

Opportunities for soundscape appraisal in Asia

W.M. To
Macao Polytechnic Institute, Macao SAR, China.

A. Chung
Macao Instituto de Acústica, Macao SAR, China.

I. Vong, A. Ip
DingDingSound, Macao SAR, China.

Summary

As societies evolve, people increasingly demand a better living environment and play greater attention to a host of environmental factors that can influence their physiological and psychological well-being. Soundscape becomes one of these environmental factors. As the majority of today's people live in cities - in particular in Asian countries, the buzzing sound of cities define the soundscape and experiencescape of city dwellers and visitors. Hence, this paper reviews and discusses the state of the art research and studies in the field of soundscape, with a special emphasis on Asia.

PACS no. 43.50.+y, 43.66.+y

1. Introduction

Soundscape refers to a sonic identity that uniquely defines a space from all other spaces. It represents how the space is perceived and understood by an individual, its users, and the society in general due to its acoustic environment [1,2]. Thus, a soundscape is also known as 'the landscape at the ear' [3,4]. As the aural impression of a space will not change dramatically over a short period of time, sound mapping and soundwalks can be utilized to identify the soundscape of a space – be it indoor, semi-enclosed, outdoor, or open space [5]. Nevertheless, when societies and cities evolve, their soundscapes will inevitably alter as a function of time throughout the day, month, and year, as well as due to geophysical and socio-economic, demographic, cultural, and lifestyle changes. Hence, the International Organization for Standardization [6] defines soundscape as the "acoustic environment as perceived or experienced and/or understood by a person or people, in context".

Knowing soundscape to be a dynamic, time-varying phenomenon due to its geographical, climatic, economic, social, and cultural dependent nature, this paper aims at reviewing research studies on soundscape, with a special emphasis on

Asia. The rest of the paper is structured as follows. First, the next section presents the Method including the approach we used and the source of data. Then, the Method section is followed by the Results and Analysis section. The paper concludes the study and highlights opportunities for soundscape studies in Asia.

2. Method

In academic and research studies, literature reviews are crucial because they facilitate researchers to establish an in-depth understanding of what prior investigations have been conducted, how the investigations were carried out, where and when they were performed, what key findings of the investigations were produced and reported, what limitations of the investigations were exposed to, and more importantly, why the topics were investigated in the first place. Yet, there are some confusion about "reviews", "narrative reviews", "systematic reviews", "meta-analysis", and "pooled reanalysis". Basically, a "review" is the qualitative summary of different studies including their scopes, methods and approaches, and key findings [7]. It can be narrative or more systematic in nature. Meta-analysis and pooled reanalysis focus on extracting quantitative

information from prior studies. Ressing et al. [7] provided a summary of these four broad categories of studies as shown in Table 1.

More specifically, Cook et al. [8] defined a systematic review as the application of scientific strategies that limit bias by the systematic assembly, critical appraisal, and synthesis of all relevant studies on a specific topic. Furthermore, Cook et al. [8] defined a meta-analysis as a systematic review that employs statistical methods to combine and summarize the results of several studies. Hence, we adopted Cook et al.'s [8] and Ressing et al.'s [7] definition and followed their guideline to formulate our study. The procedure for conducting the study is presented as below.

- i. The question(s) to be answered in the review should be clearly defined and written down in the study's protocol. In this case, we would like to answer the following questions: (1) What is the stage of research studies on soundscape in the world? (2) What is the stage of research studies on soundscape in Asia? (3) What were the focuses of soundscape studies that were previously conducted, particularly in Asia?

- ii. The inclusion and exclusion criteria should be clearly defined and written down in the study's protocol. In this case, we would consider research articles that included journal research articles, reviews, conference papers, conference review, books, book chapters, etc. that have "soundscape" in their titles, abstracts, and keywords at first. Then, we narrowed the scope of literature search by identifying soundscape studies conducted in Asian countries.
- iii. An extensive literature search should be performed. Preferably, this should be carried out using academic databases such as Web of Science, Scopus, and Google Scholar. Bar-Ilan [9] reported that Scopus has a broader coverage than Web of Science, in particular for recent publications. On the other hand, Scopus has a set of more stringent journal and conference inclusion criteria than Google Scholar [10], thus producing more accurate search results. Thus, Scopus was used as the chosen academic database in the study.
- iv. Relevant information should be extracted from the publications.

Table 1. Coverage of different categories of research studies

	Narrative review	Systematic review	Meta-analysis of published data	Pooled reanalysis
Have a study protocol and analysis plan	-	✓	✓	✓
Perform literature search for suitable studies according to pre-defined inclusion & exclusion criteria	-	✓	✓	✓
Present quantitative summary of the results	-	-	✓	✓
Analyze the collected data as a whole	-	-	-	✓

*Adapted from Ressing et al. [7]

3. Results and Analysis

3.1. Soundscape studies in the world – an overview

After logging into Scopus on 8 May 2018, we entered "soundscape" to the search term and selected "Article title, Abstract, Keywords" as the search field. In total, 2,720 publications were identified with 2,652 to be non-open access documents and 68 to be open access documents. Figure 1 shows the number of publications on soundscape from 1985 to 2018 (up to 8 May 2018). It shows that the number of publications was below 20 per year before 2001. The number of publications per year has increased rapidly from 84 in 2008 to 374 in 2017.

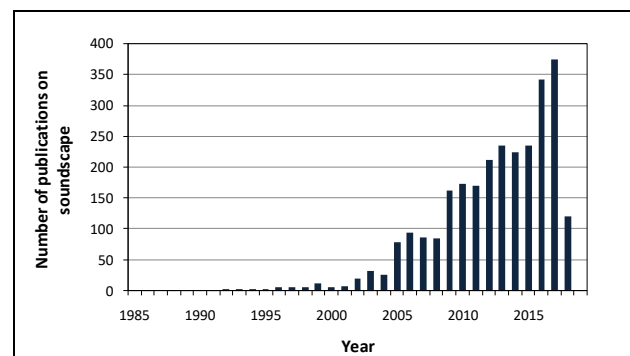


Figure 1. The number of publications on soundscape during the period 1985-2018 (with 1 pre-print for 2019)

When the publications were categorized by document type, 1,186 of them were journal research articles, followed by 1,077 to be conference papers as shown in Figure 2.

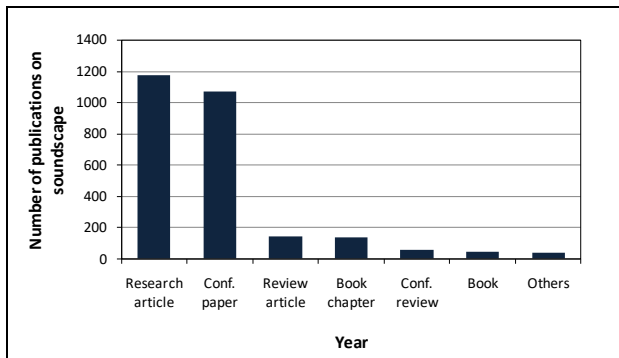


Figure 2. The number of publications on soundscape by document type during the period 1985-2018 (with 1 pre-print for 2019)

Scopus also provided the number of publications on soundscape by “author name” over the past four decades. Figure 3 shows that J. Kang produced the largest number of publications on soundscape at 116, followed by D. Botteldooren at 47, and B. Schulte-Fortkamp at 41.

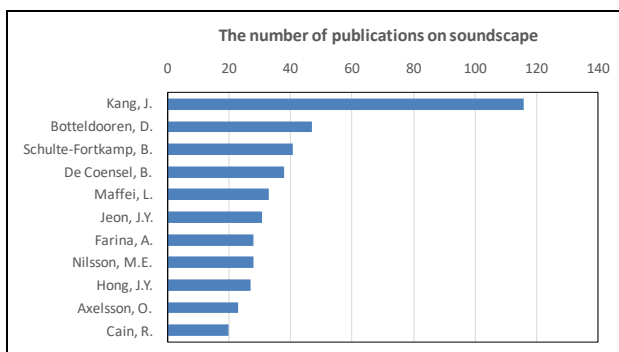


Figure 3. The number of publications on soundscape by the author

When the publications were filtered by ‘country/territory’, it was found that 571 publications on soundscape were published by authors from the United States. Authors from the United Kingdom produced 519 publications on soundscape, followed by authors from Germany

Table 2. The 27 countries/territories in Asia

Eastern Asia	Southern Asia	South East Asia
China (220)	Afghanistan (4)	Brunei (2)
Hong Kong, China (56)	Bangladesh (2)	Cambodia (1)
Macao, China (3)	Bhutan (2)	Indonesia (35)
Taiwan, China (46)	India (68)	Lao People’s De. Rep. (0)
Japan (93)	Maldives (0)	Malaysia (21)
South Korea (55)	Nepal (9)	Myanmar (1)
North Korea (1)	Pakistan (11)	Philippines (7)
Mongolia (3)	Sri Lanka (7)	Singapore (64)
		Thailand (9)
		Timor-Leste (0)
		Vietnam (8)

Note: Number of publications is shown in bracket.

with 172 publications on soundscape. Figure 4 shows the top 20 countries/territories that produced most of the publications on soundscape. Among the top countries/territories, China is the top Asian countries producing 131 publications on soundscape, followed by Japan with 93 publications on soundscape.

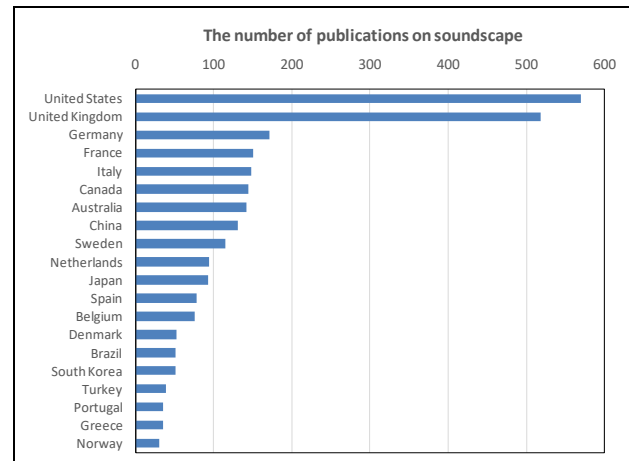


Figure 4. The number of publications on soundscape by the ‘country/territory’ of origin of the author(s)

3.2. Soundscape studies in Asia

Twenty-seven countries/territories in Asia (primarily South, East, and South East Asia) were included in the second part of the study. The countries in the Middle East such as Iraq, Israel, Saudi Arabia, etc. and Central Asia such as Kazakhstan, Turkmenistan, etc. were excluded. Table 2 lists the selected 27 countries/territories. Based on the 2,720 publications on soundscape identified in Section 3.1, we entered each of the selected 27 countries/countries as the search term. The number of publications of each country was also shown in Table 2.

Figure 5 shows the bubble map indicating the number of publications in different Asian countries/cities.



Figure 5. A bubble map indicating the number of publications on soundscape in different Asian countries/territories

Figure 6 presents a Pareto chart of the number of publications in different Asian countries/territories. It shows that seven Asian countries/territories namely China, Japan, India, Singapore, South Korea, Hong Kong, and Taiwan, contributed to over 80 percent of the total number publications on soundscape about Asian countries/territories. The other twenty countries/territories only contributed to less than 20 percent of the total number publications on soundscape in Asia.

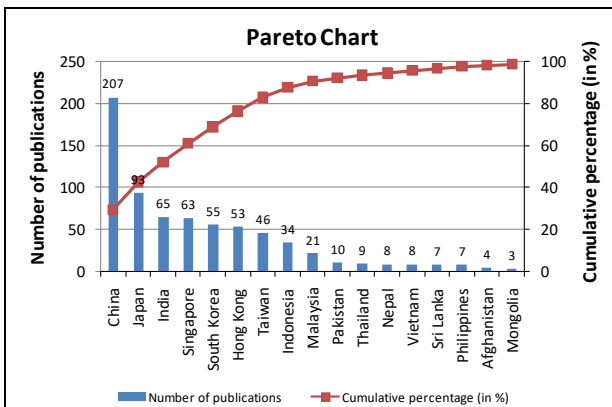


Figure 6. The number of publications on soundscape in different Asian countries/territories

To obtain a detailed view on topics and areas of soundscape that have been explored in China and India (the top three countries with the largest number of soundscape studies in Asia, we reviewed the abstracts and keywords of the identified articles including ‘soundscape’ and

‘China’, ‘soundscape’ and ‘Japan’ (focusing on authors from Japan), and ‘soundscape’ and ‘India’.

Figure 7 shows the number of publications on soundscape in China. After reviewing the abstracts, it was found that only 140 of the 220 identified articles with ‘soundscape’ and ‘China’ were relevant while 80 of them were not related to soundscape studies in China. Among the 140 articles, 39 of them were descriptive in nature with 12 of them covering music, songs, and cinematic soundscape designs. Among the remaining 101 articles, 11 of them explored soundscape in suburban, forest, and national parks while 90 of them focuses on urban soundscapes. When the 101 soundscape studies were categorized based on their approaches, 29 of them used sound measurements, 30 of them used questionnaire surveys, and 33 of them used both sound measurements and questionnaire surveys. Nine of those 101 soundscape studies focused on simulations and sound characterization. The majority of urban soundscape studies focused on outdoor environments such as city parks and gardens, open public spaces, open markets, busy streets, etc. while a few of the urban soundscape studies focused on indoor environments such as underground shopping streets, train stations, hospitals, etc.

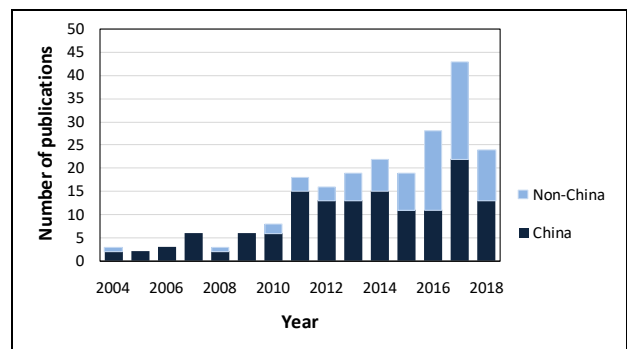


Figure 7. The number of publications on soundscape in China

We reviewed the abstracts of the identified 93 articles with ‘soundscape’ and ‘Japan’ (focusing on authors from Japan). It was found that 87 of them were soundscape studies in Japan while 6 of them were not soundscape studies in Japan. The first two articles were published in 1993 in which Japanese researchers started exploring and applying good soundscape designs.

We also reviewed the abstracts of the identified 68 articles with ‘soundscape’ and ‘India’. It was found that only 16 of them were soundscape studies in India while the remaining 52 studies had ‘soundscape’ and ‘India’ but

actually did not explore soundscapes in India. Many of them covered India songs in other countries such as Singapore, Malaysia, Indonesia, the UK, etc. Among the 16 articles, 9 of them were descriptive in nature, 3 involved simulations, and only 4 had sound measurements in Kolkata, Bhadrak, Chennai City, and underwater area in Chennai.

4. Conclusions

Our systematic review showed that soundscape studies were getting popular in the world in 2005 while soundscape studies in Asian countries have become more popular since 2011. Although most Asian countries have high popular densities, only 9 out of the 27 Asian (primarily East and South-East Asia) countries/territories had 20 or more studies exploring their soundscape environments. As not all the identified articles were really soundscape studies in those countries/territories, more work needs to be done to understand urban, suburban, and rural soundscape in each country/territories. Besides, most soundscape studies were cross-sectional in nature i.e. studies taking short-term or continuous equivalent sound level measurements at a very few locations and conducting a survey in a specific location, time and weather condition. Hence, the representativeness and generalization of these studies shall be made with great caution. Some researchers started using crowdsourcing approaches to collect quantitative and qualitative data. However, the quality and reliability of those crowded source data shall be monitored, checked, and calibrated carefully. It should also be noted that the effect of soundscape on tourist satisfaction have been explored in a number of publications in the past two years. However, the effect of tourism activities on soundscape and how changes in soundscape due to more tourism-related activities influence people's (such as citizens) perceptions on soundscape has yet to be studied.

References

- [1] R.M. Schafer: *The New Soundscape: A Handbook for the Modern Music Teacher*. BMI, Toronto, 1969.
- [2] R.M. Schafer: *The Soundscape: Our Sonic Environment and the Tuning of the World*. Inner Traditions/Bear & Co, 1993.
- [3] The University of Salford (n.d.). *Policy Applications of Soundscapes*. <http://www.salford.ac.uk/computing-science->

[engineering/research/acoustics/psychoacoustics/policy-applications-of-soundscapes](http://www.salford.ac.uk/computing-science-engineering/research/acoustics/psychoacoustics/policy-applications-of-soundscapes) .

- [4] W.M. To, A. Chung, B. Schulte-Fortkamp: Next generation soundscape design using virtual reality technologies. *Proceedings of Meetings on Acoustics* 29 (2016) article no. 040003.
- [5] W.L. Chung, W.M. To: Identification of a city's soundscape using soundwalks. *Technical Acoustics* 35 (2016) 500-503.
- [6] International Organization for Standardization: ISO 12913-1:2014 *Acoustics - Soundscape - Part 1: Definition and Conceptual Framework*, International Organization for Standardization, Geneva, Switzerland, 2014.
- [7] M. Ressing, M. Blettner, S.J. Klug: Systematic literature reviews and meta-analyses: part 6 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International* 106 (2009), 456.
- [8] D.J. Cook, D.L. Sackett, W.O. Spitzer: Methodologic guidelines for systematic reviews of randomized control trials in health care from the Potsdam Consultation on Meta-Analysis. *Journal of Clinical Epidemiology* 48 (1995) 167-171.
- [9] J. Bar-Ilan: Citations to the "Introduction to informetrics" indexed by WOS, Scopus and Google Scholar. *Scientometrics* 82 (2010) 495-506.
- [10] L.I. Meho, K. Yang: Impact of data sources on citation counts and rankings of LIS faculty: Web of Science versus Scopus and Google Scholar. *Journal of the Association for Information Science and Technology* 58 (2007) 2105-2125.

