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Review Article

Systematic Literature Reviews of Architectural Soundscapes Study

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Abstract

Sound is an inseparable part of human activity, exhibiting various phenomena related to its source, duration, timing, and interpretation. In residential environments, sound contributes uniquely to each building's character, shaped by its spatial dimensions. This auditory phenomenon is subject to interpretation by both residents and the surrounding environment, though these interpretations may differ. This study aims to explore the boundaries of recent research in soundscape studies, particularly within the field of architecture. Utilizing a Systematic Literature Review (SLR) method, this study analyzes journals from the past 20 years using the Publish or Perish (PoP) application and the keywords "Soundscape" and "Architecture" in the Scopus Index. The objective is to present a research map of the past 5 years, identifying patterns and trends in Soundscape Architecture. The findings reveal distinct concentrations in the object of study and scale within the architectural scope, contributing to a deeper understanding of the complexities and nuances of Soundscape Architecture research. Furthermore, this study highlights areas for future investigation and development, emphasizing the evolving nature of this interdisciplinary field.

Keywords

Soundscape, Architecture, Systematic Literature Reviews

1. Introduction

The study of sound, its explanation, and attention in the world of sound have been discussed since classical philosophy. Pythagoras touched on this matter in his thoughts. Research on sound began with an idea of how sound could change and become a sequence that creates certain impressions, which could then be measured by structured counting principles similar to those used in modern physics today. This notion evolved into complex formulas attempting to explain the relationship between objects emitting sound and the processes of its propagation. These thoughts became the focal point of modern physics in dividing sound based on measurement units such as octave, amplitude, decibel, and others. This development then progressed into the realm of sound as a dimensional, process-oriented space, not only viewed as a unit of value but also analyzed through units of impression. This field of study was later named Soundscape.

Soundscape is a terminology consisting of the word "sound," meaning sound, and "-scape," a suffix that denotes a domain influenced by the subject preceding it, such as landscape, cityscape, and mindscape. Soundscape can refer to a, this term if seen for the first time was coined by R. Murray Schafer in 1960 in his work "The Tuning of the World," published in 1977 [13]. This book introduced a method for approaching the identification of sounds within a space.

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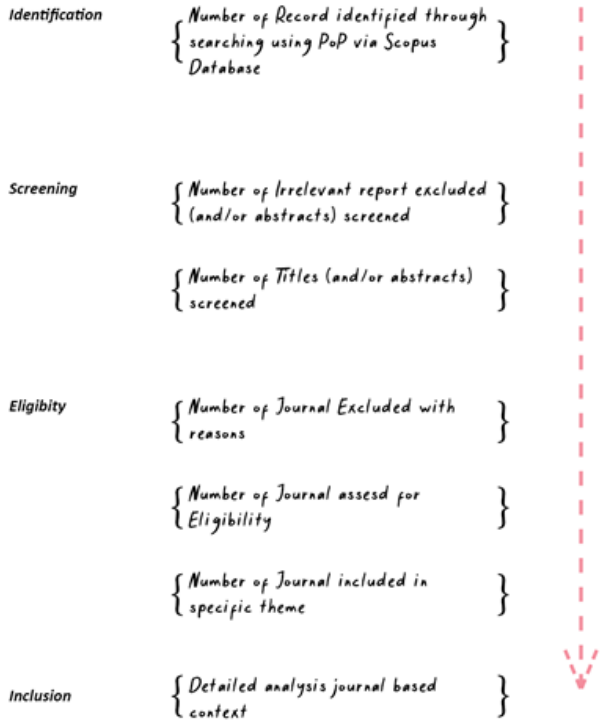
The book then attempts to describe the sounds within a space by examining the phenomena surrounding their occurrence, adjusted according to the origin of the sound, its distribution, purpose, and the response elicited by the presence of that sound. Schafer argues that sound can be understood similarly to the characteristics of the visual world and landscape; it possesses traits and "forms" that contribute to its complexity and dynamism. For instance, there are sounds that originate from sources beyond human control, while others arise from human intervention, either directly or in response to other sounds. Schafer proposed four terms to comprehend sound, which later became pivotal points in understanding Soundscape: Sound Signal, Soundmark, Keynote, and Acoustic Ecology.

As a fundamental building paradigm in understanding the identity of sound itself when observing an object, these four basic points serve as the foundation. Soundscape then becomes a topic related to numbers in its development, using numerical values and standards when interfacing with the physical world, although initially, sound was responded to using descriptive narrative methods with subjective responses depending on the receiver. The way of responding to and explaining sound then evolved with the assistance of various tools, data collection methods, presentation variations, and software as facilitators in elucidating these sounds [8].

The Soundscape paradigm has been increasingly adopted by other fields of study, such as Architecture [17]. Architecture and Soundscape can be interconnected when considering the clear relationship of sound phenomena occurring within a space. Moreover, the purpose of Soundscape itself aligns with the architectural world, which is commonly manifested in dimensional forms. This research aims to explore and analyze the development of research on Soundscape, trends, and innovations in this field of study, especially when associated with the discipline of Architecture. The goal is to identify the current research conditions, analyze trends, and explore new areas or research gaps at the intersection of Soundscape and Architecture. Through a Systematic Literature Review, this study aims to contribute to the existing knowledge in both fields and provide insights for future research directions. The scope of Scopus is considered a suitable platform for competent journals and serves as a reliable reference in tracking the latest developments in the Soundscape discourse, thus deemed sufficiently representative and credible for investigating advancements and the frontier of knowledge.

2. Method

The methodology chapter encompasses data collection, data processing, and data analysis methodologies, as well as descriptions related to the study object, research variables, research instruments, and research location. This study employs the Systematic Literature Review method, utilizing journals from the past 5 years through the PoP application with the keywords "Soundscape" and "Architecture," indexed in Scopus, which are then categorized based on relevant research themes and areas. Using the PoP application with Scopus indexing, the search is restricted to journals from the last 5 years (2017-2023). The collected data will then be analyzed to identify aspects deemed relevant to the discussion of soundscape in the field of architecture. Raw data obtained according to the machine's metadata mechanism are then selected based on the substance of the discussion in Soundscape in the field of Architecture, considering titles, keywords, and abstracts. The substance is then mined to uncover trends occurring in Soundscape research in the field of Architecture.



Source: Author, 2024

Figure 1. *Methodology Diagram.*

The discussion on Soundscape, considered through the filtering process, particularly in the substance chart after keyword searches with metadata using PoP, draws from several references. These include "The Soundscape: Our Sonic Environment and the Tuning of the World" by R. Murray Schafer, first published in 1977 and reissued in 1993. This source contributes to a general understanding of the concept of Soundscape. Additionally, "Soundscape and the Built Environment" by Jian Kang and Brigitte Schulte-Fortkamp, published in 2016 [7], is consulted for insights into Soundscape specifically within the realm of architectural discourse.

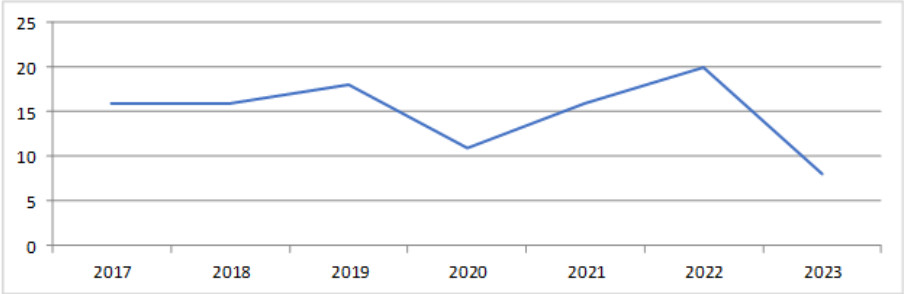
3. Discussion

The results of the Systematic Literature Review (SLR), conducted using Scopus as the primary source over a 5-year period, yielded 200 articles related to Soundscape in general and 110

articles specifically related to Soundscape within the field of architecture. The final findings indicate the following trends:

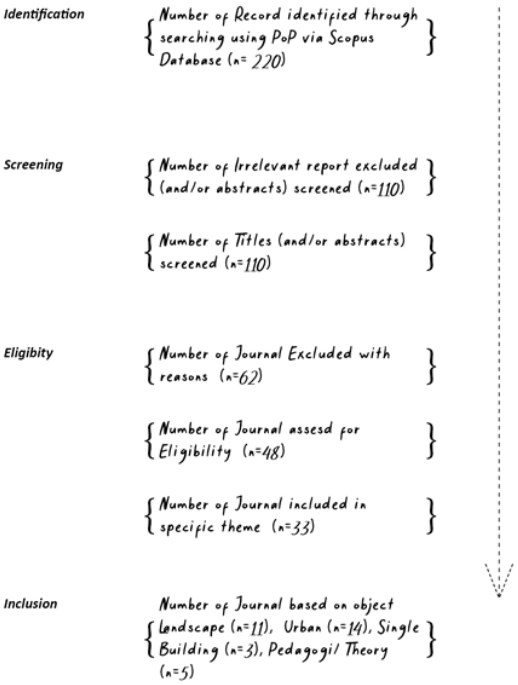
There has been a relatively stable development in Soundscape research within the field of architecture. Data suggests a consistent increase in the number of journal publications indexed in Scopus per year from 2017 to 2019. However, there was a slight decrease in publications in 2020, followed by a subsequent rise until 2022. Data for the year 2023 is incomplete as the research period is ongoing. On average, approximately 15 journals were published annually, with a slight decline observed in 2020 but remaining above 10 journals. The most significant increase occurred in 2022, with approximately 20 journals dedicated to Soundscape topics.

Manuscript should at least consist of: (1) Introduction, (2) Theoretical Review (if applicable), (3) Methodology, (4) Discussion, (5) Conclusion and Recommendation, (6) Acknowledgement and (7) References. Modification is welcomed when necessary. Introduction and other headings should be marked clearly. First paragraph of each heading and subheading should not be indented. The second paragraph should be indented by 5 points.



Source: Author, 2024

Figure 2. *Graph of research results from 2017-2023.*



Source: Author, 2024

Figure 3. *Number of Journals.*

The number of journals using the keyword "Soundscape" yielded a total of 220 journals, covering various topics. Then, by further refining the search using additional keywords to "Soundscape Architecture," it narrowed down to 110 titles. Abstracts and keywords aligned with the metadata and algorithms. Upon analysis, those relevant to architectural discussions substantially filtered down to 48 journals. This reduction is due to the remaining 62 journals primarily focusing on soundscape research in natural settings, virtual reality, software applications, and evaluations using software.

The 48 journals selected for their architectural substance excluded topics related to practical design purposes, design evaluation using software, and experimental architecture. This refinement aimed to focus on journals that solely applied soundscape as a research instrument with real-world objects. Consequently, 33 journals remained, categorized into four major topics based on the object or purpose of the journal.

Table 1. *The distribution of research themes according to objects or locations.*

Object	Result
Urban / Perkotaan	14
Landscape / Bentang Alam	11
Single Building / Bangunan Tunggal	3
Pedagogi-Teori	5

The largest trend with the highest number of journals is focused on research objects in the urban environment, totalling 14 articles. These journals encompass a variety of research objects, but share one commonality: they are situated in expansive urban environments with numerous observation points. The urban environment's characteristics are also a significant aspect of this group. Sound, as a spatial element that contributes to the "ambiance," renders the urban landscape a rich subject of observation. The complexity of urban dynamics positions soundscape as a tool to understand a city's character, particularly in densely populated and heterogeneous cities. Research in this group aims to produce outcomes that culminate in perceptual units, supported by value units. This trend can be understood by observing urban development's focus on inhabitants' quality of life; noise pollution often serves as a benchmark for research in this group, both in terms of background and research findings [12, 18, 19].

The second-largest trend focuses on research objects in the landscape or natural environment, comprising 11 articles. Similar to the group of journals focusing on urban research objects, these journals share a common focus on sound research in natural landscapes. This trend is rooted in human history, which relies on natural objects as points of assessment that fall within the realm of life. Landscapes with sounds generated by natural elements are generally believed to have a significant impact on humans. The world of the landscape, filled with external sounds not originating from humans, provides rich research material for understanding its dynamics. Research in this group centers on mapping sound sources and sound propagation processes. This is understandable because in landscapes, these layers of sound often overlap and are difficult to discern for most recipients [2-4, 11].

The third and fourth largest trends in terms of quantity are observed in the pedagogical-theoretical group and the group focusing on research objects of single buildings [1, 5, 6, 9, 10]. However, discussions about research groups with single-building objects are prioritized, considering their similarity to the two largest groups in terms of the physical nature of the location objects. The group focusing on single-building research occupies the lowest position among the other groups. This research is characterized by the narrowing of the research area to the scale of a single building with specific or at least dominant activities. The tendency of this research is to examine the patterns of sound generated by specific activities. Unlike the Urban group, which discusses the mapping of sound diversity, or the Landscape group, which focuses on mapping sound sources, this group emphasizes the dynamics and propagation patterns of impressions. The limited scope of research on a few objects is replaced by an approach that expands observations from various perspectives, such as the use of tools, software, translation methods, and detailed architectural elements not found in macro-scale urban or meso-scale natural landscape research objects.

4. Conclusion

Conclusions illustrate the answer of the hypothesis and / or research objectives or scientific findings obtained. The conclusion does not contain the repetition of the results and discussion, but rather the summary of the findings as expected in the objectives or hypotheses.

Based on the data obtained from Scopus within a 5-year timeframe, the trend in sound research within the field of Soundscape Architecture indicates an expansion into more specific application areas and disciplines, such as Architecture. Sound, initially perceived as a physical phenomenon characterized by numerical values and metrics, has evolved into a subject that can be discussed using cognitive language, avoiding the use of numbers and instead relying on subjective narratives, although it can still be extracted and simplified using statistical models.

In the field of Architecture, Soundscapes can be examined from both a physical and cognitive perspective. The phenomenon of sound can be investigated in three main aspects: sound as a source, sound as a stimulus for reactions—where the subjectivity of the listener influences how the sound is perceived—and finally, sound as waves, a topic extensively explored in the realm of physics. In Architecture, both physical and cognitive elements are considered, enriching the scope of research.

The assessment of sound by recipients can be positively influenced not only by the volume but also by various contextual factors. A space without sound is not necessarily deemed negative or positive, and similarly, noisy environments do not inherently lead to negative or positive evaluations. These assessments can vary depending on the location, the recipients, the source of the sound, and the propagation context. The dynamic and cognitively laden nature of this assessment differentiates Soundscape in Architecture from the discussion of sound phenomena in the field of Physics. The cognitive aspect gives rise to descriptive narrative explanations attempting to elucidate the background of evaluations influenced by the recipients. Factors such as history, activity background, and cultural and religious aspects become essential texts to include in the discussion.

Research on Soundscape in the field of Architecture is predominantly focused on urban environments and natural landscapes. This trend is driven by factors related to the widespread impact of sound on society or issues beyond Architecture, such as health and social impacts resulting from sound. Consequently, research attention on single buildings is relatively limited when considering their impact on society. However, studies on single buildings can enhance and deepen discussions on specific locations, activities, or users. Therefore, this research group has its own distinctive characteristics compared to other groups.

The Pedagogy-Theory group in the field of Soundscape also offers advantages in facilitating discussions and refining approaches in Architecture, particularly in the organization,

validation of research stages, data collection methods, and the establishment of common paradigms. This helps streamline debates in the initial stages and allows focus on subsequent phases. Results from pedagogy-theory, such as ISO (International Standard Operation), serve as examples that simplify the application of Soundscape across various fields. The simplification of Schafer's theory along with its sequential points and implementation facilitates its adoption by other disciplines, especially in Architecture. However, the use of ISO is not yet widespread as it was introduced only in 2018 and expanded upon in 2020 [14-16].

In the past five years, the enthusiasm for Soundscape in the field of Architecture has seen a consistent upward trend, both in terms of statistical quantity and the diversity of objects studied across various parts of the world. However, despite this development, research focusing on single buildings with specific activities has received relatively little attention. This could be interpreted as a wide-ranging opportunity for further exploration in research. Additionally, the utilization of the formulated ISO standards can serve as a significant tool in research, given its recognized role in international practice. Nevertheless, the application of Schafer's method in Soundscape research remains substantial and relevant.

To further develop this research, several steps can be taken. Firstly, researchers can expand the scope of journal searches by not solely relying on Scopus indexing but also exploring other journal databases such as Web of Science or PubMed. This would provide a more comprehensive overview of recent developments in the field of Soundscape Architecture and enable the identification of broader trends and patterns.

Furthermore, future research could consider expanding the timeframe of the literature review study to cover a longer period, for example, up to the past 20 years. This would allow researchers to trace the evolution of the concept of Soundscape in architecture over time and understand changes in trends and their impact on contemporary architectural design practices. Additionally, the research could further explore diverse research methods, including qualitative and quantitative approaches, and analyze the trends in the use of these research methods in scholarly literature. Consequently, preferences of researchers in selecting specific research methods and trends in the development of research methodology approaches in the field of Soundscape Architecture can be identified.

Abbreviations

PoP	"Publish or Perish" Application
SLR	Systematic Literature Review
ISO	International Standard Operation

Author Contributions

Army Wiratama: Conceptualization, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing

Revianto Budi Santosa: Data curation, Formal Analysis, Investigation, Supervision, Validation, Writing – review & editing

Arif Budi Sholihah: Data curation, Formal Analysis, Investigation, Supervision, Validation

Conflicts of Interest

The authors declare no conflicts of interest.

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