A Portrait of Residential Soundscape in Several Indonesian Cities

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Abstract. The residential environment is expected to be a comfortable and safe place for the family. But often, the condition of the environment is not in line with these expectations, especially from the acoustic environment, which will affect the comfort of the occupants. The increasing comfort in residential will lead to more sustainability of the city. Thus, this paper aims to examine the existing acoustic environment in urban housing by using a soundscape approach. The soundscape is an approach to investigate the human perception of the acoustic environment in context. The research method by using a quantitative method through an online questionnaire to record the human perceptions of the sound environment in several cities in Indonesia. The result of this study is a portrait of the sound environment and the level of comfort in the city. This research can be used as input for urban designers, developers, and policymakers to improve the acoustic environment in residential areas to improve the quality of the acoustic environment.

Keywords: soundscape, residential soundscape, acoustic environment, Indonesian cities.

1. Introduction

The residential environment is expected to be a comfortable and safe place for the family. But often, the condition of the environment contradictory with these expectations, especially from the acoustic environment perspectives. The sound environment is an important factor to be considered in building sustainable and healthy urban communities and cities [1]. Those acoustic environments can be assessed through the soundscape approach.

The concept of soundscape has been applied across widely diverse disciplines since the term was first used by Southworth in an urban context in 1969 (Southworth, 1969). He raised the sonic identities which in his perspective should be considered and designed for a more visible city. The first definition of soundscape by Schafer as “an environment of sound (or sonic environment) with emphasis on the way it is perceived and understood by the individual, or by society” [2, 3]. Even though the soundscape initially discussed the field of music and the acoustic environment, but it rapidly emerges into other fields: acoustics, architecture, environmental health, psychology, sociology, and urban sciences, which needed holistic research from the field of science [4, 5]. Currently, the soundscape has been defined by the International Organization for Standardization as an "Acoustic Environment that is accepted by people or communities in a context" [6].
The soundscape research begins with identifying elements and perceptions of the sound environment, then how to improve the quality of the soundscape based on the initial description. Even though the terminology of soundscape has been around since the late 1960s, research in the field of soundscapes has only developed a lot in the last decade - less than five years in Indonesia. So, the preliminary overview of the soundscape in residential areas in Indonesia does not yet exist. Therefore, this paper aims to describe the soundscape patterns of residential areas in Indonesia.

2. Research Methodology

According to Aletta, soundscape research can be done in-situ environment, laboratory environment, and recalled in memory. The in-situ environment can be assessed by a questionnaire, which asks about the elements and the dimension of soundscape [3, 7]. Due to the pandemic SARS-COV2, the assessment was done by an online questionnaire.

Total respondents who participated were 402, with 42.8% male and 56.2% female. All respondents are over 17 years old, with the largest demographic between 25 - 60 years (cf. Figure 2). Respondents who participated came from various major cities in Indonesia but based on the minimum number of respondents, the research in this paper was limited to the cities of Jakarta, Bandung, and Samarinda – as the capital of provincial city as illustrated in Figure 3.
The questionnaire questions are divided into open questions and semantic differential scales. Open questions are used to find preferred or unpreferred sound sources. The semantic differential scale is used to measure the respondent's perception of the dimensions of the soundscape. The soundscape dimensions used are a modification of the soundscape dimensions mentioned by Aletta, the International Standardization Organization, and Sudarsono [3, 7, 8], namely: Pleasant, Calmness, Vibrant, Eventful, Softness, Relaxing, and Variant. Semantic differential scales used 1 to 5, where the greater the number indicates the strength of that dimension.

3. Result and Discussion

Based on the reliability test, 97% of the data collected were valid data, with Alpha Cronbach’s .813 for 7 items measured on semantic differential scales. Therefore, this data has strong reliability to describe the perception of the acoustic environment.

3.1. Samarinda

Samarinda is the capital of the province of East Kalimantan which is located on the island of Borneo. It is located at the mouth of the Mahakam river - one of the largest rivers on the island of Borneo - with many tributaries running through the city. The name Samarinda comes from the description of how the house was built. In those days, houses were usually built on rafts and were generally of the same height. It provides important social symbolism about equality between populations; there are no private homes of persons, and therefore no person is considered higher or lower than the others. They named the settlement 'Samarenda', which means 'equally inferior'. After hundreds of years of use, the pronunciation of the name has changed slightly, and the city is known as Samarinda.
Based on the data collected, the residential area in the city of Samarinda can be said to be a very lively city, where voices can explain what is happening in the city (cf. Figure 4). This is indicated by the eventful dimension which shows an average value of 3.85 from a scale of 5. The comfort level shows a score of 3.63 which means it is quite comfortable for the respondent. Although overall the city can be said to be quite calm with a score of 3.50, the sound is not soft enough (only 3.28 out of a scale of 5) and makes the residential areas less pleasant (3.35). The sound that is heard is not inspiring (3.34), although the level of variation in sound sources is quite varied (3.60).

**Figure 4.** Soundscape dimension in Samarinda

**Figure 5.** Sound source classification in Samarinda
From the sound source, Samarinda is dominated by motorized transport sound – the muffled sound of a car, motorcycle, and heavy vehicles, and the horn of those vehicles. The animal sound also often heard – the crowing cock, chipping of bird, cat, dog, and others. The human sound is mostly dominated by human activity, the amplified music, or the prayer. They are also a signal sound which is the prayer calling from the mosque. From the source of the sound, most of the respondents like to hear the chipping sound of birds and did not like the sound of motorized vehicles howling.

3.2. Jakarta

Jakarta is currently the capital city of Indonesia. The city is the center of government and the center of the economy for the Indonesian state. Jakarta has the highest population density in Indonesia, although most of it lives in the area around Jakarta. Jakarta is bordered by Bogor, Depok, and South Tangerang on the south side, Tangerang on the west side, and Bekasi on the east. On the north side, the city of Jakarta is bordered by the Java Sea.

Figure 6 describe the dimensions of acoustic environment in Jakarta. Jakarta is describe as a busy city (Calmness score 3.37 on a scale of 5). The sound environment was also unpleasant for the respondents (3.25 out of a scale of 5). Sounds that are heard are enough to describe the events that occur around the housing area (3.65). But the sound environment around the housing is too loud so it is not soothing, this can be seen from the softness dimension, which is only 3.07 from scale 5, and the relaxing dimension which is only 3.39. In terms of sound variation, Jakarta has quite a lot of variations in its voice. 3.35. Overall, the acoustic environment in Jakarta is quite comfortable with a score of 3.51.
From the sound source classification, it seems that the biggest contribution to the loudness level in a residential area in Jakarta comes from the motorized transport category - the muffler of the car and motorcycle, and its horn. Voices that are included in the human sound category include children's voices, neighbors speaking voices, and amplify sounds such as dangdut music, and recitation. Animal sounds are mainly dog and cat, and the sound signal is the prayer calling from the mosque (cf. Figure 7).

3.3. Bandung

Bandung is the capital city of West Java province. The city is in the middle of the mountains with an elevation between 600 - 800 m above sea level so it has quite cool weather. In the city of Bandung, many heritage buildings from the Dutch colonial remains. Some urban patterns are also colonial heritage, and some are new developments. Most of the respondents live in urban housing, while a small portion of them live in gated residential.
In Bandung as figured in Figure 8, respondents rated the acoustic environment in this city as calm (3.54 out of 5) and vibrant (3.57). Audible voices can clearly describe events in the environment (4.14). Although sometimes there is a loud sound (softness score is only 3.11) but the sound environment in Bandung is considered pleasant (3.57). The variety of sound sources heard is also varied (3.71). Based on all these dimensions, the comfort level of the acoustic environment in the city of Bandung becomes comfortable (3.64 from a scale of 5).

![Figure 9. Sound source classification in Bandung](image_url)

As in Figure 9, the sound from motorized transport - the muffled sound of car and motorcycle, and its horn - is not as big as other cities. Human sound - voices from neighbors, peddlers, and children playing cheerfully - has a big contribution, so it can be concluded that the social level in the city of Bandung is quite high, where there is a lot of interaction with residents. In the city of Bandung, you can hear many animal noises, especially the sound of chipping birds and nature sounds such as the gurgling of water and the sound of the wind breaking through the trees. Based on this sound source, it can be concluded that the natural environment in the city of Bandung is still very good. The sound signal in the form of prayer calling from the mosque enriches the acoustic environment in the city of Bandung.

4. Conclusion

Based on the research results above, the residential area in Bandung City has the highest level of comfort compared to residential areas in Jakarta and Samarinda, where based on the classification of sound sources, has the lowest sound level of motorcycled transport. This shows the opposite relationship between the sound level of motorcycled transport and the level of comfort. Further research can be carried out to find these relationships between transport sound and level of comfort.

Based on the research that has been done, the sound environment has the ability to explain the conditions of the surrounding environment. For example, the city of Bandung where there are still many birds and gurgling sounds that can describe an unspoiled environment. In addition, in the city of Bandung, there are still many human sounds that describe good social conditions. This natural acoustic environment increases comfort in the residential area.

This research that has been done opens a new perspective in designing a residential environment, where environmental elements can influence the sources of the sound that is
heard, which in turn will provide a comfort dimension to the residents in it. This research needs to be continued to obtain a more complete picture for other cities in Indonesia.

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