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HOW DO WE DEFINE SOUNDSCAPE?

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ABSTRACT

Nearly 10 years ago, the definition of soundscape was codified in an ISO standard for the first time. This definition drew from Schafer and Southworth's work, which focused squarely on human perception in context. However, the term soundscape has seen widespread academic and popular adoption in fields and applications well outside its original 'human perception' context. This paper will collect a range of definitions of soundscape across urban, underwater, ecological and other contexts. These uses often conflict with the ISO 12913 definition, both by drawing the focus away from humans and by declining to define soundscape as a perceptual construct. This paper will examine these broader uses of the term and consider a new definition which aims to harmonise the standard definition with its varied uses. The presentation aims to facilitate a discussion by inviting views from outside urban soundscape and from those who do not identify with the ISO definition.

Keywords: *soundscape, acoustic environment, perception, definition, ISO12913*

1. INTRODUCTION

Soundscape, conceived as the acoustic equivalent of landscape, is defined as the acoustic environment, as perceived by a person or people, in context [1–3]. The soundscape can be the result of a single sound or a combination of sounds that arises from an engaging environment. The Canadian composer and naturalist R. Murray Schafer led much of the original work to advance research in the area [4], following Michael Southworth's first use of the term in urban studies [5]. Our goal in this paper is to explore how the term soundscape has been used and defined across a range of disciplines and to facilitate a discussion across disciplines around how the term could be defined in the future.

It was Schafer's use of the term which resulted in its widespread adoption and popularity. According to Schafer, the main components of the soundscape consist of keynote sounds, sound signals, and soundmarks, implying there is someone capable of processing and sorting environmental sounds into these semantic categories. Since Schafer, there have been several multi-dimensional classifications for soundscapes. Before further exploring how the term evolved from Schafer's conception to the form included in ISO 12913-1, it is worth seeing how the word 'soundscape' has been used and defined more broadly across different disciplines. We'll begin, in the tradition of all good undergraduate essays, with the definition according to the Oxford English Dictionary:

> **soundscape** n. *(a)* a musical composition consisting of a texture of sounds; *(b)* the sounds which form an auditory environment. [6]

Definition (a) focusses on its use in musical composition and genre, an aspect more ably addressed by Sterne [7], so we'll focus on (b). The dictionary definition neglects to make any connection between sound and space (re landscape) or with perception, instead making only the distinction between the collection of sources as sounds and the total auditory environment which arises from them.

Within the tech world, soundscape takes on an inter-

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esting blend of spatial hearing and urban environments. A recent project, dubbed *Microsoft Soundscape*, "explored the use of innovative audio-based technology to enable people to build a richer awareness of their surroundings" by providing information about the user's urban surroundings with synthesized binaural audio. This makes a more direct connection between the holistic consideration of how sounds are perceived and how they shape our relationships with the surrounding urban environment. The directed sounds introduced by the Microsoft Soundscape app act as signals creating a more purposeful auditory view of the environment to complement the mental map.

The soundscape ecologist Bernie Krause characterised soundscapes into three main domains based on the source of the sound. According to his classification, the soundscape refers to a wide spectrum of sounds, encompassing natural sounds relating to non-organic elements of nature such as waterfalls (geophony), organic but non-human sources such as animals' copulatory vocalisations (known as biophony), and all environmental sounds generated by human sources (anthrophony) such as human voices or human activity-related sounds [8, 9]. Soundscape ecology thus provides a working definition as:

> all sounds, those of biophony, geophony, and anthrophony, emanating from a landscape to create unique acoustical patterns across a variety of spatial and temporal scales" [10].

The term soundscape is commonly used in acoustic ecology and underwater acoustics – see titles such as 'The soundscape of bat swarms' [11], 'An integrated underwater soundscape analysis in the Bering Strait region' [12], 'Soundscape analysis and acoustic monitoring document impacts of natural gas exploration on biodiversity in a tropical forest' [13], and 'Identification and quantification of soundscape components in the Marginal Ice Zone' [14]. Several analysis packages have also been developed for the purpose of soundscape analysis, whether for urban-, underwater-, or bio-acoustics, which include no aspect of human perception in context (see e.g. Soundscape Viewer [15] and scikit-maad [16].

These fields appear to use the term soundscape more broadly, without a reference to human perception, to refer to either a broad consideration of the entire sound environment or to a focus on the sound environment as experienced by all creatures, not just humans. This last definition comes from Pijanowski et al. [10] where the authors state that 'soundscape ecology focuses mostly on macro or community acoustics [...] the composition of all sounds heard at a location that are biological, geological, or anthropogenic' to differentiate it from previous acoustic ecology studies which 'focus on a single species or a comparison of species'. Within the ISO 12913 framework, this would more accurately be described as the acoustic environment ('sound at the receiver from all sound sources as modified by the environment').

2. SOUNDSCAPE IN ISO 12913

From its starting point in urban planning studies, music, and soundscape ecology, urban soundscape studies have advanced over the last two decades [17, 18], eventually leading to the Soundscape-COST action [19] and the ISO 12913 standardization. [20] noted that the standardization of soundscape methods was necessary to provide 'minimum measurement requirements leading to a (minimal) guaranteed level of reliability'. ISO 12913 Part 1 [1] sets out the definition and conception of soundscape, defining it as the 'acoustic environment as perceived or experienced and/or understood by a person or people, in context'. Here, the soundscape is separated from the idea of an acoustic environment, which encompasses all of the sound which is experienced by the receiver, including any acoustically modifying effects of the environment. It should be noted that this closely resembles the definition given within soundscape ecology above [10]. In contrast, the soundscape considers the acoustic environment, but also considers the impact of non-acoustic elements, such as the listener's context and the visual setting, and how these interact with the acoustic environment to influence the listener's perception.

The beginning of this definition of soundscape can be found in Truax [21]:

> An environment of sound with emphasis on the way it is perceived and understood by the individual, or by a society. It thus depends on the relationship between the individual and any such environment. The term may refer to actual environments or to abstract constructions such as musical compositions and tape montages, particularly when considered as an artificial environment.

Eventually these developments led to the normative definition given in Part 1 of ISO 12913 [1]:

> acoustic environment as perceived or experienced and/or understood by a person or people, in context.

In the end, these conflicting and overlapping definitions can make cross-disciplinary communication more difficult and prone to disagreements and misunderstandings. The ISO definition's focus on human perception also clearly conflicts with other popular definitions of soundscape.

3. HOW DO WE DEFINE SOUNDSCAPE?

In examining these varying definitions of soundscape, we (the authors) also need to acknowledge that our own use of the term often does not align with the ISO definition. In many cases, our use of the term refers more strongly to its shared meaning with landscape. Likewise, although our own work does fall squarely within human soundscape as covered by the ISO, we tend to agree with its broader use to describe the soundscapes of other settings and species. Rather than ignore this discrepancy, we feel it is prudent to instead consider other concepts that more accurately reflects how we (and many other authors) are actually using the term. In the 2023 Urban Sound Symposium, a similar discussion resulted in the simple proposal from a member of the bioacoustics community to remove the reference to "a person, or people" from the ISO definition. This would still retain the perception aspect, but would refrain from limiting soundscape to a human-exclusive discussion.

To harmonise these concepts, we begin from an expanded definition given by Brown [22], which differs slightly from the one which made its way into the standard. The author begins by reviewing the definition of landscape, as given by The European Landscape Convention Agreement, as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors". This is then adapted for use in soundscape [22]:

> soundscape is the acoustic environment of a place, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.

Following the suggestion at USS 2023, and to maintain the important connection with how context impacts the soundscape, we would update this to the following:

> soundscape is the acoustic environment of a place, as perceived, experienced, and/or understood, whose character is the result of the action and interaction of acoustic, non-acoustic, and contextual factors.

This conception reflects the holistic view of soundscape analysis which aims to consider more than the sound environment alone and also consider how non-acoustic factors impact how sound environments impact listeners. It expands the use of the term into areas which are not human-centred, explictly incorporates non-acoustic contextual factors, and reintroduces the connection with landscape. In urban and human soundscape studies, the investigation and understanding of the soundscape is focussed on human perception as in ISO 12913-1:2014 [1]. In soundscape ecology, it reflects the desire to consider sources from many species, including anthropogenic sources, and especially to focus on the impact on the animals and ecological systems. A scientific consensus of what constitutes the definition of the secondary, non-auditory and contextual factors is still being developed, notably as a proposed ISO Technical Specification [23]. A preliminary definition of non-acoustic factors was proposed by Riedel et al. [24] as:

> All factors other than the objective, measured, or modelled acoustic parameters which influence the process of perceiving, experiencing and/or understanding an acoustic environment in context, without being part of the causal chain of this process.

4. FINAL THOUGHTS

This paper has briefly reviewed how the term soundscape has been defined across several academic disciplines and its usage in non-academic settings, such as in analysis software, tech products, and even the dictionary definition. Our goal has been to highlight that the standardized definition put forward in ISO 12913-1 often fails to align with how the term has been used broadly. While an alternative and comprehensive definition has been considered, it is not the only possible choice.

One concern often raised in discussions of the definition of soundscape is to "resist the impulse to apply it ubiquitously to all studies of the social life of sound" [25]. Is it not possible that this would in fact be the most useful approach? It may be necessary to allow the term soundscape to be defined very broadly, but to be more thoughtful about what specific sub-field of soundscape is being

discussed. As such, the ISO definition might more accurately refer to 'human soundscape perception', while our proposed definition may be tweaked to only refer to 'urban soundscape'. Perhaps it is best not to attempt to either reign in the whole term to one restricted meaning or to exclude other fields from its use. This option of broadly defining soundscape and allowing for various uses under its umbrella was also discussed in [26] where the necessity for soundscape to be defined as the perception is softened:

> While the ISO definition provides an important, and rigorous, distinction, it is recognized that some, particularly planners, designers, lay persons, and even those primarily interested in management of the acoustic environment through environmental noise control, will find it convenient to use "soundscape" as a synonym for the physical acoustic environment. As long as such equivocal usage of the term soundscape does not introduce confusion in communication, we can be relaxed about the ambiguity.

The implications of this discussion are significant for both research and practice. It acknowledges that soundscape is not only a human phenomenon, but also a relevant concept for other living beings. It also recognizes that soundscape is not a fixed or objective reality, but a dynamic and subjective one, influenced by the contexts and perspectives of the listeners. This discussion opens up new possibilities for interdisciplinary collaboration and cross-fertilization among soundscape researchers and practitioners. It also invites further reflection and debate on the ethical, aesthetic, and ecological dimensions of soundscape.

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