order to research the aforementioned relationship from a situated perspective, with attention to ecological validity. This chapter is among the first known work to extend the evaluation of the auditory environment with situated context variables into the temporal domain. It was inspired by and expands on the people-activity-place framework proposed by Aspuru and her associates (Aspuru et al. 2010) by integrating the space-time dimension of the relationship between use of public spaces and users' auditory environments. In doing so, it contributed to a multi-dimensional description of the park, how users engage with it as well as how they perceive their auditory environments, in context.

Including ethnographic observations and behavioural mapping to the mixed-methods toolkit allowed the documentation of clear temporal patterns both in the auditory profile as well as the use of the park. It also allowed for a systematic recording of the most frequented trajectories of the park per time frame. The situated questionnaires offered insight into affect and how users evaluated their auditory environment in relation to their use context. Integrating different methods permitted the authors to minimize one of the main methodological limitations associated with questionnaires and other direct forms of engagement with park users i.e. encouraging questionnaire respondents to *listen* attentively to their auditory environments rather than engage with the latter as they would do in their everyday experiences. By collecting additional behavioural data on the respondents' patterns of use of space as park *users*, i.e. ethnographic observations of their engagement with the space and researcher-centred descriptions of sounds and the environment, the research design allowed for a triangulation of the data. The methods informed each other and allowed for an integrated analysis of the relationship between users, their use of the park and their auditory environments. Incorporating the space-time dimension was also particularly relevant in relation to the auditory experience, that is very much embedded in an ever changing multi-sensory context; these differences were visible in users' descriptions of their auditory environments, enumeration of sounds and particularly in their pleasantness-based classifications of sounds (as pleasant, unpleasant or neutral) that depended on time of day and week.

Despite these considerations, the data collected did not yield clear distinctions between the auditory descriptions of respondents engaged in different activities. This could be because of limitations inherent to the selected methodologies, also mentioned above. For example, when doing behavioural mapping, the data collected remains the interpretation of the observer, irrespective of the thorough training beforehand; furthermore, it continues to be difficult to adequately visualize the temporal dimension of use of space. In the case of filling in questionnaires and self-reporting, it might prove challenging for

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one to express themselves in a “natural” way. Finally, context stays a challenge, particularly for on-site studies, as there are a large number of factors, ranging from personal profiles, to weather conditions, changing traffic patterns (which could influence the acoustic environment) or other users, that can frame and influence engagement with a space.

The authors contend that this is also influenced by users’ activities as well as their expectations for the park in relation to their intended or performed activities, for which different categories of sounds are appropriate, pleasant or relevant. While both lunchtime and evening respondents referred to “relaxing” as the activity they were performing, the majority of evening self-reported activities were specifically referring to social interaction (including drinking, talking, “hanging out” with friends), while those collected during lunchtime focused more on eating and “taking a break”; this distinction in the purpose of using the space could justify the evaluation of certain sounds as being pleasant or neutral, depending on how they affect users in their performance or enjoyment of their activities. Sounds that are referred to as unpleasant and their perceived levels seem thus to not be sufficient to deter users from using the space. One could relate this to aspects of choice or availability of spaces; during lunchtime, due to time restrictions, users depend on public space accessible in their vicinity, whereas in the evenings, there are more spaces to choose from. The findings also seem to show that, in the absence of extremely disturbing sounds, the park more or less accommodates all the activities that respondents reported, so the speculation is that people arrive in a park with certain expectations (including auditory, albeit implicit), and, in the absence of overt violations of this (auditory) “image”, the park fulfils its function for these groups of users.

Integrating the data collected on context, use of space and users’ descriptions and evaluations of sounds and their auditory environments, the study indicates that users come for the amenities that the park has to offer, including here not only the benches and the gazebo, but also the green grass, trees and the associated fauna, as amenities for relaxation and urban enjoyment. Sounds like birds, the wind and rustling leaves, together with the conversations of others, help in the creation of an ambiance, offering users the urban pocket park experience they expected. The proposed methodology can support a complex understanding of how the park is being used and perceived and what users focus on to enhance their experience, including from an auditory perspective. Given that pocket parks might “look like” larger parks in terms of greenery and amenities, but, due to their position in the city and their size, do not always “sound like” parks, the interaction between audition and sight is a key aspect in understanding how they are perceived and used. As they lack the physical structure to isolate themselves from the city generally, they are spaces where their existing amenities and patterns of use differentiate them from the urban fabric. This is consistent with the findings of the section on respondents’ descriptions and perception of the park and their enumeration and evaluation of sounds (clearly contrasting birds and wind through the leaves as pleasant and cars and traffic as unpleasant), as well as with the temporal patterns of the use of the park. Together, they offer sufficient evidence towards the need for integrating activity approaches in researching the relationship between use of spaces and users’ auditory environments.

### **Implications for Design and Planning**

As part of this chapter, the authors developed a data collection and processing protocol that can be of use to other researchers interested in experimenting with methods and the implications of the findings outlined here can feed insight into planning and design practices aiming at understanding, developing or

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managing spaces from a behavioural and auditory perspective. While relatively labour-intensive, such a protocol can be a useful addition to the toolkit of researchers, particularly as part of applied research projects in collaboration with various city makers. The protocol helps to collect insight on how urban public spaces that are appropriate for solitary or socially interactive activities sound like, raising more questions on how not only to design, but also program such spaces and how decisions could compromise perception of appropriateness. It could thus offer evidence and support more place-based approaches that access alternative knowledge on the auditory experience in relation to the public space itself (and its use), while also opening an avenue for engaging with other sound experts (e.g. soundscape experts or acousticians) in processing the findings in a manner that can lead to successful public space transformations.

The multidimensional research detailed here is part of a process of experimentation (particularly methodological) aiming to add to the few existing attempts at observing and studying users' auditory environment as a function of activity, and proposes a toolkit for doing so in the process. This chapter was inspired by the importance of studying the human experience in its full complexity (holistic, multisensory and activity-based) to understand the interaction between physical context (space) and time considerations, and users' perception and use of the space, with a focus on the auditory experience. The results failed to show an effect of local activity (e.g. eating vs. talking) on auditory environment evaluations in relation to activity, nor are the findings necessarily exclusively auditory - for example the observations on the park could have also been made without integrating auditory perception. However, novel insight has been collected on the effect of the level of social interaction (namely solitary vs. socially interactive activities) on public space users' evaluations of their auditory environments in relation to their activities (see also Bild et al. 2017, *in preparation*), as well as how users' activities are distributed in space and time. The research thus offered an empirically grounded contribution to emerging theories and models on what influences public space users' evaluations of their auditory environments, pointing to the level of social interaction of users' activities as a variable that can moderate the effect of activity on the user-auditory environment relationship.

The chapter shows that more work is needed to fully demonstrate the need for situated approaches that integrate activity as a key mediating factor for researching public spaces from a multisensory perspective. Studies (and subsequent methodologies) as the one described in this chapter strive to understand the core auditory features that contribute to urban spaces being used extensively and perceived positively by their users, particularly in relation to their activities, e.g. roads or amenities like fountains, benches and trees. Comparable results have been found for the effects of microclimate on spatial behaviour in public spaces; referring to a previous study by the same authors (Zacharias et al. 2001), they concluded that "when choice is unconstrained, people tend to refer to microclimatic conditions when deciding where to spend time and in which activities to engage" (p. 640). Similarly, choice and proximity influence the decision to use a space more than the auditory environment. But while not all people have the luxury to choose to use spaces that are acoustically appropriate for their activities in the calculus of their everyday decisions, planners and designers are responsible for ensuring that users' auditory environments in public spaces do not affect them in negative ways and allow and encourage the performance of basic daily activities. The authors continue to advocate for the importance of tailored methods to gain insight relevant for urban planners and designers, potentially leading to interventions that are more sensitive to the auditory dimension of the public space experience. Integrating the potential of sound as a resource rather than a waste in design projects may lead to more intentional and informed urban auditory outcomes.

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## KEY TERMS AND DEFINITIONS

**Activity:** The way in which a public space user engages with a space and its amenities. Activity is proposed as a key variable influencing users' individual relations to their auditory environments.

**Auditory Environment:** The environment of sound as experienced by users, both individually and as a group. As users come with different internal and external contexts (e.g., their personal experience or biases, their purpose in using the space), they engage differently with their surroundings, leading to different auditory experiences and thus different, yet potentially similar auditory environments.

**Behavioral Mapping:** On-site data collection method used to systematically document public space use both spatially and temporally on a map. In this chapter, behavioral mapping was completed by trained data collectors using a handheld device equipped with specially designed software.

**Context:** The sum of all factors variables that influence users' auditory environments. In this chapter, context includes the visible and tangible physical properties (amenities) and layout of the park and its surroundings as well as the audible elements of the environment.

**Mediator:** A variable that explains the relationship between a dependent and an independent variable, outlining the basis for which one variable affects or influences the other. In this chapter, activity is proposed as a mediating variable/mediator of the relationship between public space users and their auditory environments.

**Mixed-Method Research:** A method that integrates quantitative and qualitative research methods for data collection and processing to offer a complex analysis of the object of study. There is a particular emphasis on the methods informing each other.

**Pocket Park:** A small, central urban park. Pocket parks are not necessarily isolated from traffic, and while they may provide a number of traditional park amenities like greenery, shade, or benches, they

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are not necessarily “quiet.” They are frequently designed to offer urban dwellers a space for temporary respite or a break or can be ideal spaces for social and cultural programming, particularly benefitting the adjacent communities.

**Research Protocol:** A set of data collection and processing methods that have been designed to be used together and integrated, and that can be tested further and employed as such in other studies with similar research questions.

**Respondent:** User who completed the on-site questionnaire.

**User:** A person performing a number of activities in a certain public space (e.g., engaging with the space amenities [e.g., sitting on benches]), interacting with other users, and lingering in the space (for longer than three minutes) rather than passing through.

## **ENDNOTES**

<sup>1</sup> *World Topo Basemap* - Attributed to the following sources: ESRI, Delorme, HERE, TomTom, Intermap, increment P Corp, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, ESRI Japan, METI, ESRI China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community.

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<sup>2</sup> See Endnote “1”

<sup>3</sup> Translation from French: “calme (à part des voitures sur St. Laurent)”. All translations from French by authors, if not stated otherwise.

<sup>4</sup> “il y a trop de bruit provenant de trafic (Rue St. Laurent)”

<sup>5</sup> “un peu bruyant à cause de la rue St. Laurent. Les autos son trop bruyantes, mais les oiseaux sont agréables.”