



The eventful environment that characterises Indonesia's urban sound-scape

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ABSTRACT

Noise control is still one method to improve the urban acoustic environment in many countries, including Indonesia. The noise control tries to reduce the sound level in a particular space to increase comfort. In other words, the acoustic environment is designed to be comfortable and uneventful. Previous studies have shown that public spaces in Indonesian cities have a unique sound than cities in developed countries. Here, further studies to investigate whether the soundscapes of these cities are also unique are reported. Soundscape surveys added with sound pressure level (SPL) measurement and audio recording in 28 public places in ten major Indonesian cities indicate that a noise control approach to provide acoustic comfort and uneventful public spaces may not suit Indonesia. The analysis shows that, in general, the soundscape is perceived as an eventful environment, which is compatible with the SPL and audio recording. Furthermore, the results were significant among the ten cities. This study shows that soundscape improvement should focus on developing an environment that is perceived as eventful and comfortable at the same time. Therefore, a different strategy is needed to improve the acoustic environment in Indonesia.

1. INTRODUCTION

Previous studies related to the noise of cities in Indonesia have shown that Indonesian cities are considered noisy [1]. This is because city sounds have sound pressure levels (SPL) above the Indonesian standard and are dominated by human activities, traffic, construction, and industry [2]. However, the high noise level is not considered negative by Indonesians, which is quite surprising because noise is considered detrimental in many countries, so it needs improvement [3,4,5,6]. Furthermore, noisy public places are acceptable because Indonesians are mostly expecting communal activities while visiting public places [2]. In contrast, people with different cultures, such as in developed countries, usually carry out individual activities every time they visit public places [7].

Cities in Indonesia, represented by public places such as parks, squares, markets, memorial sites, and waterfronts, have unique sounds compared to cities in developed countries [2]. They are dominated by sounds from human activities, including people talking, children playing, music, etc. All these sounds indicate that Indonesians mostly interact with other people when in public, and the sounds they enjoy are the sounds they make based on their activities. This study focuses on identifying the concept of improving the acoustics of public spaces in Indonesia using soundscapes. This approach was selected because soundscape tries to analyse human interaction with the acoustic environment in a more holistic approach than noise measurement based on SPL [8].

2. METHODS

2.1. Selection of Public Places

Indonesia is a large country that stretches from a city called Sabang on the westernmost side to Meurauke on the easternmost side. There are 98 cities in Indonesia [9], but only a few are categorised as large or metropolitan cities with high density, most of which are located on the island of Java. Based on the preliminary study to map the sounds of cities in Indonesia, ten Indonesian cities were selected for this research. The ten cities represent different city sizes, locations (entirely land or seaside), and cultures. They are Medan, Palembang, Jakarta, Bandung, Yogyakarta, Surabaya, Banjarmasin, Makassar, Denpasar, and Kupang. All of them are provincial capitals covering the western to eastern parts of Indonesia – namely North Sumatra, South Sumatra, Special Capital Region, West Java, Special Region of Yogyakarta, East Java, South Kalimantan, South Sulawesi, Bali, and East Nusa



Tenggara respectively. Twenty-eight public places in ten cities were surveyed. Each city is represented by three public places, except for Jakarta and Surabaya, only two. Twenty-eight public places vary from parks to markets and shopping malls. As such, they comprehensively represent the diverse preferences of public places to be visited by Indonesians of various cultures and economic levels.

The study was planned to collect data from 30 public places, as in the initial study. However, the coronavirus pandemic from 2020 to early 2022 forced the local municipality to close several public places to avoid crowds. Two planned public places remain closed during the survey. Thus, this study collected data on 28 public places only, consisting of 11 parks, seven squares, two memorial sites, three waterfronts, three streets, one market, and one shopping centre (Table 1). By the end of the research period, a public place, a mix of parks, squares, and memorial sites in Jakarta, namely the National Monument, and a park in Surabaya, namely Bungkul Park, were closed. The survey of these two places is pending until they are opened to the public. In addition, a memorial place in Jakarta, namely the Hotel Indonesia Roundabout, was replaced by a public space, a mix of parks and sports arena, namely Gelora Bung Karno. Unfortunately, the Jakarta Provincial Government bans public activities during the pandemic at the Hotel Indonesia Roundabout, so the environment is too quiet for a soundscape survey.

Environmental acoustic data were collected using a questionnaire distributed to users of public places supported by sound pressure level (SPL) measurements. Three to five site-specific data in each public place were collected depending on the size of the venue and the specific features provided. Large public places were measured at five locations, while smaller ones were measured at three. Preliminary studies show that Indonesians are mostly involved with communal activities while visiting public places. Various features accommodate the communal activities of users of public places in the vicinity. For example, urban parks and squares in Indonesia are generally equipped with playgrounds, artificial water bodies and fountains, seating and sports, and food stalls, as shown in Figure 1. Therefore, data collection of these particular features is important. A total of 101 spots from 28 public places in ten cities in Indonesia were collected.

Table 1: Twenty-eight public places in ten Indonesian cities surveyed in this study

City	Public place (type – number of spots)		
	1	2	3
Medan	Taman Merdeka (park – 5)	Taman Sri Deli (park – 5)	Taman Teladan (park - 5)
Palembang	Benteng Kuto Besak (square – 5)	Taman Kambang Iwak Besar (park – 5)	Pedestrian Sudirman (street – 5)
Jakarta	Gelora Bung Karno (square – 3)	Taman Lapangan Banteng (square – 4)	-
Bandung	Alun-alun Bandung (square – 3)	Jalan Braga (street – 3)	Taman Badak (park – 3)
Yogyakarta	Malioboro (street – 3)	Tugu (memorial site – 3)	Alun-alun Kidul (square – 3)
Surabaya	Tunjungan Plaza (shopping centre – 3)	Taman Flora (park – 3)	-
Banjarmasin	Area Siring Tendean (waterfront – 4)	Pasar Terapung Kuin Utara (market – 3)	Taman Kamboja (park – 3)
Makassar	Pantai Losari (waterfront – 3)	Lapangan Karebosi (square – 3)	Center Point (square – 3)
Denpasar	Lap Niti Mandala Renon (park – 4)	Lap I G Ngurah Made Agung (park – 3)	Taman Kota Denpasar (park – 3)
Kupang	Taman Nostalgia (park – 4)	Pantai Teddys (waterfront – 3)	Bundaran Tirosa (memorial site – 3)



Figure 1: Compilation of various spots and allotments found in Indonesian public spaces. (A) a culinary spot in pedestrian Siring Tendean, (B) a work-out space in Taman Kamboja, (C) sitting areas in Taman Kamboja (the three spots are in Banjarmasin), (D) a jogging line and a playground in Taman Lumintang in Denpasar, and (E) a playground in Taman Flora in Surabaya.

2.2. Soundscape survey and the participants

The soundscape survey was conducted at 101 points. Three hundred and seventy-seven responses were collected from 38 participants who visited public places. They are undergraduate students from ten leading universities in the ten cities, aged 19 to 24, with 20 females and 18 males. This age range



follows the findings of previous studies that public places are dominated by those aged 21-40 years [10,11]. However, the range of this study is narrower than that of the referenced study, as the age range of undergraduate students is generally narrow. Similar studies also commonly use students as participants [12,13]. Previously, they voluntarily participated in the research as surveyors to record the SPL of the public places under study. Later, the research team considered inviting them as participants in a soundscape survey due to the Coronavirus pandemic, limiting human interaction, such as interviewing participants. The students were guided in three sessions, including filling out a soundscape questionnaire and collecting noise data. Young age is also suitable for soundwalking in an area that covers an area of 140,400 m² or 14.4 hectares, such as Lapangan Niti Mandala in Denpasar. This research received ethical approval from the Aisyiyah University Health Research Ethics Committee, as stated in the letter number 1413/KEP-UNISA/V/2021 dated 28 May 2021.

2.3. The questionnaire

The questionnaire was developed using 5-point Likert scale questions 'Method A' stated in ISO 12913-2:2018 [14] with minor modifications to suit local conditions (Table 1). The standardised terminology of the ISO was translated to Bahasa Indonesia based on a previous soundscape study specific to Indonesia [15]. Questionnaires were distributed and filled out online during visits to designated public spaces. At the same time, the SPL was also recorded for each place. The more relaxed conditions of the Coronavirus pandemic allow in-situ surveys. However, it is still not possible to conduct interviews with users of public places because interactions between communities are still limited and supervised by municipal officers.

Table 2: The questionnaire

Questionnaire types	Questions	Scales
5-points Likert scales	Do you hear traffic?	Not at all – dominate completely
	Do you hear sound from human beings (activity)?	Not at all – dominate completely
	Do you hear natural sound?	Not at all – dominate completely
	Do you hear music?	Not at all – dominate completely
	Do you hear other sound (construction, workshop/industry)?	Not at all – dominate completely
	Pleasant feeling (Indonesian: menyenangkan)	Strongly agree – strongly disagree
	Chaotic feeling (Indonesian: ribut/semrawut)	Strongly agree – strongly disagree
	Vibrant feeling (Indonesian: bersemangat)	Strongly agree – strongly disagree
	Uneventful feeling (Indonesian: sepi)	Strongly agree – strongly disagree
	Calm feeling (Indonesian: tenang)	Strongly agree – strongly disagree
	Annoying feeling (Indonesian: mengganggu)	Strongly agree – strongly disagree
	Eventful feeling (Indonesian: ramai)	Strongly agree – strongly disagree
	Monotonous feeling (Indonesian: membosankan)	Strongly agree – strongly disagree
	How noisy is the environment?	Not at all – dominate completely
	How is the acoustic environment?	Very good –very bad

2.4. The sound pressure level

In-situ SPL measurements were conducted as directed in Annex A of ISO 12913-2:2018 [14]. It was measured using a sound level meter connected to the SoundLab software at 101 specified spots. To describe the general acoustic environment in a given place, the SPL is set in L_{Aeq(10-min)}.



Figure 2: Students collected the SPL of Taman Lapangan Banteng, Jakarta

3. FINDINGS AND DISCUSSION

The ratings collected from the soundscape survey of each spot were analysed based on the median value of the respondents, as suggested in ISO 12913-3:2019 [16]. Furthermore, the median rating score was used to determine the pleasantness and eventfulness dimensions which were calculated based on Equations 1 and 2, respectively.

$$Pleasantness = (pleasant - annoying) + \cos 45^\circ(calm - chaotic) + \cos 45^\circ(vibrant - monotonous) \quad (1)$$

$$Eventfulness = (eventful - uneventful) + \cos 45^\circ(chaotic - calm) + \cos 45^\circ(vibrant - monotonous) \quad (2)$$

The comprehensive ratings of the sound environment in ten cities are dominated by the perception of chaos (positive eventfulness and negative pleasantness) and vibrant (positive pleasantness and positive eventfulness) (Figure 3). This finding confirms earlier studies that the noisy Indonesian cities [1] and their public places align with communal activities as the dominant activity found in these places (Figure 5). However, it is dissimilar to activity in public parks in other countries, where public places, especially parks, are mostly dominated by individual activity or peers but in a small group [17] (Figure 6). Social activities are also found in public places, such as meeting friends or colleagues, followed by chatting activities, but not as massive as in public places in Indonesia. In Japan, people visit public places such as parks and squares to exercise, get fresh air, and relax [7], which are more individual than social activities. In Indonesia, it is very common for people to engage in a large group of social gatherings while in public places such as a group aerobics, bicycle rider community, arisan, etc. Arisan is a social gathering where members contribute and take turns winning an aggregate sum of money.

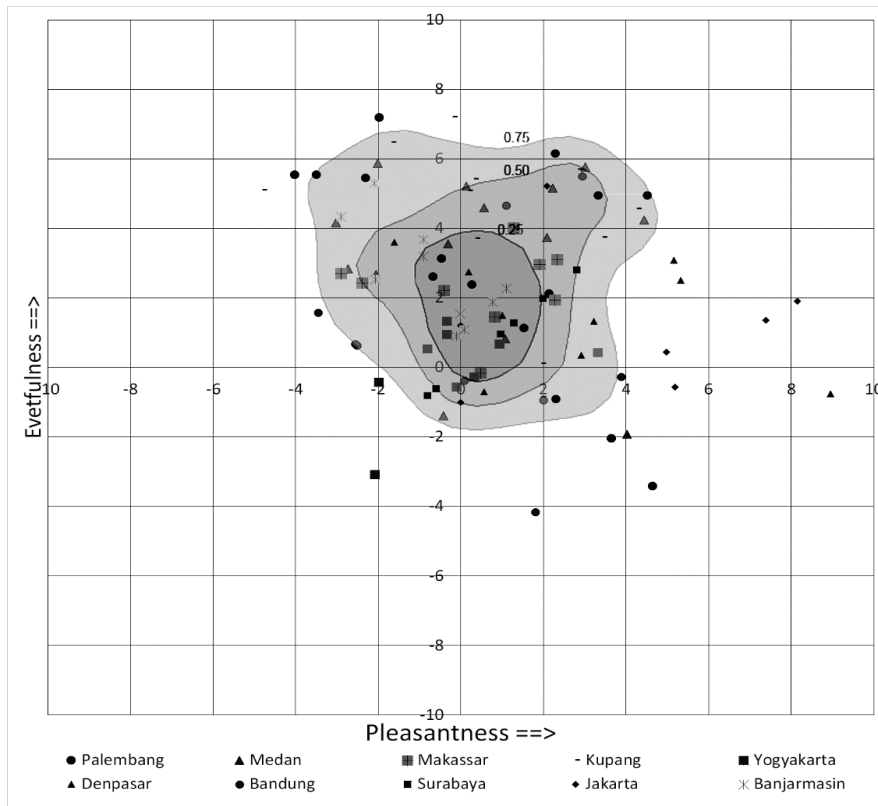


Figure 3: The soundscape data collected in 10 Indonesian cities shows that Indonesian perceived the eventful environment in public places as pleasant environment. Th

The perception of the eventful acoustic environment is to be confirmed to the SPL recorded at the 101 spots in 28 public places. The SPLs plotted against permissible noise levels of public places with a maximum of 60 dBA [18] show that only 8.91% of data is within the standard, as mentioned in Figure 3. The domination of high SPL is in line with the dominant eventful activity in public places. An earlier study revealed that noise source is primarily from human activities, traffic, construction, and industries [2,11]. The eventful and noisy as well as pleasant acoustic environment of Indonesian public places is the soundscape appreciated by Indonesians. They visit the public spaces with the intention of engaging in communal activities. Therefore, it is reasonable that they expect to meet many people and perceive a pleasant ambience within a crowded and noisy environment. When individual activities are expected to be carried out in a relaxed, simple, and private environment, communal activities are expected to be done in a less relaxed, more varied and communal environment [19]. Because the primary activity is social or communal, which mostly produces noise, it is no wonder that noise is generally not an issue in Indonesia [2]. However, the regulation in Indonesia still focuses on the noise limit, which in most cases is not relevant.

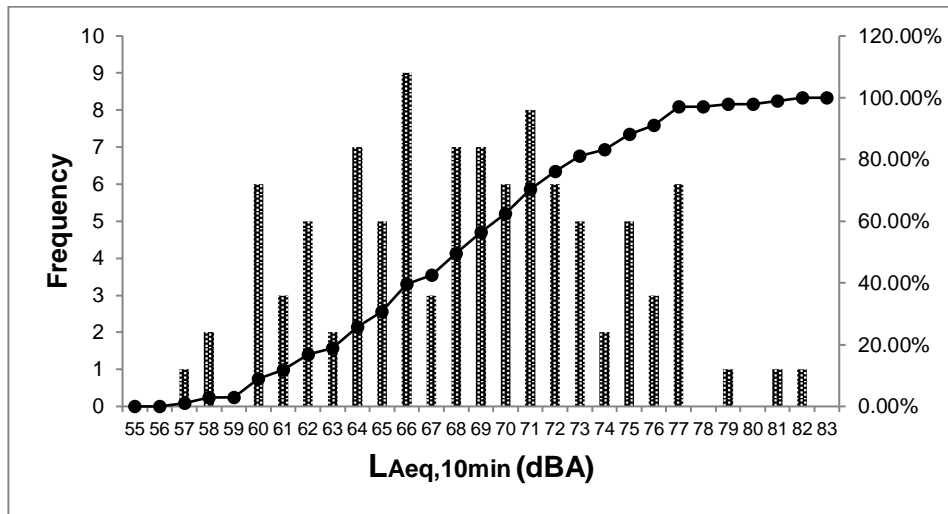


Figure 3: SPLs in $L_{Aeq}(10\text{-min})$ recorded at 101 spots of 28 public places in 10 Indonesian cities

The fact that the sound of Indonesian public places is dominated by human activity sound is consistent with Guastavino et al. [20] that the sound of human activities is ideal for urban soundscapes for social activities. Even though Jia et al. [21] showed that the dominant characteristic of a place is determined by a combination of certain sounds rather than a dominant sound, attention is to be made here since data from earlier studies showed that visitors were not only perceived sound from human activities but added with traffic, construction, and industries [2,11]. Construction and industrial sounds may not be combined with the usual sound sources emitted in public places.



Figure 5: Screenshots of public places in Indonesian cities describe the domination of communal activities. (A) Aerobics community in Alun-alun Selatan, Yogyakarta, (B) aerobics and jogging community in Taman Merdeka, Medan, (C) children playing at the playground accompanied by their parents in Taman Flora, Surabaya, and (D) youth night gathering in Lapangan I G Ngurah Made Agung, Denpasar.



Figure 6: Screenshots of public places in England and Wales, which are mostly uneventful (A) a person sits peacefully to observe and enjoy his/her surrounding, and (B) even when they play or workout, they do it in a very small group.

The Indonesian noise regulation guides how to establish comfort levels based on certain noise limits. Thus, the implementation of the regulation focus on creating a calm space, as shown in Figure 7A. However, our study of the soundscapes of public spaces in ten cities in Indonesia found that most of the spaces had noise levels exceeding Indonesian noise standards but were still perceived as positive soundscapes. Further investigation shows that most public spaces in Indonesia are considered eventful-pleasant and eventful-unpleasant.

In this regard, it is recommended to change the approach to improving the quality of public places in Indonesia by focusing more on creating a lively environment rather than a quiet environment. This approach makes more sense because various communal activities dominate the urban environment in ten cities in Indonesia. Therefore, the soundscape needs to be improved towards a more positive perception by users by shifting some of the chaotic to fully vibrant (Figure 7b).

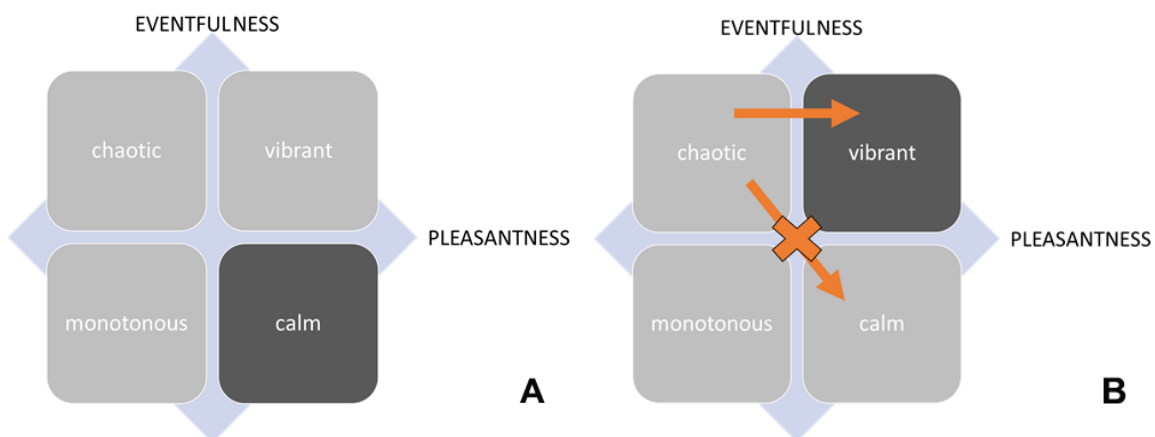


Figure 7: (a) Superimposed of the pairs of perceptual attributes, which 'calm' is the most positive approach to improve urban soundscape elsewhere, (b) due to the Indonesian urban soundscape, which chaotic and vibrant are dominant, the improvement using vibrant approach is recommended.



4. CONCLUSIONS

A series of surveys conducted at 101 points in 28 public places in ten cities in Indonesia was carried out to study visitors' perceptions of the acoustic environment of the venues. Data was collected using the soundscape method, and the SPL was also recorded. The ratings collected from the soundscape survey of each place were analysed based on the median score of the respondents, and the results showed that visitors perceive the acoustic environment as primarily chaotic and vibrant. It is supported by the SPL data, which shows that only 8.91% of the spots fall below the noise standard used in Indonesia. Interestingly, users perceive the acoustic environment in public places as generally positive, even though the noise level is above standard. The unique sound of cities in Indonesia, represented by the dominance of human activities, traffic, construction, and industrial sounds [2], is supported by this study's findings that most public spaces in Indonesia are considered eventful. This suggests that the approach to creating pleasant-eventful (vibrant) space is a better option to be implemented in Indonesia rather than creating pleasant-uneventful (calm) space.

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