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An Exploratory Study on the Influence of Activities on Public Space Users' Descriptions of Their Auditory Environments on Site: The Case of Amsterdam

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Summary

This paper is an exploration into whether public space users performing different activities describe their auditory environments in noticeably different ways. Building on soundscape and psycholinguistic literature, a questionnaire study was conducted in a large park in Amsterdam (NL), where 92 park users described, in writing, their activities and auditory environments. Users' self-reported activities were categorized based on their level of social interaction (solitary vs. socially interactive), and using open coding, generating categories of activities grouped by semantic range. The written corpus on auditory environment descriptions was analysed through a proposed classificatory framework, coding descriptions at three semantic and one syntactic level. We preliminarily tested whether there are associations between various categories of activities and of auditory environment descriptions, categorized at different levels. Our results suggest that, while for detailed levels of activity categorization there were no non-distinct patterns, the level of social interaction of users' activities has an observable effect over users' descriptions of their auditory environments. This holds particularly in relation to types of sounds listed, as well as for differences in descriptions at a syntactic level. These findings point towards subtly different auditory experiences in the same public space for users performing solitary or socially interactive activities.

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1. Introduction

The ways urban public spaces are used are intimately connected with their users' multisensory experiences of the spaces. The activities that they perform in public spaces are influenced by and influence, in turn, how their environments appear, sound or feel. Repeated calls have been made to acknowledge the importance of a sensual / sensuous understanding of the city, both in practices for investigating and "making" the city, driven by growing recognition of the relevance of the other senses for the urban experience ([1, 2, 3, 4, 5] *inter alios*). However, mainstream research and design initiatives remain overwhelmingly focused on visual aspects (see e.g. Ibid., [6]). In this context, soundscape studies focus specifically on sound and the auditory dimensions of urban experiences, aiming to understand the ways public space users *describe, interpret, evaluate* and overall *relate* to and *act* upon their auditory environments ([7, 8], see [9] and [10] for reviews). Building upon the latter, we base our paper on a question that arises from everyday situations: to what extent does a public space user's activity influence how they describe what they hears?

Human beings are rather quick to evaluate auditory environments as "good enough" (suitable) for the activities they want to perform, even if this evaluation could be unintentional or unconscious. How many times have you thought: "This park is too loud for me to read, I can't focus with all this noise around me", or "This park is perfect for our barbecue, it's so wonderfully lively". In communicating auditory experiences to each other, the "same" park becomes, then, both "too loud" and "wonderfully lively". We have different auditory needs, expectations and, ultimately, experiences that depend, among others, on social, cultural, personal or contextual factors, on our activities and the ways in which we engage with our spaces. We contend that these differences are apparent in the ways we describe our auditory environments. Understanding how users of public spaces talk about their auditory experiences in context and in relation to their activities can yield valuable insights for

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researchers and urban designers, as it might be closer to users' experiences than when they are asked to complete a survey with closed-ended questions or to participate in a controlled laboratory study.

Soundscape research has indicated that activities play an important role in influencing users' auditory environment evaluations [11, 12, 13, 14, 15] as well as their spontaneous descriptions or categorizations, both on site and in laboratory conditions [26, 17]. Despite this sparse scientific evidence, studies explicitly and systematically focusing on the role of activity as potentially mediating auditory environment descriptions have yet to be conducted (see [18, 19] for a pilot study using an experimental setting and [20] for a proposed larger scale experimental setup; [21]). This paper proposes an exploratory investigation into whether public space users' activities systematically influence the way they describe their auditory environments, on site. To this end, we developed a methodology testing various levels at which we can categorize users' activities and code their descriptions of their auditory environments in order to infer the potential ways in which activity mediates description.

We situate our inquiry at the interface of two partially overlapping bodies of knowledge that have seldom been discussed together in empirical research (see [22, 23, 24]). On the one hand, we build on the work of soundscape researchers focused on understanding the relationship between users' evaluations of their auditory environments and the activities that they perform or intend to perform in public spaces (in relation to e.g. comfort [25, 26, 23] or restoration [27, 24]), with special attention paid to the extent to which users' auditory environments facilitate the performance of certain activities [28, 29]. On the other hand, we rely on the multidisciplinary efforts of a group of subject-centred scholars, working, primarily in the French language, at the intersection between psychology and linguistics to research how users of public spaces experience their urban auditory environments and how their experiences are conveyed and shared through language [22, 23, 30, 31, 32, 33, 26, 34, 35]. By integrating psycholinguistic methods, this paper can contribute to existing knowledge with insights on the explicit relationships between users' activities and their descriptions of their auditory environments. This integration takes place through an exploratory endeavour on site, enriching the existing body of soundscape knowledge, as well as potentially expanding its toolbox.

Our analysis was based on empirical data collected in the Dutch language during two days in the summer of 2016 in Oosterpark, a large urban park in Amsterdam, The Netherlands. The questionnaires were completed by Dutch native speakers and included a mix of closed and open-ended questions. The resulting written corpora were subjected to various semantic and syntactic analyses.

In Section 2 we summarize the multidisciplinary knowledge that represented the basis for our research question as well as our methodology, structured around soundscape research and activity (2.1.) and psycholinguistic research, with a focus on auditory experiences (2.2). Section 3 refers to the data collection, processing and analysis methods, describing the Oosterpark case study, while Section 4 provides the results. Finally, Section 5 is a discussion on the patterns observed in this study, addressing at length the methodology and its limitations, as well as outlining avenues for future research.

2. Background

To address the knowledge gap on the relationship between public space users' descriptions of their auditory environments and their activities, in context, we explore two different bodies of literature: one originating in soundscape research, studying the role of activity in the user-auditory environment relationship, and the other, from psycholinguistic research, focusing on the relationship between language and auditory experiences.

2.1. Soundscape research and activity

"It is therefore the subjects' activities that structure their relations to the world and hence their knowledge of the world, from which it follows that types of categories differ according to the different types of relations the subjects have to the world." [31, p. 59]

Calls to integrate public and private space users' activities in scientific models attempting to explain their relationship with the socio (psycho)-physical environment (including their auditory environments) have been made for over two decades (Ibid.); evidence indicating the role of activities in the evaluation, description and sorting of auditory environments can be traced back to the work of [36, 34] and, more recently, to that of [26] and [17]. However, "activity" has only recently become the explicit focus of scientific inquiries in relation to audition [37, 12, 3]. In previous studies, activity has been mostly treated as a contextual or dependent variable in the user-auditory environment relationship (discussed below). To a far lesser extent, activity has been treated as a *mediating* variable that could explain the aforementioned relationship [31, 18, 38].

As a contextual variable, "activity" is often encountered in various theoretical and analytical frameworks proposed to describe the perception or evaluation of auditory environments ([36, 39], *inter alios*). Activity has also been researched in relation to the use of private and public spaces, particularly to the effects of specific music styles on moderating patterns of consumption and other activities. This has informed numerous public and private space design interventions (e.g. the placement of water fixtures or of benches) as well as more targeted sound interventions [40, 41, 42, 29]. A number of music recommendation services even offer playlists based on what customers intend on doing (dinner, dance, clean)[1] and aim to help

[1] "Spotify Introduces Video Clips, Podcasts, And Activity-Based Playlists". TechCrunch. Article available online at: https://techcrunch.com/2015/05/20/spotify-introduces-video-clips-podcasts-and-activity-based-playlists/. Accessed September 18th 2017.

e.g. improve productivity[2]. A recent study proposed an approach to study the influence of different music stimuli on activities and people's use of open public spaces on a university campus [43]. Soundscape research has also researched extensively the role of sound or sound environments on restoration, recreation, rehabilitation and other broader health-related goals, more or less explicitly referring to specific activities associated with these goals ([44, 45] for restoration, [46] for a review of quiet area-related projects, [47] for rehabilitation, [48] for work on environmental comfort).

Comparatively, less attention has been dedicated to the role of activity as a *mediating* variable beyond a theoretical understanding; the role of activity in mediating the process of sound categorization has been discussed in psychological studies [25]. It has only recently been researched explicitly in relation to the evaluation of auditory environments [12, 13, 40]; preliminary findings indicate that "the soundscape affords a set of possible actions to the listener, while the listener's intention to act in the environment influences the perception of the soundscape by selecting which sounds to pay attention to" [12, p.7].

Activity has also been integrated in conceptual models attempting to capture the complexity of the user-auditory environment relationship ([37, 3]). However, only one empirical study, to our knowledge, has so far attempted to operationalize the proposed models to collect empirical explicit insight testing the effect (if any) of activity [18].

Finally, the mediating role of activity has also been implied in the work on soundwalking as a dynamic method for collecting situated insight into the auditory experiences and knowledge of users as they interact with their surroundings and for acquiring "accounts of perception in motion" ([30, p.6], [49, 50], *inter alios*). However, in this paper we focus on the "spontaneous" or "ordinary" – usually static – activities that users are already performing at the time of their descriptions. We contribute to this scholarship by further unpacking the nature of activity and its role in the public space user-auditory environment relationship, by relying on processes of bottom up language elicitation and analysis (in a sociological sense). Informed by psycholinguistic research (see Section 2.2), we expand on a point raised previously [3] to integrate an additional line of questioning on the potential mediating role of activity on the specific ways in which public space users describe their auditory environments.

2.2. Psycholinguistic research

We lack the ability to directly access the ways public space users relate to their auditory environments: one strategy to address this challenge relies on language production to study auditory experiences empirically [51, 52, 25]. Psycholinguists argue that the linguistic devices that users rely on to describe sounds can be considered approximations based on which inferences can be made on users' underlying psychological processes in their ways of experiencing their environments [31, 51, 52, 34, 35]. A tentative explanation in that sense can be found in [30]: "[j]ust as words only take on meaning alongside a non-verbal backdrop, what is perceived inevitably involves a backdrop of inattentiveness. Describing an event presupposes that it was perceptible and that it became poignant enough to talk to us, to make us talk and to talk through us" (p. 10). Furthermore, the complexity and variety of linguistic constructs used to describe our auditory environments [32] asks for "broadening the analysis beyond single words to complete statements provided by language in discourse" [53, p.204]. It is why a large part of the psycholinguistic efforts have been centred on understanding the principles of *categorization* that help humans classify what they hear, in a meaningful manner, and make sense of their auditory environments (see [31, 61, 53]). Guastavino argues that, "to mediate between individual experience and shared knowledge, the analysis of free-format verbal descriptions provides relevant insights since language is by essence both shared and individual" [53, p.195]. An analysis of users' descriptions of auditory environments rooted in psycholinguistics allows us to research their personal sensory experience as "collective *representations* shared in language and elaborated as *knowledge*" ([53, p.184], emphasis in original).

Considerable effort has been invested both in soundscape and sound design research to find the dimensions (and terms) that best define or describe the auditory experience, in order to develop sets of validated scales to support the quality assessment of auditory environments or the sounds of particular objects ([54] for the Swedish Soundscape Quality Protocol, [10, 55] for a test to evaluate the sound of rolling office chairs). However, while such linguistic explorations are useful to develop tools that can be implemented in e.g. policy, or allow for large-scale investigations with minimum resources, they condense and limit the auditory experience to a set of categorical evaluations that do not capture its complexity.

In this paper, we focused on bottom up language elicitation and we asked whether and how a public space users' self-reported activities influence their language use in how they describe their auditory environments. We empirically tested whether the activities users performed influenced the ways Dutch users described their auditory environments in writing, at semantic and syntactic levels, with the help of the classificatory framework described in the next section.

3. Methods

Soundscape research offers a variety of data collection methods to study the auditory experience by relying on qualitative, free verbalizations (including open-ended questions in questionnaires, interviews, commented soundwalks – see [56, 10] for reviews), as well as approaches for analysing the resulting written corpus (e.g. grounded theory methodology [57] or content analysis

[2] "The best music to listen to for optimal productivity, according to science". Business Insider. Article available online at: http://www.businessinsider.com/the-best-music-for-productivity-2015-7?international=true&r=US&IR=T. Accessed September 21st 2017.

Table I. Selection of questions from original questionnaire. Original Dutch, and English translation (by authors).

Question (NL)	Question (EN)
Denk terug aan uw activiteiten in dit park vandaag en beschrijf deze zo uitgebreid mogelijk. Wat viel u op tijdens het uitvoeren van uw activiteiten in dit park?	Think back at your activities in this park today and describe them in as much detail as possible. What caught your attention during the activities that you performed in this park?
Beschrijf wat u hoorde tijdens het uitvoeren van uw activiteiten in dit park.	Please describe what you heard during the activities that you performed in the park.
Hoe zou u wat u hoorde tijdens het uitvoeren van de activiteiten omschrijven aan een kennis die niet bekend is met dit park?	How would you describe what you heard during the activities that you performed to someone you know that is not familiar with this park?
Waarom bent u vandaag naar dit park gekomen?	Why did you come to this park today?

method [58]; for a difference between the two, see [59]). In this study, we developed a questionnaire with a set of four open-ended questions, to study the potential relationships between categories of activities emerging from the data and the descriptions of auditory environments coded at semantic and syntactic levels. We tested whether users performing different activities have different auditory experiences outside laboratory conditions; moving outside of the lab meaning sacrificing environmental control in favour of investigating users' experiences in a real-life context, under everyday life conditions, thus trading a decrease in internal validity with an increase in ecological validity (for a discussion on the value of ecological validity, see [51]).

3.1. Data collection

3.1.1. Questionnaire

The questionnaire included a mix of closed and open-ended questions and tasks. The design of the questionnaire was based on previous research instruments that relied on open-ended questioning and free verbalizations [60, 25, 26]. Its aim was to access users' individual experiences of public space and their auditory environments, at the time of the data collection, and how they shared their experiences through language. The 16 questions, alternating between closed and open-ended, were phrased to minimize negative connotations of terms used and to avoid imposing a specialized terminology (see [38] for an overview of the closed ended questions). This, we contend, allowed users to describe their experience in a manner as similar to their everyday language as possible [60]. To those ends, we also put particular emphasis on the order of questions (see [26] p. 115–116 for a review).

The questionnaire started with a general description of users' experiences (both of the space and their auditory environments), progressively going into more detail on their evaluations of their auditory environments in relation to their activity and their expectations, and ended with users' personal details (expectations, familiarity with the space and with what they heard, and demographic characteristics). The questionnaire was part of a larger research project and, in here we focus on the responses to four open-ended questions, listed in Table I (the original Dutch formulation alongside the English translation). First, for the description of activity, we asked users to describe their activities in the park and afterwards why they came to the park that day. Second, for their descriptions of their auditory environments, we asked them to complete two tasks: to describe their auditory environments during their time in the park (referred to as "description to researcher" hereinafter – "DR") and to imagine how they would describe that to someone else who is not familiar with that park (referred to as "description to others" hereinafter – "DO"). The idea behind using two differently phrased tasks was based on the assumption that users would expect researchers and other potential users of the park to look for different insights on their on-site auditory experiences, as they would be using and collecting this information for different purposes.

3.1.2. Location

Oosterpark is a busy urban park in the East of Amsterdam, which recently doubled in size as part of a large-scale renovation project[3]; it hosts a number of festivals on its large grass fields on a regular basis[4]. The park is designed to be predominantly green (with a large number of trees and grass fields) and due to its size, it can be split in sub-sections. For this preliminary study, we selected an urban park because of the likelihood of a large number of users conducting a relatively small number of types of activities. In addition, urban parks offer a clearer boundary between those performing activities that engage the space for extended periods of time (that we consider here public space users) and passers-by, when compared to e.g. urban squares, where the distinction is less clear-cut.

We completed our data collection in two sub-sections, marked in the plan in Figure 2 as S1 (Figure 1, left) and S2 (Figure 1, right). The sub-sections have different designs, available amenities and green-to-built ratios. Subsection S1 Oosterpark is a large open space with minimal amenities: a central oval-shaped grass field, surrounded by a pavement-based pathway lined with sparsely distributed

[3] Information available online, in Dutch, on the website of the Municipality of Amsterdam (Gemeente Amsterdam) https://www.amsterdam.nl/projecten/oosterpark/planning/. Accessed Feb 14th, 2017.

[4] Information available online, in Dutch, at: http://www.oosterparkfestival.nl/festivals/. Accessed Feb 14th, 2017.

Figure 1. Sub-sections S1 (left) and S2 (right) of Oosterpark. Source image left: first author. Source image right: Newspaper "Het Parool"[5].

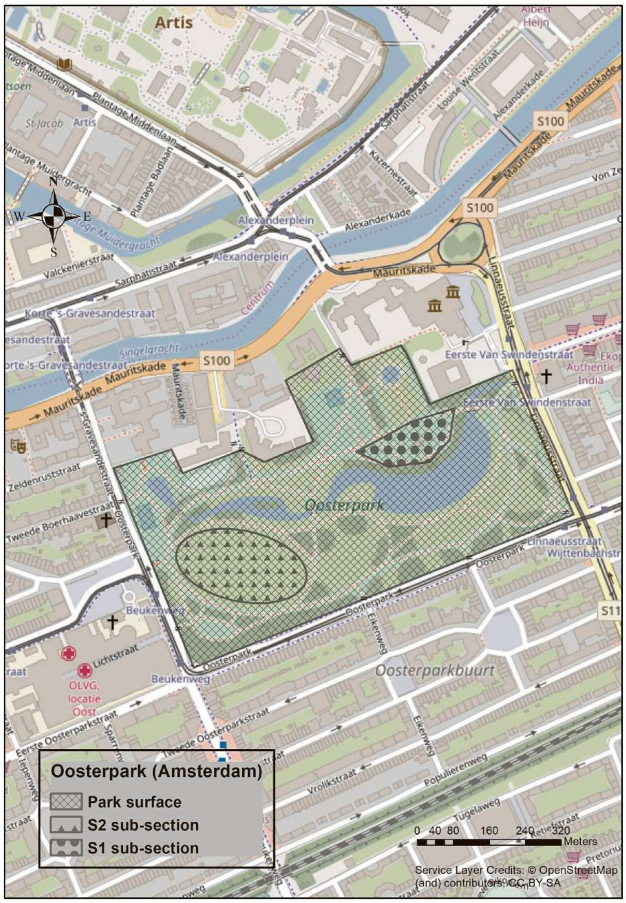

Figure 2. Plan of the Oosterpark and data collection sub-sections (Design: Author). Service Layer Credits: OpenStreeMap (and) contributors.

benches and trees; shade is provided by trees on the sides. Sub-section S2 Oosterpark has comparatively more amenities and the pavement-based area of the space offers many sitting and shade opportunities. Not pictured in Figure 1 is the area to the left of the gazebo, including a grass field and hedges that overlook the lake and the water fountain, and benches lining the field.

3.1.3. Procedure

The questionnaire was distributed in the afternoons of two sunny days in July 2016 (one during the week and one in the weekend), in both sub-sections in the Oosterpark, during four approximately one-hour long data collection sessions (one hour per day, per sub-location). Due to the relatively low turnover of park users, we considered that one hour-long sessions were sufficiently long to collect data from a sample of respondents that offered an accurate representation of park use (in terms of age, size group and types of activities performed). We randomly selected park users, irrespective of their activity or whether they were alone or with others, to complete the questionnaire to the best of their abilities; the users were told to take all the time they needed, offering support with any questions they had. Only native Dutch speakers were asked to fill out the questionnaire. The questionnaires were completed by individual users. Users that were in pairs or groups were asked to focus on their personal experience and limit discussing the questions with others.

3.1.4. Respondents

We collected 92 questionnaires (S1: 65, S2: 26), with park users aged between 18 to 71 (mean 32.2 years, median 28 years) and a relatively equal distribution by gender (45% of respondents identified as male and 55% as female). Split by level of social interaction, for socially interactive users (68 users), 29 male and 39 female users completed the questionnaire, with an age mean of 30.6 years, and for solitary users (24 users), 12 male and 12 users female, with a slightly higher age mean of 37.6 years.

3.2. Data processing and analysis

The written free-responses to the four questions listed in Table I were transcribed and analysed in two steps. In

[5] Photo available online at: http://www.parool.nl/amsterdam/stadsdeel-plant-anderhalf-miljoen-bloembollen-in-oosterpark a4263171/. Accessed Feb 14th, 2017.

Table II. Categorization of activities and number of users per category (in original Dutch and English translation). Active activities: physically energetic activities, usually involving movement.

Categories	Activities included in the category	S1	S2	Total
Reading	"lezen" – "to read"	6	3	9
Enjoying	"genieten" – "to enjoy"	7	2	9
Relaxation-related activities	"relaxeren" – "to relax", "ontspannen" – "to wind down", "chillen" – "to chill"	14	6	20
Sleeping	"slapen" – "to sleep"	2	1	3
Observation-related activities	"bekijken" - "to look around", "observeren" – "to observe", "denken" – "to think"	2	4	6
BBQ (short for "barbecuing")	Used as a verb: "BBQ-en" – to have a barbeque, or as a noun. Includes picnic-related activities	2	8	10
Active activities	"frisbeen" – "to play Frisbee", "voetballen" – "to play football", "wandelen" – "to take a stroll", "rondlopen" – "to walk around", "sporten" – "to do sports", "cricket spelen" – "to play cricket"	11	1	12
Celebration-related activities	"socializeren" – "to socialize", "vieren" – "to celebrate", and "borrelen" – "to have some drinks"	7	1	8
Music-related activities	"muziek maken" - "to make music" and "muziek luisteren" – "to listen to music" or mentions of "muziek" – "music"	2	4	6

a first step, the analyses of the written responses to the given tasks on descriptions of performed activities and auditory environments were completed separately (detailed in 3.2.1. and 3.2.2.) and led to the categorization of activities and the coding of users' descriptions of auditory environments. In the second step, we researched whether there are relations of dependence between categories of activities and categories of auditory environment descriptions (detailed in Section 4): do users performing different activities rely on different linguistic constructions in their auditory environment descriptions? Given that this is an exploratory study, we adopted different non-discrete levels for coding our dataset.

3.2.1. Categorizing users' descriptions of their activities

Informed by soundscape and public space-related literature, users' written descriptions of their activities were analysed using a content analysis strategy, a method using processes of systematic coding and theme identification to analyse the content of text data [63]. To this end, we used (1) an a priori coding scheme in relation to the level of social interaction [62], and (2) open-coding strategies [63], building on the demonstrated restoration and relaxation effects of users' auditory environments in parks [26].

For (1) the distinction between the categories of "solitary" and "socially interactive" activities is essential in auditory terms because being alone or with others might affect a user's relation with their environments [18, 38]). For example, if alone, a "noisy" environment might distract a solitary user from their activity but might stimulate communication between users in a pair by offering a feeling of "auditory intimacy", or between users in a group by creating a dynamic environment in which they can "have fun". To determine the level of social interaction of users' activities, we relied both on semantic and syntactic features of the written data. From a semantic perspective, for certain activities, the level of social interaction was implicit in the activity name (e.g. reading is usually done alone and talking usually requires a present partner, with the exception of the specifically mentioned "talking on the phone"). For those activities where the level of social interaction was unclear or not implicit, we inferred the level from other indicators, such as pronouns, verb persons and other adverbs (e.g. "I am here alone", compared to "we are here together").

For (2), we processed users' responses to generate a bottom up list of activities. The resulting activities were brought together in nine new categories, grouped by semantic range (presented in Table II, distributed per subsection).

Given the complexity of how users engage with their public space, the emerging categories are non-discrete and one user can perform more than one category of activities. Due to the small size of the sub-sample, we did not analyse the descriptions of those performing the "sleeping" activity (3 users).

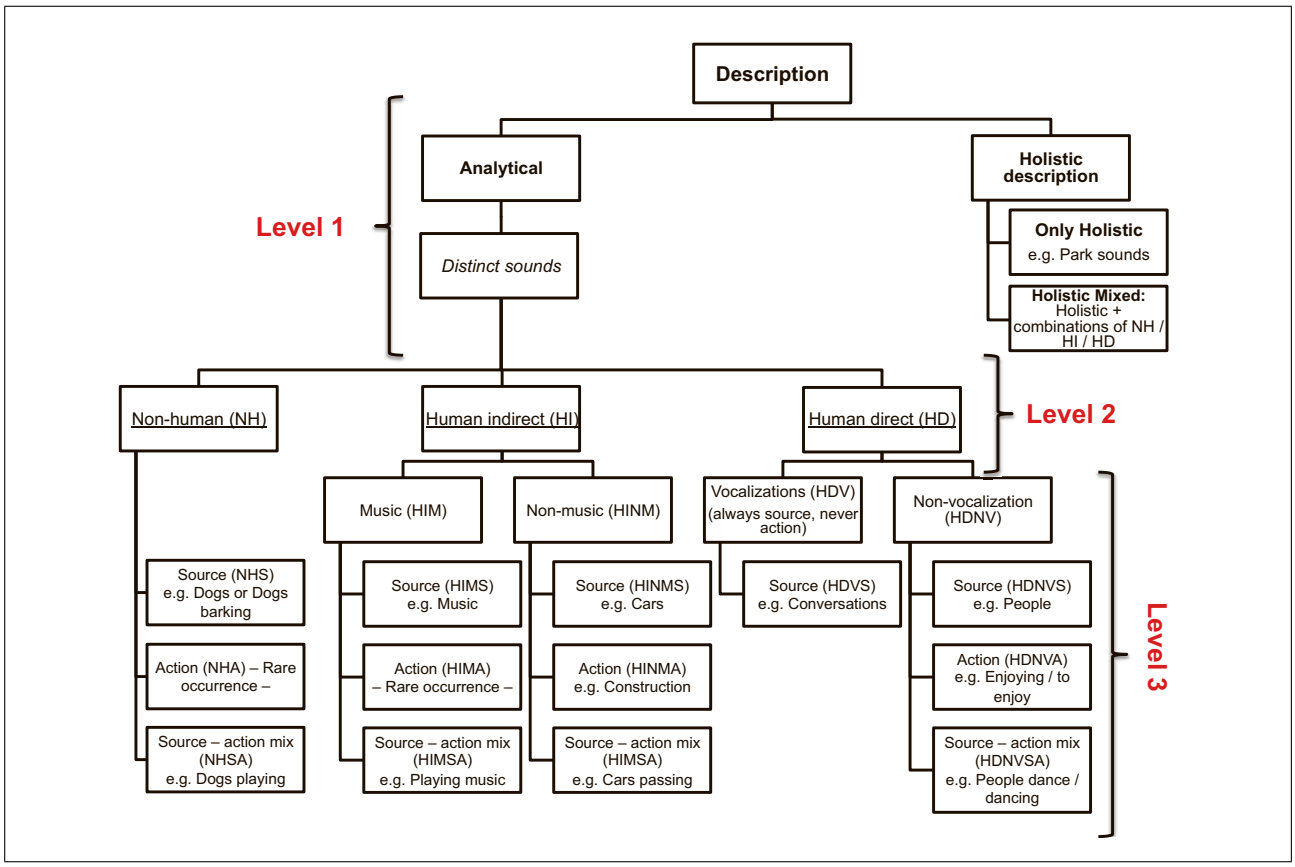

Figure 3. Classificatory framework to analyse users' descriptions of their auditory environments Semantic analysis.

3.2.2. Coding users' descriptions of their auditory environments

The written descriptions of auditory environments were subjected to content analysis, first from a semantic and then from a syntactic perspective [26]. This was done to elicit how users convey a component of their experience that they do not usually communicate about [33], in the Dutch language. The descriptions were first analysed semantically using a *classificatory framework* (Figure 3) influenced by Rosch's pioneering work on principles of categorization [64, 65] and its subsequent appropriations in soundscape literature (see [53], for an overview), proposing cross-classifications ranging from general to more specific. Our proposed classificatory framework has three levels of coding: level 1 – type of description, level 2 – type of sounds listed, and level 3 – *detailed* types of sound listed, and one syntactic (level 3). The coding process and the resulting types were reinterpreted and adapted from a number of previously proposed analytical models ([25, 26, 53], among others). The syntactic analysis was added to further explore the linguistic constructs that Dutch native speakers rely on when describing their auditory experience.

Level 1. Type of description

Evidence has shown that public space users describe their everyday auditory environments either analytically i.e. by listing sounds, or holistically, referring to the auditory environment itself without listing specific sounds [25]. Raimbault associated these two kinds of descriptions with two different of auditory experiences i.e. descriptive listening and holistic hearing, respectively (Ibid.). Based on this, we distinguish between *analytical* types of descriptions i.e. lists of "distinct sounds" (e.g. "birds, dogs, people") and *holistic* types of descriptions. We also include a "mixed" type, i.e. a combination of holistic and distinct sounds because it illustrates an intermediary state of users engaging with their auditory environments, that is, when they transition from hearing to listening by listing *specific* sounds that we hypothesize are relevant for their activity. We consider the mixed type as part of holistic types of descriptions; thus, holistic types include both "holistic (only)" descriptions (e.g. "quiet") as well as "holistic and additional sounds" descriptions (e.g. "I hear city sounds – *holistic* – and birds – *distinct sound*").

Level 2. Type of sounds listed

Given the importance of the presence of sounds relating to humans and their activities for auditory envoironment evaluations e.g. in terms of pleasantness [26], we analysed users' listed sounds according to Delage's proposed categorization based on the level on which sounds reflect human presence ([66], see [52, 53]). We code the sounds listed as:

- Non-human sounds: sounds that do not reflect human presence e.g. sounds of nature (adaption from French. Original: "étrangers à l'humain")

- Human indirect sounds: sounds reflecting human presence indirectly e.g. the sounds of vehicles
- Human direct sounds: sounds reflecting human presence directly e.g. the sounds of voices.

This level of analysis applies only to "Analytic descriptions" and "Holistic mixed" as it refers to specific sounds listed.

Level 3. Detailed types of sounds listed

Informed by the extensive knowledge that has been collected on speech and music, and by the insight on the presence of the two as meaningful for the auditory experience (see e.g. [53, 67, 61, 68], *inter alios*), we proposed an additional level of coding; we distinguished between music and non-music for human indirect sounds, as well as between vocalizations and non-vocalizations for human direct sounds.

Research in sound categorization has also shown that users distinguish between *sound sources* and *sound events*, referring to the *actions* causing the sound, that are usually attributed to specific sound sources [69, 53, 61]. We thus further coded our data according to whether users refer to a source ("dog"), an action ("biking"), or a combination of the two ("cars driving by"). Based on a review of sound taxonomies [53], we considered human vocalizations as always being a human direct sound *source*.

Syntactic analysis of users' descriptions

We drew on previous studies with similar emphases on psycholinguistic analyses [60, 32, 25, 26, 26, 35] to perform a syntactic analysis of users' descriptions by applying the insight collected previously for the French language to a Dutch corpus. We coded each response according to the types of phrases used in auditory environment description. The part of speech of the head-word in the phrase determined the membership to one of three categories: adjective phrases, noun phrases and verb phrases. In our dataset, *noun phrase* was dominant across categories of activities. We performed an additional analysis of noun phrases, to better understand the level of complexity at which users describe their auditory environments. We distinguished between "simple nouns" e.g. "dog", "birds", "child", and more complex noun phrases, that is, nouns modified by adjective or adverb phrases, like "barking dog". The Dutch language allows for the creation of nominal compounding i.e. when two or more words are brought together to produce a new noun [70]. Such structures were seldom used in our corpus. The nominal compounding was used mostly in relation to holistic descriptions e.g. "stadspark" – "city park" or "stadsgeluiden" – "city sounds", and was treated as "simple noun".

4. Results

We applied the coding strategies outlined in Section 3 to the data collected in the two sections in the Oosterpark. While we found clear activity zones (e.g. celebration- related activities mostly took place in S1 while barbecuing mostly took place in S2), there were no differences between the two areas in terms of descriptions. Consequently we did not make the distinction between S1 and S2 in our subsequent analyses. We first explored what patterns emerge when comparing descriptions between socially interactive ("SI") and solitary users, as well as in further depth, per activity type.

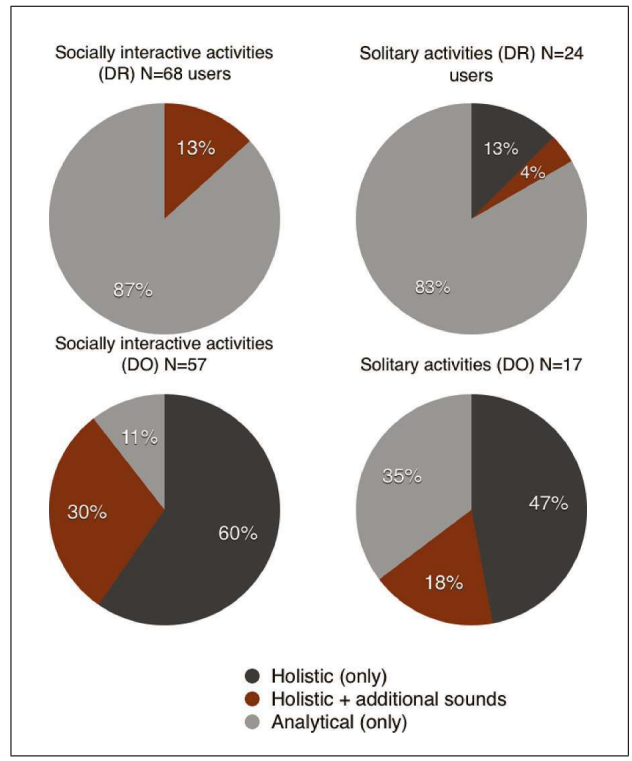

Figure 4. Level 1 of semantic analysis. Type of description. Socially interactive vs. solitary activities (comparison between DR and DO).

4.1. Semantic analysis

Level 1. Type of description

In Figure 4, we observe that, for their DRs, SI users (upper left chart) were slightly more likely to describe their auditory environments using lists of distinct sounds than those performing solitary activities (upper right chart), whose descriptions include marginally more exclusively holistic descriptions. When describing their auditory environments to others (bottom two charts), there was a shift in the dominant type of description, with both SI and solitary users relying more on exclusively holistic descriptions. A larger majority of SI users relied on holistic descriptions compared to solitary users, for which slightly under half of descriptions were holistic. The latter's descriptions were more likely to be exclusively descriptive, with SI users' using slightly more combinations of holistic and additional sounds. An explanation could be that, when describing their auditory environments to others, SI users felt comparatively more embedded in their auditory environments and thus focused more on the effects that sounds had on their experience than those performing solitary activities.

These findings are consistent with preliminary findings in literature [19].

The observed shift in dominant types of descriptions between the responses to the two tasks (upper and bottom charts) could indicate that users addressed two different "audiences" in their responses: the researcher / data collector and an imagined *other* user of the space. In the first case, users relied predominantly on lists that are focused on the *identification* of sounds. In the second case, the predominantly holistic responses (and the high numbers of combinations of holistic and additional sounds) pointed towards users' attempt at depicting an auditory "scene". One example was the response of the same user (performing both an active activity as well reading): "Birds, some traffic in the background and a couple of chatting people around me" (DR) and "a *cheerful* constant buzz from birds, playing children and chatting people" (DO)" (emphasis ours)[5]. It thus showed how introducing an imaginary other alters their communication about their auditory experience, raising the question on which of the two descriptions were closer to their everyday experience.

Figure 5 illustrates the coding of responses per detailed type of activity. It further points towards the existence of the aforementioned overall trend in descriptions: when describing their auditory environments to the researcher, users, across all activities, offered predominantly analytical responses and, when describing their auditory environments to an imaginary other, they relied on predominantly holistic responses. On the other hand, there are less clear patterns when comparing detailed types of activities. The small differences between activities per type of descriptions was more related to the wording of the two tasks, rather than the nature of the activity.

Level 2. Types of sounds listed

Figure 6 also shows that direct human sounds dominated users' descriptions across the four categories. This might show the importance of the context in this case, an urban park and its subsequent patterns of use by others. It is also consistent with previous soundscape studies demonstrating the importance of the presence of sounds of *others* in their evaluation of soundscape "pleasantness" [52].

A more in-depth look indicates that SI users, in both their types of descriptions, were slightly more likely than solitary users to list non-human sounds. In their DRs, both types of users were slightly more likely to list human indirect sounds than in their DOs; in the latter, the proportions of human indirect sounds decreased and those of non-human sounds increased. This could be an indication of users being more focused on e.g. emphasizing the sounds of nature in their DOs, in accordance to what a potential other user might expect a park to "sound like". The analysis for the detailed categories of activities shows no meaningful.

[5] Original in Dutch: "Vogels, wat verkeer op de achtergrond en een paar kletsende mensen om me heen" and "een vrolijke constante roezemoes van vogels, spelende kinderen en kletsende mensen".

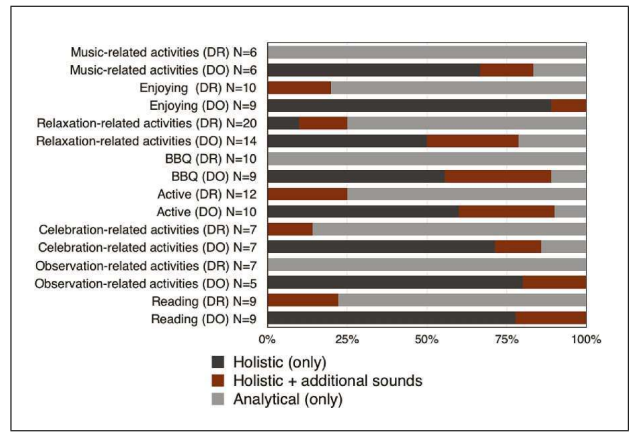

Figure 5. Level 1 of semantic analysis. Type of description. Detailed categorization of activities (comparison between DR and DO).

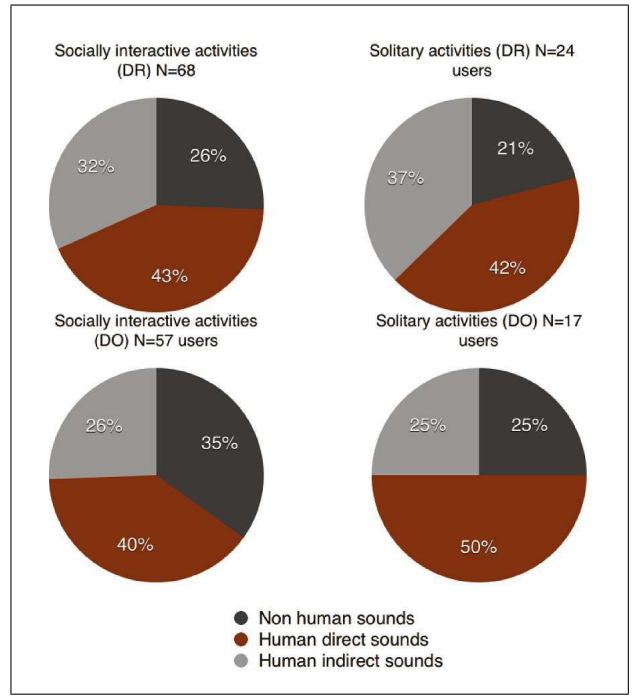

Figure 6. Level 2 of semantic analysis. Type of sounds listed. SI vs. solitary activities (comparison between DR and DO).

Level 3. Detailed types of sounds listed

Speech and music

Figure 7 shows the trend in the types of sounds that users included in their lists, with users across descriptions focusing on non-human sounds (i.e. "natural" sounds e.g. water fixtures, animals), human direct sounds, both vocalizations and non-vocalizations (e.g. sounds of others' activities) and music. While overlapping to a large extent, users' auditory experiences differed slightly, with different sounds "relevant" for their time in the park, particularly in relation to human indirect sounds (both musical and non-musical).

SI users, responding to both tasks, focused more on non-human sounds (i.e. "natural" sounds e.g. water fix-

tures, animals), followed by human direct sounds (including vocalizations and non-vocalizations). Solitary users, in their DRs, had a similar distribution of sounds mentioned, with slightly less non-human sounds mentioned than SI users, and with a comparatively higher number of musical sounds than the latter. The focus on non-human sounds also increased when shifting the description from the researcher to an imagined other (as for SI users). Unlike SI users, who were only slightly more likely to include human direct sounds in their descriptions than non-human sounds, solitary users' descriptions were dominated by human direct sounds (in higher proportions than in their DRs). In their DRs, both category of users listed similar types of sounds, while in their DOs, both users were more likely to refer to non-human sounds, as well as to non-vocalization related human direct sounds. However, while SI users were marginally listing musical sounds and were very likely to include non-musical sounds in their descriptions, solitary users did not mention such non-musical human indirect sounds, their focus being on musical sounds in this case. No distinct patterns were observed when looking at detailed activities.

Source and action

We focused on DRs for the distinction between source and action, as the DOs did not yield sufficient responses for an analysis. Solitary users tended to use marginally more source and action combinations (e.g. "people biking") than SI users, particularly for human direct and human indirect sounds. For non-human sounds, SI users were more likely to use a combination of source and action, while solitary users used exclusively sources. This could indicate that solitary users related to human direct and indirect sounds as stimulations that have an effect on their own experience through the sound-producing action, whereas non-human sounds were comparatively listed as "objects" in their auditory environments that they did not interact with.

Similarly, for more refined categories of activities, the distinctions between source and action indicated that users performing different activities related differently to the effect that certain sounds have on their experience. For example, users performing "enjoying" and "reading" activities were more likely than other users to use a combination of sources and actions in relation to non-human and human direct sounds, minimally using such a combination for human indirect sounds. Comparatively, those performing barbecue-related activities only used the combination in relation to human direct sounds, relying exclusively on sources for non-human and human-indirect sounds, suggesting that the only sounds that they felt had an effect over their own experience are the sounds of others' activities e.g. "children playing".

4.2. Syntactic analysis

The syntactic analysis represented in Figure 8 showed that users engaged in activities with different levels of social interaction relied on different linguistic strategies, of varying complexity. As already observed at all the previous levels of analysis, there was a shift in the dominant types of phrases used by both categories of users when describing their auditory environment in response to both tasks.

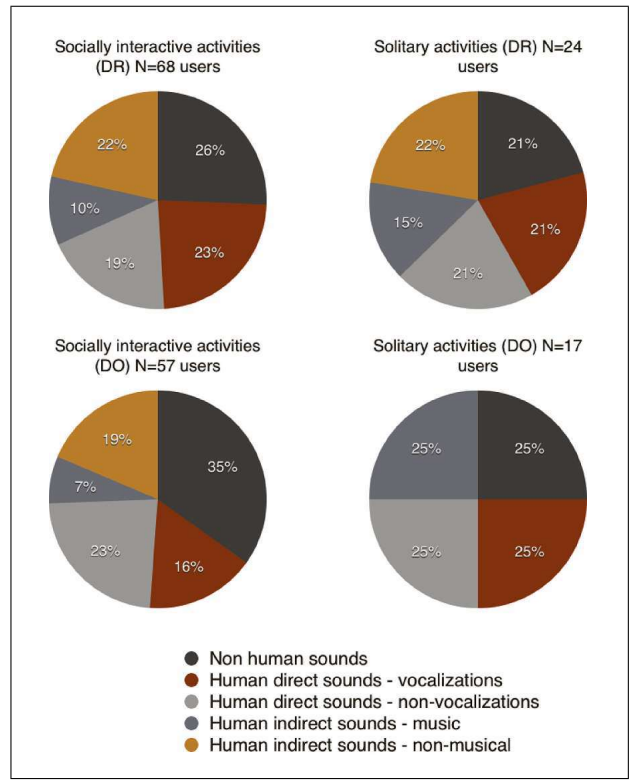

Figure 7. Level 3 of semantic analysis. Detailed types of sound listed: speech and music. SI vs. solitary activities (comparison between DR and DO).

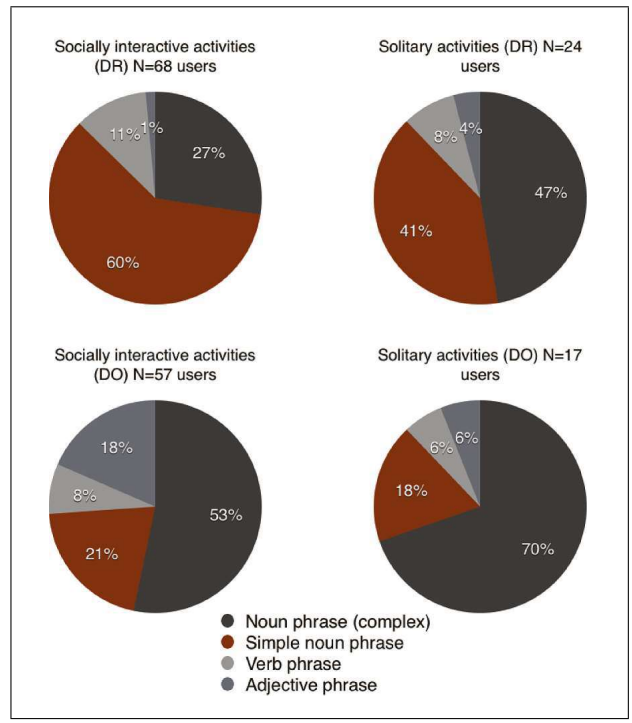

Figure 8. Syntactic analysis. Phrases used in descriptions. SI vs. solitary activities.

Their likelihood of relying on complex noun phrases exponentially increased and their use of simple noun phrases increased when comparing their descriptions to the researcher and those to imagined others.

In both types of descriptions, solitary users tended to rely more on complex noun phrases, potentially attempting to portray a complex, detailed auditory "image" of the park. Comparatively, SI users tended to use more verb phrases (thus focusing more on action) and more simple nouns (like "park").

Specifically, for their DOs, SI users included also adjective phrases that referred to assessments e.g. of quietness or liveliness, seemingly relying more on an implicit understanding of the existence of a common language shared among park users. We do not report on the syntactic analysis of more refined categories as no significant trends were observed, in large part due to the small sample size.

5. Conclusion

The goal of this paper was to conduct a preliminary exploration into whether users performing different activities describe their auditory environments differently. To this end, we developed a methodology inspired by soundscape and psycholinguistic literature that allowed for the categorizations of users' responses at different semantic and syntactic levels. The application of user-centred auditory research as it applies to urban spaces is an underexplored topic. The development and testing of a methodology that could expand our understanding of the auditory experience in urban public spaces and how activity mediates it could be a useful addition to the toolbox of urban researchers and, by extension, urban decision makers. The knowledge on whether users performing different activities relate to and engage with their auditory environments differently can sensitize urban designers or policy makers on the importance of sound for the use of public spaces; it can also support the collection of an updated vocabulary on how users talk about their sounds and their auditory environments and experiences, for example knowing what are the terms and linguistic constructs that Dutch native speakers rely on. This can support the development or updating of instruments like region or nation-wide surveys on sound evaluation to ensure the reliance on a richer vocabulary that more accurately represent urban auditory experiences, beyond evaluations of noise annoyance. The knowledge collected through the updated instruments on evaluation can lead to understanding how to design public spaces that are (acoustically) suitable for a variety of activities and users.

Our preliminary findings indicate that activity mediates, to an extent, users' descriptions of their auditory environments, albeit in subtle ways, like in relation to the effect of the level of social interaction of users' activities. This is consistent with the findings of previous small-scale studies performed in the Netherlands and Canada ([19] and [18]). Due to the small sample resulting from our detailed categorization and coding strategies (e.g. distinguishing between music-related and relaxation-related activities based on users' own wording), the results are not noteworthy at all levels of analysis. They rather pointed toward emerging trends that require further research to address this issue in depth. Our results, however, represent useful insight for others aiming to pursue a similar avenue for research and illustrate the challenges of fitting the complexity of the urban auditory experience into narrow categories. The findings raise the need for additional reflection on how to measure human auditory experiences in an ecologically valid way that addresses the sample-size-categorization problem.

This study has two main intertwined outcomes: (1) preliminary insight on the relationship between users' auditory descriptions and their activities, and (2) a methodological contribution to be tested in future studies on the user-auditory environment relationship:

1. At a detailed level of activity categorization, we observed a gereral pattern on how users describe their environment across activities. Variations between how users who are e.g. relaxing or reading are insufficient to make strong claims on relationships between language use and activity. Nonetheless, such differences can be observed more between solitary and socially interactive users. We observed emerging trends at three distinct semantic levels and the syntactic level:

- type of sounds listed: human-direct sounds dominate all users' descriptions. However, socially interactive users mentioned non-human sounds relatively more often than those engaged in solitary activities. While this may be counterintuitive, it could be because socially interactive users tried to describe what they heard besides the other users they were with, while solitary users engaged in a more contemplative state, observing and listening the sounds of the other park users;
- detailed types of sounds listed, speech and music: socially interactive users tended to refer less to music than solitary users, who also referred marginally more to non-vocalizations (i.e. non-speech related human direct sounds)
- detailed types of sounds listed, source and action: for non-human sounds those engaged in socially interactive activities uses a combination of sources and action relatively more often in their descriptions than those engaged in solitary activities, who were more likely to combine source and actions for human direct and human indirect sounds;
- at a syntactic level, solitary users relied more on complex noun phrases in their descriptions than socially interactive users, who relied more on simple noun phrases and verb phrases.

These findings point to subtly different auditory experiences in the same public space, with users emphasizing different sounds in their descriptions as well as focusing differently on sound sources or sound actions.

An additional insight of this research is related to the differences between users' descriptions of their auditory

environments in response to two distinct requests: when asked to describe what they hear and when asked to describe what they hear to someone who is not familiar with the space. While the descriptions offered to the first request, with small variations, were mostly analytical, the descriptions offered to the second request were overwhelmingly holistic. Despite the smaller size of the "description to others" dataset, the differences between the two were also visible in the syntax of the responses, with more complex statements employed by users for the latter request. One possible explanation for this might be the perceived "audience" of each request: the first request provides information to data collectors (i.e. researchers) and the second to other potential users of space. That is, the description to the first request was analytical and "objective", potentially due to the users' own assumptions of the "scientists' " expectations and thus focused on identifying sound sources or actions. Comparatively, the description to the second request was probably closer to everyday "natural" communication, as it built on a presupposed shared language and knowledge (e.g. on what a "normal" park sounds like); this included higher number of amorphous sounds listed, as well as of quality judgments (e.g. "busy city park"). This difference in communication / language raises an interesting methodological concern as it shows the importance of phrasing questions and requests in written data collection. It also calls into question the validity of results from urban questionnaires and of surveying as a "go-to" method altogether, making the argument for a more critical process in developing more user- and everyday language-centred tools.

2. The methodological contribution includes a strategy for researching users' descriptions of their auditory environment that can be replicated in future studies. It also proposes a theoretically and empirically driven classificatory framework, focused on human activity, to aid in the analysis of descriptions of auditory environments and sounds particularly in a public space setting, in a meaningful way, mirroring users' urban experiences.

While we argue that the proposed methodology could be a useful contribution to current debates on how to study the urban auditory experience in context, we acknowledge its inherent limitations, ranging from the language of the study, the size of the dataset as well as our sample selection process. With respect to language, we based our analysis on research done previously in French and extended it to Dutch, a Germanic language with a different syntax. Further research can focus on the particularities of the language in which the descriptions are offered e.g. whether the Dutch language, with its specific types of word formation, allows for the same types of inferences as French for relations between language use and auditory experiences. This exploration can be extended to discuss cultural differences between members of different linguistic communities in their relations to both public spaces in general and as their auditory environments in particular, in terms of expectations, needs or preferences. With respect to our selection process, we questioned users already in the space and the lack of variance in responses could be justified by insufficient variance in activities, considering that this is a park where there is a limited diversity of uses. However, engaging with users in a public space directly, through surveys or interviews, is challenging; the method of inquiry itself draws the users' attention to their auditory environment triggering more analytic descriptions that can, as Thibaud [30] argued, "quite clearly lead us away from everyday life situations, [...] since the obligation to describe would continue to have an influence [over descriptions]" (p. 30-31). Given that this challenge cannot be avoided and alternative research methods also come with their intrinsic limitations (see Ibid. for a reflection on the paradox of observation methodologies in sound research), questionnaires should be used together with other data collection strategies to ensure a higher validity and robustness of findings.

This paper was an exploratory effort and a proof of concept for a method to analyse users' descriptions of their auditory environments. However, testing the relationships in a statistically significant manner was beyond the scope of the study due to our sample size. The size of the representative sample depends on the population size (number of users per public space) as well as on the number of activity categories that will emerge from the data (as independent variables). Considering that Oosterpark is one of the most visited parks in Amsterdam, with over 5.3 million visits every year[6], depending on the accepted margin of error, we suggests collecting at least 385 questionnaires for a representative sample size[7]. The emerging picture is of high complexity, with contextual factors (ranging from weather to how close a user lives to the public space) playing a substantial role. Nonetheless, this study provides what we believe to be a useful classificatory framework and methodology for future researchers to test potentially statistically significant correlations between categories of activities and linguistic patterns in describing auditory environments in a rigorous manner. Despite the limitations and more fundamental challenges, this research represents an interesting methodological contribution because it illustrates an approach that integrates linguistics to make sense of how users experience their auditory environments out of the laboratory, 'in the wild'.

Finally, this paper focused on the *description* of the auditory environment in relation to users' activities and did not touch upon users' evaluations of their environments, for example whether what they heard was suitable for the activity they were performing at the time. As previously mentioned, ample evidence has been collected on the evaluation of specific types of sounds in an urban (outdoor) setting, including music or sounds of nature, and how their

[6] Description of Oosterpark on the official website of the Municipality of Amsterdam (in Dutch). Available online at https://www.amsterdam.nl/toerisme-vrije-tijd/parken/oosterpark/. Accessed June 17th 2018.

[7] Calculation based on the output of an online sample size calculator. http://www.raosoft.com/samplesize.html. Copyright Raosoft Inc., 2014.

evaluation might depend on the activity that users are engaged in [71, 72, 47]. However, systematic efforts to understand how users *evaluate* their auditory environments and what they evaluate as, for example, disrupting, stimulating or suitable in relation to their activities, in context are still scarce (see Bild *et al.* 2018 for an attempt). In doing so, future research can explore auditory environment evaluation methodologies as well as support the collection of insights that can be integrated in the design of public spaces catering to the needs and expectations of their users and their activities.

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