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Indonesian shopping malls: a soundscape appraisal by sighted and visually impaired people

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ABSTRACT

Similar to normal-sighted people, visually impaired people also like to spend leisure time in shopping malls. Regrettably, public facilities in developing countries hardly accommodate the visually impaired, who mainly use their sense of hearing. A soundwalk method was employed to collect the sonic perception of sighted and visually impaired people in shopping malls, and varimax rotated principle analysis was used to extract the data. The results reveal that soundscape dimensions of pleasantness and space are the two most prominent factors for both groups of participants. In general, the visually impaired perceived the surveyed shopping malls more favourably than the sighted, which is unexpected. They also perceive soundscape dimensions of danger and direction using the hearing sense alone, which can help improve shopping malls. In contrast, the sonic perception of the sighted is somehow mixed with visual perception.

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Introduction

Public spaces in emerging countries, including shopping malls, are hardly equipped with sufficient signage for people with visual disabilities. Shopping malls have become a new space for social interaction (Abaza, 2001). The phenomenon is found almost everywhere around the world. When many shopping malls in developed countries, e.g. in the US, are out of business due to a significant decline of visitors (Bhattarai, 2019), the opposite occurs in developing countries. Shopping malls in developing countries and countries that use shopping activities to attract tourists, such as cities in the UAE, are still increasingly flourishing and expanding (Mohamad, Al Katheeri, & Salam, 2015; Zaidan, 2016). The development of shopping malls has paralleled the globalisation of retail culture and the standardisation of urban architecture (Voyce, 2006). Malls displace public spaces (Crawford, 1992; Cybriwsky, 1999; Davis, 1992) when people begin to enjoy time walking in malls to shelter from terrible heat and massive traffic jams. Because of the shortage of public parks compared with the population, shopping malls may not be a space for shopping, but rather to socialise socialise (Abaza, 2001). Shopping centres simulate the complexity and vitality of a city centre without the noise, dirt, and confusion (Ergün Kocaili, 2010 in Fahmy, Alablani, & Abdelmaguid, 2014); thus, they are more preferred by urban communities to gather and socialise. Shopping mall customers vary with the composition of urban communities, including people with disabilities.

When consumers are inside such places, they could be anywhere in the world as all these types of situations seem to be the same regardless of being in the downtown centres, airport shopping aisles, or shopping malls (Augé, 1995; Ritzer, 2004). The uniformity of shopping mall design (Nee, 2015) can

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make it less attractive to visitors. It is also typical that visitors have difficulty finding a shop in shopping malls, especially in large malls with multiple floors and various tenants. This problem may become worse for those with a visual impairment visiting shopping malls with limited signage. Those with special needs are typically less considered by architects and developers due to the design complexity and cost. Non-empathic designs take place when architects do not involve clients with special needs during the design process. A successful empathic design requires the involvement and perspective of the clients (Mediastika, 2016).

This study aimed to investigate how visually impaired people perceive shopping malls while spending leisure time in there. A soundwalk method was employed to learn about the possibly unique soundscape dimension elicited by the hearing sense alone. The involvement of visually impaired people in this study is expected to produce conclusions that borne from the sense of hearing alone rather than mixed with the sense of sight as usually draws by sighted people. The study's final goal is to offer a design reference for shopping malls to become more empathic and visitor-friendly for those with visual impairments.

The study approach

Visually impaired people in Indonesia

Three and a half million Indonesians live with visual impairment, which is 1.5% of Indonesia's 267 million population (Pusdatin, 2010). It places Indonesia as the second-highest rate of blindness after India (UNDP, 2017). This group comprises low-vision and blind people, ranging from children to adults. Many of them have been taken care of by the Indonesian Government and private institutions to get proper education and life-skills. Nonetheless, most vision-impaired people live in remote and rural areas with minimal access to education and public facilities. The high occurrence of blindness in the remote area is dominated by cataracts and the fact that most are reluctant to undergo eye operations. The educated visually impaired people are taught to be independent; however, the limited inclusivity of public facilities is common in Indonesia, making the independence skills taught in class hard to use.

Visually impaired people primarily use their auditory and tactile senses, which causes blind people to be more sensitive to sound than normal-sighted people (González-Mora, Rodriguez-Hernandez, Rodriguez-Ramos, Díaz-Saco, & Sosa, 1999). They are also typically able to better process acoustic information (Lessard et al., 1998), enabling them to describe the surrounding environment in more details than the sighted (Mediastika et al., 2019). A high-fidelity acoustic environment is the most critical factor in guiding, navigating, and orientating them (Mediastika et al., 2020). When the surrounding environment has a high noise level of many sound sources, it is an acoustic environment with low fidelity that is made instead of high fidelity. A low-fidelity acoustic environment is when individual acoustic signals are masked in an over-dense population of sounds (Schafer, 1977). This type of acoustic environment barely supports the needs of visually impaired people. Given the lack of signage and facilities installed in public spaces, a high-fidelity acoustic environment in which visually impaired people can use one or two clear sounds to navigate them, is a necessary substitute.

In an unintentional conversation with the visually impaired people, the corresponding author comprehended that they also have the intention to live normally just like sighted people. They want to have more chances to explore the city frequently, such as visiting parks, enjoying time in shopping malls, and watching movies in cinemas. Unfortunately, they are not free to do so because their sighted relatives have limited time to accompany them and would not let them do the activities independently as they are worried about the safety of the visually impaired.

Shopping malls in Indonesia

The era of shopping malls in Indonesia started in the late 1960s. It was initiated by Sarinah department store, followed by Gadjah Mada Plaza. Both are in the capital city, Jakarta. Later, Tunjungan

Plaza was opened in Surabaya. It is now easy to spot thousands of shopping malls in Indonesia, even in small towns and suburban areas. Because there is a shortage of public places to socialise, and due to terrible heat and the less safe outdoor spaces, shopping malls have become the favourite place for Indonesians to enjoy their leisure time. Typical Indonesian shopping malls include prayer rooms (churches and mosques), medical clinics, pharmacies, cinemas, travel agents, spas, beauty salons, body slimming clinics, dentist, banks, driving licence corners, tax corners, money changers, exhibition halls (of any kind from fashion to automotive), discotheques, etc. to meet the diverse needs of various visitors. Given the lack of signage, the complexity of tenants' locations can be frustrating for customers.

Surabaya is the second-largest city in Indonesia after Jakarta. It is also the centre of business for the eastern Indonesia region; thus, trading is the primary occupation for its citizens. There are at least 25 shopping malls in Surabaya, starting from small and modest ones to large ones. They also range from shops and eating places only to a shopping centre with various kinds of tenants. The existence of shopping malls undeniably has put a substantial burden on road traffic, causing traffic jams around the area. The availability of parking spaces has also become an endless issue for Indonesian shopping malls.

Another city included in this study is Yogyakarta. It is a small city located in central Java, which is now overcrowded by more than 10 shopping malls. The first shopping mall in Yogyakarta is Malioboro Mall. Located at the most historical and the most visited place in Yogyakarta, i.e. Malioboro, it is the oldest and the most iconic mall, just as Tunjungan Plaza in Surabaya. Compared with Tunjungan Plaza, Malioboro Mall is far smaller and has less diversity among tenants; however, its location has somehow made the crowd in Malioboro Mall more congested than Tunjungan Plaza.

Soundscape

The acoustic environment, as perceived by humans in context, is called 'soundscape' (ISO, 2014). The concept of soundscape was initiated by Southworth (1969) and popularised by Schafer (1977). Research on soundscape using a soundwalk method has been conducted widely to evaluate people's sonic perception and is mostly conducted in open urban public places, such as parks (Aletta, Kang, Astolfi, & Fuda, 2016; Brambilla, Gallo, Asdrubali, & D'Alessandro, 2013; Filipan, Boes, Oldoni, De Coensel, & Botteldooren, 2014; Jeon et al., 2018; Jeon & Hong, 2015; Liu, Kang, Behm, & Luo, 2014; Mediastika et al., 2020; Payne, 2009; Tse et al., 2012), plazas (Jeon, Lee, You, & Kang, 2012; Kang & Zhang, 2010; Nilsson, Botteldooren, & De Coensel, 2007; Yang & Kang, 2005; Zhang, Ba, Kang, & Meng, 2018), pavements (Boya, Jian, & Hui, 2014; Mediastika, Sudarsono, & Kristanto, 2020) and streets (Veitch, 2017). For indoor environments and semi-public places, it was conducted in offices (Abdalrahman & Galbrun, 2017; Acun & Yilmazer, 2018; Ma & Shu, 2018), classrooms (Akbari, 2014; Anderson, 2004; Çankaya, 2016; Flagg-Williams, Rubin, & Aquino-Russell, 2011; Shin, 2014), transport hubs (Park, Song, Song, Jang, & Kim, 2004; Tardieu, Susini, Poisson, Lazareff, & McAdams, 2008; Wang, Kang, & Zhao, 2020), religious places (Ergin, 2008; Kiser & Lubman, 2008; Zhang, Zhang, Liu, & Kang, 2016), libraries (Dokmeci Yorukoglu & Kang, 2016; Xiao & Aletta, 2016) and eating places (Rohrmann, 2003; Rychtarikova & Vermeir, 2011; Zhang & Kang, 2016). However, appraisal of the sonic environment of enclosed shopping centres is still lacking. Studies on shopping malls by Meng and Kang (2013) and Hellström, Sjösten, Hultqvist, Dyrssen, and Mossenmark (2011) involved sighted people only.

People may spend only a limited amount of time outdoors with a high degree of mobility choosing a place they like but spend more time indoors, mostly with less mobility to choose a place that better suits their needs. Thus, more attention is needed for indoor soundscape because contextual differences can produce different expectations and differences in the objective acoustic environment (Torresin et al., 2020). However, soundscapes are equally valid both indoors and outdoors since people do not turn off their auditory sense (Torresin et al., 2020). The indoor environment of a shopping mall is unique in comparison to other indoor functions as people may spend a lot of time strolling around shops' aisles to choose their preferred place, in which a soundwalk can be performed.

Therefore, a soundwalk method was also selected in the study to collect the sonic perception of the participants. The assessment of spaces using a sonic method is considered appropriate in countries where visually impaired people's population is significant because they are very sensitive to sound (Nilsson & Schenkman, 2016). The soundscape analyses conducted by these people is purer without the additional visual construct compared with those perceived by sighted people because the visually impaired use their hearing sense to guide the direction (orientation), detect danger, and 'know' space (Mediastika et al., 2020). Belir and Onder (2013) also suggest using a sonic method to appraise the indoor environment of shopping malls by declaring that the most noticeable landmarks in shopping malls as perceived by the visually impaired are smell and sound.

Methodology

The study used both off-site and *in-situ* surveys. A focus group discussion method was assigned for the off-site stage to collect attributes associated with shopping malls as perceived by the participants. The attributes were then constructed in a closed-ended questionnaire for the *in-situ* survey.

The participants

Seventy-six people participated in the study: 38 visually impaired and 38 sighted people. The visually impaired people were two groups of students from two institutions: The Foundation of Education for Blind Children (YPAB) of Surabaya and Yaketunis of Yogyakarta. The sighted participants were undergraduate students of Petra Christian University (PCU). The project plan of partnering with YPAB was presented to a panel of the Independent Research Ethics Committee of the Ministry of Research and Technology and Higher Education of the Republic of Indonesia. Approval was granted by the Body of National Unity, Politics, and Community Protection (Bakesbangpol), a body under the Surabaya City Government, with licence number 070/6619/436.85/2017, dated 19 July 2017. Official approval letters to include publishing images taken during the project were also received from the Headmaster of YPAB dated 1 August 2017 and the Chairman of Yaketunis dated 1 April 2019.

The visually impaired are 17 females and 21 males between 16 and early 20 years of age. The sighted are 16 females and 22 males between 19 and 21 years of age. The visually impaired students' age is within a similar range to that of the PCU student's age as the visually impaired students have special needs. The selection of the participants' age was based on the likely age when one spends leisure time in shopping malls. Based on the World Health Organization categorisation, this age group is considered adolescents or early adults. At this point, the age difference was considered to be within an acceptable range because the survey would only collect their instant appraisal of the visited shopping malls, which does not require advanced knowledge or experience. This survey's age range is considered to be as identical groups of participants and has elicited identical results in similar studies (Ma, Wong, & Mak, 2018; Mediastika et al., 2020). The participants resided in Surabaya or Yogyakarta for quite some time, either as locals or students; thus, they are all considered locals. The demographic factors are deemed to have less influence on the data as the participants' age range, occupation, and residency period are identical.

There were about 40 students in YPAB and 45 in Yaketunis with several types of degrees of blindness. However, most did not have proper orientation and mobility to walk on their own in public places. The selected participants were all equipped with adequate orientation and mobility, and all were in total blindness conditions. According to the two headmasters, students with total blindness and those born-blind are more confident than those with low vision and those who are blind later. Further studies are required to validate these opinions.

The shopping malls

Two shopping malls in Surabaya, Tunjungan Plaza, and Grand City Mall were selected for the study, considering that 850,000 visually impaired people live in Jawa Timur (Pusdatin, 2010), a province of which Surabaya is the capital. Tunjungan Plaza was chosen as it represents Surabaya's oldest and most iconic mall. Grand City Mall was chosen because it promotes the mall as 'disabled-friendly'. The third mall was Malioboro Mall in Yogyakarta. This city was chosen for the survey because it has a significant population of approximately 2,000 visually impaired people (Bappeda Propinsi Daerah Istimewa Yogyakarta 2019). Both Tunjungan Plaza and Malioboro Mall are located precisely in the centre of Surabaya and Yogyakarta, respectively. Tunjungan Plaza, which was opened in 1986, is now the second-largest shopping mall in Surabaya, with a retail area of 160,000 m2 and more than 500 tenants (Figure 1a). Grand City Mall is a medium-sized mall with an area of 45,000 m2, including an exhibition hall opened in 2009 (Figure 1b). Malioboro Mall was selected as it represents the oldest and most iconic mall in Yogyakarta. It has significantly smaller retail areas compared with the two shopping malls in Surabaya. Opened in 1993, Malioboro Mall has approximately 22,000 m2 of retail area (Figure 1c). Each selected shopping mall was grouped into four routes for the survey. Therefore, with 76 participants of sighted and visually impaired people, 304 data were collected.

Building the questionnaire

The *in-situ* survey questionnaire was designed by incorporating the attributes about shopping malls as perceived by the two participant groups. The attributes were collected through focus group discussions (FGD) with three visually impaired students, and three sighted students, selected from 76

Figure 1. Snapshots of the main atrium of the surveyed shopping malls (a) Tunjungan Plaza (www.tunjunganplaza.com) (b) Grand City (www.yukpigi.com) (c) Malioboro Mall.

participants, which were conducted separately. The FGD of sighted students was conducted earlier together with a meeting to discuss the accompanying method that would be applied during the soundwalk. The three sighted students were the coordinators of the sighted participants. Three persons in the discussion are not an ideal size for an FGD. The ideal group size is between four to eight people (Kitzinger, 1995). However, due to the limited opportunity for visually impaired people to visit shopping malls on their own, only three YPAB students visit shopping malls frequently with their relatives, and none of them in Yaketunis has done so. To share narrations about shopping malls and their ability to communicate and maintain involvement in the discussion, the FGD only picked frequent visitors to shopping malls as participants. For sighted people, the participants were easily chosen because many are frequent visitors to shopping malls. Three were selected to balance the size of the visually impaired.

The discussion was conducted to collect the participants' perceptions about shopping malls that they frequently visit, including their good and bad experiences while visiting shopping malls. The questions in the FGD were (1) what a shopping mall is? (2) what clues make a place categorised as a shopping mall? (3) how often do they visit shopping malls? (4) with whom do they visit shopping malls? (5) what activities are carried out in shopping malls? (6) what do they like and dislike about shopping malls? (7) their opinion about shopping malls. Questions (3) and (4) were used to validate previous information about frequent visitors. The narrations collected from 6 participants were then extracted into keywords or attributes from each group of participants. The attributes could not be merged because each group has different terminologies about shopping malls. The attributes were constructed into two sets of questionnaires, one for each group of participants (Table 1). Based on this difference, it was impossible to compare the two groups' perceptions using identical attributes (Mediastika et al., 2020). When the attributes used in the questionnaire were forced to be uniform for both groups of participants, some attributes were found to be irrelevant through a communality test procedure (Mediastika, Sudarsono, & Kristanto, 2020). Communality is a statistical definition of common variance that ranges between 0 and 1. It is a procedure to partitioning the variance in a factor analysis performed using SPSS. The procedure of using extracted attributes belongs to a method of direct elicitation, namely, individual vocabulary techniques, introduced by Bech and Zacharov (2007). The method uses the vocabulary developed by the particular subject and a set of principal components representing the common attributes identified using statistical procedures. A perceptual measurement of sound quality is a multidimensional problem that includes some individual auditory attributes. Therefore, it is possible to elicit and use individual attributes emerging from a mixture of interviews and personal experiences.

Table 1. The list of close-ended questions for the two groups of participants. The bipolar scale did not appear in the questionnaire. It was only used during the data analysis. Each question to select the perceived attribute began with 'what do you feel about the surrounding?'.

	Semantic attributes listed in the closed ended questionnaire with the scale					
	For sighted participants			For visually impaired participants		
1	(−1) complete	(0) neutral	(1) incomplete	(−1) happy	(0) neutral	(1) unhappy
2	(−1) good	(0) neutral	(1) bad	(−1) good	(0) neutral	(1) bad
3	(−1) crowded	(0) neutral	(1) empty	(−1) spacious	(0) neutral	(1) narrow
4	(−1) clear	(0) neutral	(1) unclear signage	(−1) cool	(0) neutral	(1) warm
5	(−1) neat	(0) neutral	(1) messy	(−1) noisy	(0) neutral	(1) calm
6	(−1) luxurious	(0) neutral	(1) modest	(−1)large	(0) neutral	(1) small
7	(−1) tight	(0) neutral	(1) loose	(−1)luxurious	(0) neutral	(1) modest
8	(−1) cool	(0) neutral	(1) warm	(−1) modern	(0) neutral	(1) ancient
9	(−1) comfortable	(0) neutral	(1) uncomfortable	(−1) know	(0) neutral	(1) don't know the position
10	(−1) like	(0) neutral	(1) dislike	(−1) mute	(0) neutral	(1) loud
11				(−1) safe	(0) neutral	(1) dangerous
12				(−1) clamorous	(0) neutral	(1) quiet
13				(−1) comfortable	(0) neutral	(1) uncomfortable
14				(−1) like	(0) neutral	(1) dislike

Both sets of questionnaires were constructed in two sections. Section one comprises closed-ended questions on a straightforward bipolar semantic scale of −1 0 1. Scale −1 is given for the attributes emerging by the FGD, 0 for the neutral response and 1 for the attributes' antonym. All semantic attributes extracted from the FGD were given scale −1, which does not correlate whether it is a positive or negative perception. An attribute might be perceived differently by different people. For example, the 'crowded' attribute could be positive for someone but negative for someone else. When using this type of scaling, we may see that the scale appears random. It was also intended to let the participants answer the question based on the semantic instead of the scale. For visually impaired participants, questions were read by the accompanying persons. Thus the scales assigned only represented which attributes should be read before the other. Meanwhile, for sighted participants, it represented the position in the questionnaire form. There was no scale appeared in the questionnaire (Table 1).

The use of three-point scales is confirmed to be good enough (Jacoby & Matell, 1971) and validated by Mediastika et al. (2020). Instead of the typical five or seven points by Likert, the three-point scale was used to simplify the questionnaire reading by the sighted interviewer that was helping the visually impaired participant to complete. Using the standard scale would lengthen the question's reading by the interviewer, extend the time an interviewee would have to grasp the issue, and lengthen the time to choose an accurate answer. The questionnaire was concluded with an open-ended question for the participants to suggest improvements needed by the surveyed malls. Through the FGD, 10 and 14 attributes were elicited by the sighted and the visually impaired, respectively, which were each validated statistically (Table 1). Here, we see that sighted participants' attributes are somehow affected by other senses, i.e. visual (tidiness) and thermal (temperature). Again, because there are two sets of questionnaires, we should be aware that it would not be possible to compare the two groups' perceptions with identical attributes precisely. Both groups have different opinions of the surrounding sound from the first stage of data collection.

Factor analysis was chosen to process the semantic data. Principal component analysis (PCA) with a change of coordinates known as varimax rotation (Field, 2000) was run to extract the orthogonal factor underlying the 10 and 14 attributes of the sighted and visually impaired, respectfully. Here, a polychoric correlation was used instead of Pearson's correlation given that the ordinal data comprised three-scale bipolar data, which tends to have strong skewness or kurtosis (Gilley & Uhlig, 1993; Muthén & Kaplan, 1985 in Basto & Pereira, 2012). The soundscape dimensions are selected based on the PCA eigenvalues (eigenvalue > 1). By PCA, the assigned variables or attributes that consistently show high scores, which indicate strong correlations among them, were grouped into factors or dimensions. The groups were labelled relative to the word that could explain or represent the factor in general based on the attributes that appeared in the group. The concept of common vocabulary was introduced by Kang and Zhang (2010) and Axelsson et al. (2010), and was also used in previous soundscape projects with visually impaired people (Mediastika et al., 2020; Mediastika, Sudarsono, & Kristanto, 2020).

The soundwalk

The participants' sonic perception was collected using a soundwalk method, i.e. a walk on an area or route focused on listening to the acoustic environment (ISO, 2018). In this case, the designated routes were in each shopping mall. The routes were designed to cover various segments and tenants within malls over a reasonable time to allow the participants to have a relaxing walk without being too exhausted, which may cause bias in their questionnaire responses. Each shopping mall was segmented into four routes and typically started from the main entrance or the main lobby to the most remote tenants through all available floors. Excluded from the survey in Tunjungan Plaza was the newly extended area, namely, Tunjungan Plaza 6, as it was deemed too far to survey within a reasonable time.

Figure 2. Snapshots of the soundwalk surveys in (a) Malioboro Mall along the exhibition area, (b) Tunjungan Plaza, while passing up the escalator (permissions are given by YPAB and Yaketunis to publish the photos).

In Tunjungan Plaza, 12 visually impaired and 12 sighted participants completed the survey. In Grand City, another 12 visually impaired and 12 sighted participants involved. Meanwhile, in Malioboro Mall, there were 14 visually impaired and 14 sighted participants. Thus in total, there were 38 visually impaired participants and 38 sighted participants. The visually impaired participants were grouped based on their familiarity with the shopping mall. The familiarity with the surveyed place is crucial for visually impaired people because they need initial experiences to give valid responses to a questionnaire (James & Armstrong, 1975). However, this is not the case for sighted participants who mainly use the sense of sight to familiarise and appraise their surroundings in no time.

The soundwalks were conducted on three Saturdays, either around lunch or dinner times, to represent the shopping malls' typical crowd. Three hundred and four data were collected from 76 participants and four routes in each mall. The minimum sample size for PCA is suggested 40 (Shaukat, Rao, & Khan, 2016). However, specifically for evaluating the soundscape in urban areas, a sample size of about 100–150 is suggested (Kang & Zhang, 2010). The data were analysed in two batches, 152 each for sighted and visually impaired participants. It is possible to incorporate data collected from 3 different malls, because PCA using a linear combination of a set of variables, as long as the change is consistent. Kang and Zhang (2010) combined two different places in one batch using PCA.

During the first stage, a visually impaired participant was accompanied by a sighted person to carry the survey. The accompanying person is a sighted participant who had completed a soundwalk. The soundwalk was done in groups of four participants, each with a 5-minute pause to avoid a collision (Figure 2). The routes in each shopping mall are shown in Figure 3. The types of tenants and sound sources along the routes are listed in Table 2, which describes each route in detail. The questionnaire was completed immediately after each route was completed. One set of questionnaire was asked at the end of a route and repeated on the next route. Communication between the interviewer and the interviewee was kept to a minimum in order to allow the interviewee to experience the surroundings.

During the soundwalk, the Sound Pressure Level (SPL) at the 12 designated spots (four in each shopping mall) was recorded using calibrated NTi-SL2 with M2211 microphone Class 1 frequency response by IEC 61672 and ANSI S1.4. To describe the general noise levels within the designated spot, the SPL was measured in LAeq (10 min) and LAFmax and LAFmin. The relationship between the semantic attributes obtained during the FGD and the measured SPL was identified using correlation, based on P- values of 0.05 and 0.01. With this method, we may learn whether the changes in noise level is in line with changes in perception.

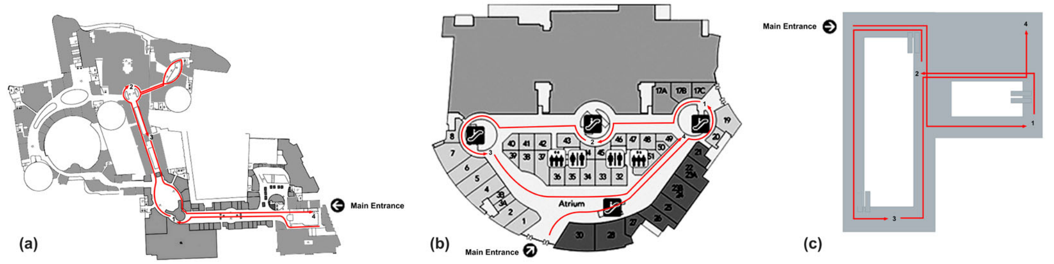

Figure 3. The soundwalk route in (a) Tunjungan Plaza, where the extended section of the mall was excluded, (b) Grand City Mall, (c) Malioboro Mall (a simplified-sketch of the mall layout). The route in each mall was designed to pass all areas of the shopping malls except for Tunjungan Plaza. The figures do not show the real routes that were factually passed all floors. In these figures, all floors of each shopping mall are merged into one layout to show that participants reached the most remote area.

Results and discussion

The sound pressure levels

Table 2 shows that the noise levels were overall the highest in the smallest mall in the survey (Malioboro Mall). It is reasonable because within a smaller enclosure, the crowd is tighter, and the music played is readily reflected by the narrow aisle between tenants. In the large mall (Tunjungan Plaza), there are routes of soundwalk past quiet corners. These corners were less visited, resulting in a more peaceful acoustic environment. The average noise levels at the three surveyed malls are around 70 dBA, which is above the acceptable background maximum of 45 dBA for a relaxed conversation (Berglund, Lindvall, & Schwela, 1999). In some routes, the noise levels are above the standard of commercial buildings of 70 dBA (Kementerian Negara Lingkungan Hidup, 1996). In the current background and ambient noise, a more vocal effort is required for comprehensible conversation. The measured noise levels are to be discussed later concerning the participants' sonic perception.

Table 2. The acoustic environment and sound pressure levels of the surveyed shopping malls.

	Segments	The primary sound sources	Tenants	LA_{eq} (dBA)	LAF_{max} (dBA)	LAF_{min} (dBA)
1	Tunjungan Plaza 1	Music and conversation	Bakery, homeware, fashion, small exhibition plaza	71.2	84.1	62.1
2	Tunjungan Plaza 2	Music and conversation	Fashion	66.7	79.1	61.4
3	Tunjungan Plaza 3	Music and conversation	Fashion, café, homeware	68.0	77.1	60.3
4	Tunjungan Plaza 4	Music, cooking, conversation	Fashion, café, cinema, food court	70.8	82.6	64.1
5	Grand City 1	Music and conversation	Fashion	68.9	78.2	62.8
6	Grand City 2	Music and conversation	Fashion	70.4	88.8	64.3
7	Grand City 3	Music and conversation	Fashion, homeware, indoor amusement park	70.8	82.6	64.1
8	Grand City 4	Music, cooking, conversation	Fashion, food court	75.9	85.8	67.3
9	Malioboro 1	Music and conversation	Fashion, restaurant, small exhibition plaza	70.1	90.5	63.9
10	Malioboro 2	Music and conversation	Fashion, beauty accessories	71.6	84.8	61.6
11	Malioboro 3	Music and conversation	Fashion, restaurant, indoor amusement park	74.7	85.7	62.8
12	Malioboro 4	Music, cooking, conversation	Fashion, food court	74.6	85.6	61.5

The soundscape dimensions

There are three soundscape dimensions extracted from the data of sighted participants, which are labelled 'pleasantness', 'space' and 'facilities' (Table 3). The dominant soundscape dimension of factor 1 is related to the perception of pleasantness, which includes 'good', 'neat', 'modest', 'warm', 'comfortable' and 'like'. This dimension explains 35% of the variance. Factor 2 is associated with perception of space, which includes 'crowded', 'messy', and 'tight'. This dimension explains 27% of the variance. Factor 3 is associated with perception of the facility, which includes 'complete' and 'clear signage'. This dimension explains 17% of the variance. Here, the attributes that explain each dimension elicited by sighted participants indicate that other senses affect the soundscape dimensions instead of the hearing sense alone, such as 'neat', 'modest', and 'messy'. It is understandable because both visual and aural elements build people's perceptual construct (Aletta et al., 2016).

Soundscape dimensions that affect sighted participant's perception while visiting shopping malls are in line with studies about customer satisfaction. Wong, Ng, Wong, and Wong (2012) grouped mall attributes that affect customer satisfaction as 'convenience', 'quality of retailers', 'quality of customer services', 'environment', and 'reward'. Meanwhile, similar to Wong et al. (2012), Ahmad (2012) added aesthetic, accessibility, and entertainment into the category. The dimension of pleasantness extracted in this study describes the participant's perception about the mall's convenience and environment at the same time, which includes sub-categories such as good floor plans, temperature control and cleanliness (Ahmad, 2012; Wong et al., 2012). The dimension of space relates to convenience, aesthetics, and the mall's environment, including sub-categories such as spaciousness and tidiness (Wong et al., 2012). The facility's dimension represents convenience, quality of retailers, and customer services at the same time, which includes sub-categories such as tenant varieties, product qualities and accurate information (Ahmad, 2012; Wong et al., 2012).

Five soundscape dimensions are extracted from visually impaired participants, namely 'pleasantness', 'space', 'eventfulness', 'danger', and 'direction' (Table 4). The dominant soundscape dimension of factor 1 is related to the perception of pleasantness. This dimension explains 31% of the variance, which includes 'happy', 'good', 'luxurious', 'modern', 'comfortable', and 'like'. Factor 2 is related to the perception of space. This dimension explains 15% of the variance, which includes 'spacious' and 'large'. Factor 3 is associated with the perception of eventfulness. This dimension explains 13% of the variance, which includes 'noisy', 'loud', and 'clamorous'. For common people, attributes that develop eventfulness of visually impaired seem to be more related to sound. It is understandable because visually impaired people appraise their surroundings using the sense of hearing. A place is perceived as full of people and activities when they hear a mix of a lot of kinds of loud sounds and vice versa (Mediastika et al., 2020). Factor 4 is associated with the perception of danger. This dimension explains 10% of the variance, which includes 'dangerous'. Factor 5 is related to the perception of direction. This dimension explains 8% of the variance, which includes 'know the position'. The attribute 'know the position' means that participants can detect their position in the mall,

Table 3. Factor analysis of the soundscape survey by sighted participants (Kaiser-Meyer-Olkin test = 0.819, cumulative = 79%, *N* = 152).

		Factors		
	Attributes	35% (1: Pleasantness)	27% (2: Space)	17% (3: Facilities)
1	Complete – incomplete	0.077	0.096	0.911
2	Good – bad	0.825	−0.140	0.238
3	Crowded – empty	−0.139	0943	0.056
4	Clear signage – unclear	0.058	−0.456	0711
5	Neat – messy	0.502	−0.639	0.290
6	Luxurious – modest	−0.926	0.188	0.217
7	Tight – loose	−0.366	0832	−0107
8	Cool – warm	−0.614	0.348	−0.018
9	Comfortable – uncomfortable	0.691	−0422	0.251
10	Like – dislike	0.827	−0.260	0.281

Table 4. Factor analysis of the soundscape survey by visually impaired participants (Kaiser-Meyer-Olkin test = 0.722, cumulative = 78%, $N = 152$).

	Attributes	Factors				
		31% (1: Pleasantness)	15% (2: Space)	13% (3: Eventfulness)	10% (4: Danger)	8% (5: Direction)
1	Happy – unhappy	0.903	0.124	0.118	−0.004	0.061
2	Good – bad	0.892	−0.033	0.098	0.074	0.048
3	Spacious – narrow	0.066	0.924	0.014	−0.035	0.012
4	Cool – warm	0.209	0.425	−0.240	0.410	−0.388
5	Noisy – calm	0.192	0.210	0.756	0.099	0.235
6	Large – small	0.327	0.855	0.138	−0.021	0.037
7	Luxurious – modest	0.821	0.207	0.020	−0.147	−0.046
8	Modern – ancient	0.800	0.089	0.079	0.270	−0.173
9	Know the position – don't	0.029	0.048	−0.040	0.163	0.864
10	Mute – loud	0.093	0.032	−0.745	0.160	0.181
11	Safe – dangerous	−0.139	−0.017	0.132	0.825	0.223
12	Clamorous – quiet	0.188	0.017	0.764	0.220	−0.078
13	Comfortable – uncomfortable	0.744	0.357	−0.031	−0.470	0.019
14	Like – dislike	0.773	0.281	0.006	−0.394	0.041

whether they are near or far from a particular point. They use clues around them, especially sound, to detect their position.

Many studies about facilities for people with disabilities in shopping malls have been conducted, but they did not focus on the participant's appraisal and satisfaction levels. Not many studies could be found about the satisfaction level of visually impaired people while visiting shopping malls. A study revealed that these people prefer to shop in small shops nearby than shopping malls because it is handy (Eskytė, 2014). Pattarakitham (2015) showed that convenience has the most significant influence on satisfaction. It explains why pleasantness is the first dimension for both the sighted and visually impaired. Factor 1 is labelled as the dimension of pleasantness because three identical attributes related to pleasantness were found in both groups of participants after the PCA. They are attributes of values (good/bad), comfort (comfortable/uncomfortable) and fondness (like/dislike) (Tables 3 and 4). The labelling based on similar attributes is also used by Axelsson et al. (2010). Meanwhile, Kang and Zhang (2010) prefer to use the term 'relaxation' to represent similar attributes. The fourth identical attribute that builds factor1 of the two groups is luxurious. As for the sighted, the first four attributes of factor 1 are added with attributes of tidiness (neat/messy) and temperature (cool/warm). Whereas for the visually impaired, they are added with attributes of happiness (happy/unhappy) and modernity (modern/ancient).

The same concept applies to factor 2, which is named the dimension of space because the attributes appear in factor 2 relate to space. Accordingly, Kang and Zhang (2010) use the term 'spatiality' to represent attributes that relate to space. The second dimension of space perceived by the two groups could also be regarded as an aspect of convenience in visiting shopping malls. The attributes collected by the FGD indicated that it is not possible to compare the sonic perception of the two groups side by side. Even when the PCA clusters the identical attributes of the two groups into the first and second dimensions, which are also labelled identically; still, these two dimensions cannot be fully compared.

Some studies testified that visually impaired people need additional tools, specific gadgets, or interactive tactile maps to do a shopping activity in shopping malls (James & Armstrong, 1975; Sowmya, Tharun, Yeshwanth, & Srinivas, 2020; Weixiu, 2008). This explains why it is not easy to find sources about how visually impaired people appraise shopping malls on their own without assistive tools. The finding of this study indicates that dimensions of pleasantness, space, eventfulness, danger, and direction are essential for the visually impaired, which can be a reference for those studying the development of assistive tools.

The five dimensions of the visually impaired instead of three of the sighted strengthen the findings of previous studies of the same series (Mediastika et al., 2019; Mediastika et al., 2020; Mediastika, Sudarsono, & Kristanto, 2020), where visually impaired participants perceive a more extensive range of soundscape dimensions compared with sighted participants. Again, they include the dimensions of danger and direction, which are uniquely borne by them. The two most dominant factors identified by both participant groups while enjoying shopping malls are pleasantness and space. When the soundscape dimension of facilities is the third important for the sighted, it is more about dimensions of eventfulness, danger, and direction for the visually impaired. By the last two soundscape dimensions, the visually impaired perceive the shopping mall as a safe place because they can know their position while inside the mall. A further outcome of the last open-ended question reveals that the visually impaired participants know their position in the malls based on differences in smell, crowd, and types of music played at each segment, which become landmarks for them (Belir & Onder, 2013).

The relation of soundscape dimensions of pleasantness and space and the verbal response

Through factor analysis, the study shows that the soundscape dimension of pleasantness is the most prominent dimension for both sighted and visually impaired participants based on their perception of preference of the shopping malls. Besides, for both groups, the level of luxury also affects pleasantness (Tables 3 and 4). By the FGD, the two groups mentioned 'luxurious' is a clue for a place to be categorised as a shopping mall, which is proven through the PCA that it is a significant attribute to build the first factor of all participants' perception. However, by the in-situ survey, the sighted participants perceived the malls were not as luxurious as their prior visualisation, which is indicated by a negatively correlated value of the PCA. This perception is supported by the semantic analysis in which the sighted disagrees to the semantic 'luxurious' (Figure 5). Both the PCA and semantic analysis show that sighted participants perceived the surveyed malls 'modest' (as opposed to luxurious), which seems to correlate with the attribute of tidiness. The PCA displays that the sighted perceived the surveyed malls 'messy'. On the contrary, the visually impaired perceived the malls 'luxurious' (Figure 6). Whether it is perceived 'luxurious' or 'modest', the aspect of luxury affects the perception of factor 1, i.e. the dimension of pleasantness.

In the FGD, the visually impaired associated 'luxurious' to large buildings with the availability of many kinds of goods and places for leisure, which are the opposite to small convenience stores they are familiar with (Eskytė, 2014). Meanwhile, the sighted associated 'luxurious' to the quality and authenticity of branded goods being sold, usually represented by the mall's environment or design. These further explain how the aspect of luxury was perceived differently by the two groups through the PCA. A study about a high-end mall in Surabaya by Kaihatu and Spence (2016) indicated that in a mall, which develops its image as a luxurious mall, the relationship between 'shopping' and 'loyalty' was significant. The 'shopping' factors include the quality and product assortment being sold and the overall ambience.

Indoor air, represented by the 'cool-warm' attribute, is another dimension recorded by the sighted, but this did not apply for the visually impaired. The sighted perceived that the mall's indoor temperature affects the dimension of pleasantness. According to them, the malls were warm (the 'cool' attribute has a correlation value above 0.614 but in a negatively correlated, which means the opposite). It seems that visually impaired people have more tolerance toward warm temperatures than sighted people. A study of the same series also showed a broader tolerance of visually impaired people toward the warm indoor temperatures while watching films (Mediastika & Sudarsono, 2020). Further studies are required to validate this indication.

By the data collected from the open-ended question, the two groups' sonic perceptions can be investigated deeper. The open-ended question allowed participants to provide as many answers as they sense to suit their perceptions. Therefore, more than 152 data points (38 participants multiplied

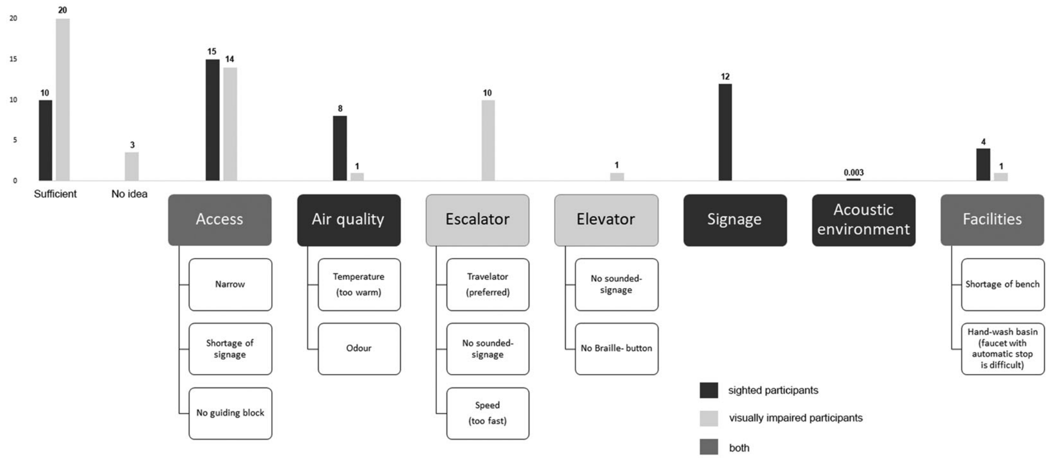

Figure 4. The taxonomy of shopping malls' features suggested for improvement with the responses' ratio from 339 semantic data collected from 76 participants. There is no sub category elicited from 'signage' and 'acoustic environment', which they describe simply as the shortage of signage and too loud music.

by 4 soundwalk routes) were collected: 168 responses from the sighted and 171 from the visually impaired participants. Sixty-seven terminologies (20%) were conveyed by the visually impaired that the shopping malls are sufficiently designed (Figure 4). Meanwhile, only 34 (10%) terminologies were collected from the sighted regarding the sufficiency. When responses to the open-ended question are linked to the closed-ended questions' responses, the consistency of the visually impaired perception becomes evident. Through PCA, the visually impaired perceive that the attribute of spaciousness affects the soundscape dimension of space (Table 4), which is supported by their agreement that the malls are spacious and large (Figure 5).

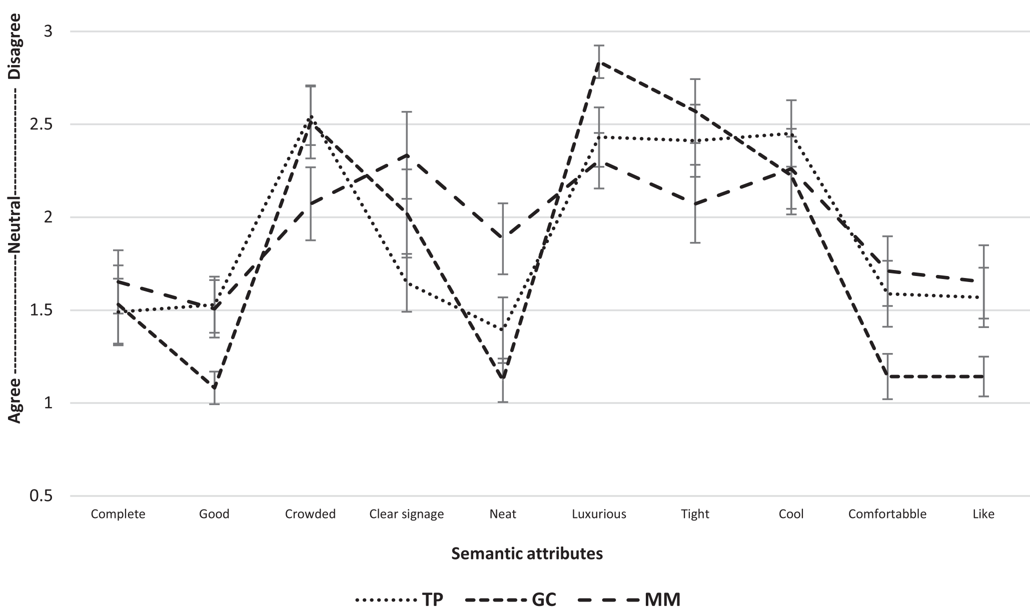

Figure 5. The sighted participants' verbal response of the close-ended bipolar questionnaire of each shopping mall: Tunjungan Plaza (TP), Grand City (GC), and Malioboro Mall (MM).

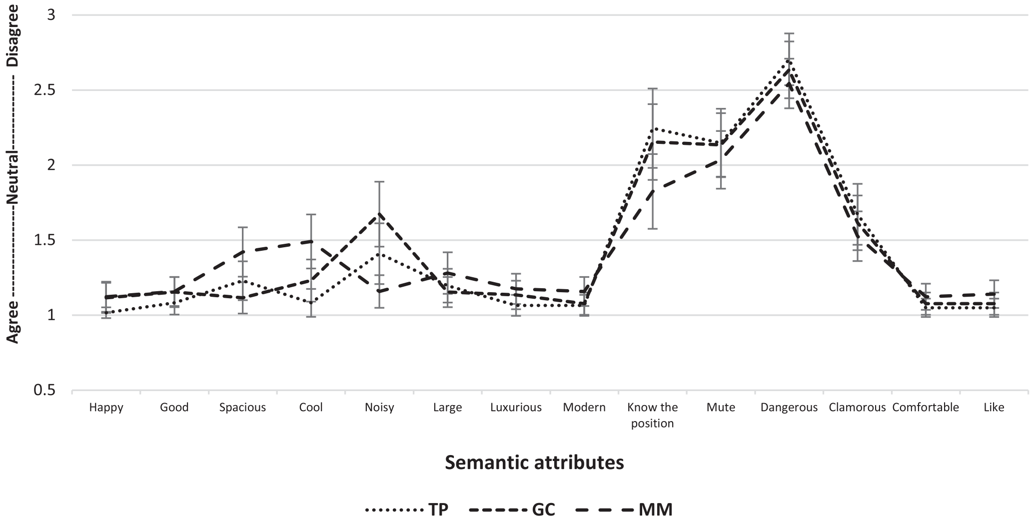

Figure 6. The visually impaired participants' verbal response of the close-ended bipolar questionnaire of each shopping mall: Tunjungan Plaza (TP), Grand City (GC), and Malioboro Mall (MM).

Meanwhile, sighted participants' responses seem less consistent in perceiving the malls. They use attributes of crowd, tidiness and tightness to describe the soundscape dimension of space (Table 3); however, these attributes are neither agreed nor disagreed (neutral responses are given; Figure 4). Figure 4 emphasises that, in general, the visually impaired perceive the surveyed shopping malls more favourably than the sighted. It is apparent by more agreement of favourable attributes given by the visually impaired (Figure 6). Meanwhile, less agreement of favourable attributes is found from the sighted (Figure 5). The visually impaired agree to the attributes of 'happy', 'good', 'spacious', 'cool', 'large', 'luxurious', 'modern', 'comfortable', and 'like'. The sighted agree to lesser attributes, with most of them regarded as neutral/average. They even disagree with the attribute of 'luxurious'. The visually impaired perceive the three surveyed malls as almost identical (Figure 6), whereas the sighted reactions are more dynamic (Figure 5).

The final open-ended question collected responses regarding improvements to shopping malls shows that access is the primary element. Both groups of participants perceive the current access is too narrow and lacks signage and guiding blocks (Figure 4). This suggests that guiding blocks, which are commonly installed outdoors, are also necessary indoors. It is interesting to find that sighted participants suggest more signage be installed in shopping malls. When sighted people notice on the shortage of signage, it is noticed even more by visually impaired people who suggest more specific signage to meet their needs, such as sounded-signage for escalators and elevators.

Temperature and facilities are also quite significant factors for the sighted. They noticed the shopping malls were too warm and had an unpleasant smell at particular routes, which are suggested to be improved, whereas temperature is not an issue for the visually impaired. However, they commented on the facilities. They feel it challenging to use an automatic faucet on the washbasin and perceive it as a non-user-friendly feature. There was no attribute of facilities elicited by the visually impaired during the FGD; therefore, no semantic bipolar data about facilities have emerged in the in situ surveys. The converse is true for sighted participants who expressed the attribute of facilities, i.e. complete or incomplete, during the FGD (Table 3). The response about automatic faucets was an impromptu occurrence but should be deemed as a crucial input for shopping mall designers and developers.

Through the FGD, the visually impaired elicited attributes of noisy and muteness concerning how they perceive shopping malls. This is validated by the numerical data extracted using PCA, which shows that the two attributes affect soundscape dimension of eventfulness (Table 4). Visually impaired people use their surrounding sounds to detect their surrounding activities. The noisier the acoustic environment, the more activities with lots of people are detected (Mediastika et al., 2020). Even though a 'noisy' attribute was elicited during the FGD, no suggestion about improving acoustic environment was found from the visually impaired; but, one sighted participant stated that the music was too loud (Figure 4). The only response about sound by a sighted participant is understandable because 3 sighted participants of the FGD did not elicit sound attributes.

However, the 'no response' to sound by the visually impaired is considered a unique phenomenon. Indeed, the verbal data show that they deem the malls noisy (demonstrated by the PCA score 0.726 (Table 4) and the score 1 'agree with noisy', and the score 2 'neutral of muteness' (Figure 6)), which bond a strong correlation with the average high noise levels (Table 2). Even so, it did not trigger them to suggest a sound environment improvement. In short, the noisy, but in high fidelity, acoustic environment of shopping malls is acceptable to the visually impaired, which is proven by 'know the position' (Table 4).

The relation between semantic attributes and SPL

The relation between semantic data and SPL was deepened because visually impaired participants perceived the shopping malls noisy, which was supported by the objective data. Even so, they were not disturbed by the acoustic environment. It contrasts with the findings of two studies in shopping malls, in which high SPL reduces the satisfactory level of acoustic comfort (Chen & Kang, 2004) and causes headache of mall's workers (Alnuman & Altaweel, 2020). In Chen and Kang's study, the local context (i.e. people from a developed country) influences respondent's preference of SPL to be lower when compared to the preference of respondents in this study (i.e. people from a developing country). Meanwhile, in Alnuman and Altaweel's study, the purpose of visits by workers and visitors' to malls is different.

Correlation analysis shows that although SPL in a shopping mall correlates with several semantic attributes, participants' perceptions of the acoustic environment were more influenced by crowds at the malls compared to SPL. For sighted participants, different SPL parameters (Leq, Lmax, and Lmin) provide identical acoustic perception (Table 5). This explains that sighted people are not very sensitive to the dynamics of their acoustic environment and that the sense of sight generally influences their perception. They perceived the surrounding sound concerning the crowd. The more crowded the shopping mall, the higher SPL is perceived. Changes in the crowd, as perceived visually, affect other perceptions.

Table 5. Correlation between the semantic attributes of sighted participants and SPL ($N = 152$). Only semantic attributes that show significant correlation are listed.

Attributes		Leq	Lmax	Lmin
Good	Correlation Coefficient	0.268	0.166	0.153
	Sig. (2-tailed)	0.000	0.014	0.024
Crowded	Correlation Coefficient	−0.173	−0.160	−0.269
	Sig. (2-tailed)	0.008	0.014	0.000
Neat	Correlation Coefficient	0.259	0.230	0.355
	Sig. (2-tailed)	0.000	0.000	0.000
Modest	Correlation Coefficient	−0.341	−0.249	−0.249
	Sig. (2-tailed)	0.000	0.000	0.000
Tight	Correlation Coefficient	−0.194	−0.177	−0.276
	Sig. (2-tailed)	0.003	0.007	0.000
Warm	Correlation Coefficient	−0.245	−0.185	−0.232
	Sig. (2-tailed)	0.000	0.004	0.000
Comfortable	Correlation Coefficient	0.266	0.213	0.302
	Sig. (2-tailed)	0.000	0.001	0.000
Like	Correlation Coefficient	0.194	0.156	0.177
	Sig. (2-tailed)	0.004	0.019	0.008

Table 6. Correlation between the semantic attributes of visually impaired participants and SPL ($N = 152$). Only semantic attributes that show significant correlation are listed.

Attributes		Leq	Lmax	Lmin
Spacious	Correlation Coefficient	0.010	−0.003	−0.201
	Sig. (2-tailed)	0.879	0.966	0.002
Cool	Correlation Coefficient	0.227	0.163	0.068
	Sig. (2-tailed)	0.000	0.012	0.292
Noisy	Correlation Coefficient	−0.340	−0.183	−0.049
	Sig. (2-tailed)	0.000	0.004	0.447
Know the position	Correlation Coefficient	−0.145	−0.122	0.007
	Sig. (2-tailed)	0.023	0.055	0.914
Loud	Correlation Coefficient	0.091	0.048	0.123
	Sig. (2-tailed)	0.146	0.441	0.049
Quiet	Correlation Coefficient	−0.163	−0.119	−0.135
	Sig. (2-tailed)	0.010	0.060	0.034
Recognise the smell	Correlation Coefficient	−0.239	−0.123	−0.050
	Sig. (2-tailed)	0.000	0.053	0.429

The visually impaired also perceived the acoustic environment concerning the crowd just as the sighted but in more details. Leq correlates to the noise of human activities. When they hear the sound of human activities combined with the music being played, they perceived the environment is noisy. The strongest correlation exists between Leq and 'noisy' (Table 6). There is an interesting finding that the food court area in a shopping mall was easily identified by the crowd and smell. 'Recognise the smell' is a semantic attribute elicited through the FGD but was excluded from the PCA because it did not pass the communality test. Table 6 shows that visually impaired participants were able to recognise different acoustic parameters, which affect different perceptions of the surrounding environment. However, this was not the case of sighted participants, where different acoustic parameters influenced similar perceptions, which might indicate the dominance of the visual senses.

Conclusion

The study invited sighted and visually impaired participants to experience the atmosphere of three urban shopping malls in Indonesia using their sense of hearing. A series of soundwalk surveys was conducted to collect the sonic perception of the participants. The survey concluded the following:

(a) The most prominent soundscape dimensions perceived by both sighted and visually impaired participants are pleasantness and space. For the sighted, the dimension of pleasantness is affected by the factors of values (good/bad), comfort (comfortable/uncomfortable), fondness (like/dislike), luxury (luxurious/modest), tidiness (neat/messy), and temperature (cool/warm). For the visually impaired, it is affected by the factors of values, comfort, fondness, luxury, happiness (happy/unhappy), and modernity (modern/ancient). The size of shopping malls influences the soundscape dimension of space. Yet, to the sighted, it is added by the factor of tidiness. It suggests that for sighted people, the visual sense influences their sonic perception.

(b) Visually impaired people perceive the acoustic environment of shopping malls in five soundscape dimensions: pleasantness, space, eventfulness, danger and direction. The sighted perceive it in three dimensions: pleasantness, space and facilities. In line with the previous study (Mediastika et al., 2019; Mediastika et al., 2020; Mediastika, Sudarsono, & Kristanto, 2020, here we see again that visually impaired people use the sense of sound to perceive more details in the surrounding environment than sighted people.

(c) Attributes or indices about shopping mall environments elicited by sighted participants during the FGD show that other senses influence their sonic perception, i.e. visual and thermal senses.

(d) Visually impaired people perceive shopping malls better than sighted people, which is supported by their perception that the shopping malls have been sufficiently designed to meet their needs. Meanwhile, the sighted perceive the surveyed shopping malls less favourably.
(e) The most noticeable features to be considered while improving shopping malls is that related to signage. The sighted people observed the lack of general signage. Meanwhile, the absence of sounded-signage, particularly at escalators and elevators, was observed by the visually impaired.
(f) Regarding the acoustic environment, noisy shopping malls, which in this case were generally caused by quite a loud background music and human voices, were not deemed as a nuisance by visually impaired people. It reflects that they enjoyed the acoustic environment in shopping malls and that the music and human voices helped them to recognise the place and to feel the atmosphere.

Finally, the study's findings imply that visually impaired people can walk around and enjoy shopping malls in the current state. However, the data show that both sighted and visually impaired people also perceive a potential improvement in the detailed design of the malls that refers to conclusion (e). Nonetheless, the conclusions drawn in this study may not be instantly transferrable to shopping malls in other regions with different customer characteristics and social backgrounds.

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References

Abaza, M. (2001). Shopping malls, consumer culture and the reshaping of public space in Egypt. *Theory, Culture & Society*, *18*(5), 97–122.
Abdalrahman, Z., & Galbrun, L.. (2017). Soundscape assessment of a water feature used in an open-plan office. Proceedings of PLEA, 1245–1252.
Acun, V., & Yilmazer, S. (2018). A grounded theory approach to investigate the perceived soundscape of open-plan offices. *Applied Acoustics*, *131*, 28–37.
Ahmad, A. E. M. K. (2012). Attractiveness factors Influencing Shoppers¡ satisfaction, loyalty, and word of Mouth: An Empirical Investigation of Saudi Arabia shopping malls. *International Journal of Business Administration*, *3*(6), 101–112.
Akbari, E. (2014). *Soundscape compositions for art classrooms* (Doctoral dissertation, Concordia University).
Aletta, F., Kang, J., Astolfi, A., & Fuda, S. (2016). Differences in soundscape appreciation of walking sounds from different footpath materials in urban parks. *Sustainable Cities and Society*, *27*, 367–376. doi:10.1016/j.scs.2016.03.002
Alnuman, N., & Altaweel, M. Z. (2020). Investigation of the Acoustical environment in A shopping mall and Its Correlation to the acoustic comfort of the workers. *Applied Sciences*, *10*(3), 1170.

Anderson, K. (2004). The problem of classroom acoustics: The typical classroom soundscape is a barrier to learning. *Seminars in Hearing*, *25*(02), 117–129. Copyright© 2004 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA.
Augé, A. (1995). *Non-places*. London: Verso.
Axelsson, Östen, Nilsson, Mats E, & Berglund, Birgitta. (2010). A principal components model of soundscape perception. *The Journal of the Acoustical Society of America*, *128*(5), 2836–2846. http://dx.doi.org/10.1121/1.3493436
Bappeda Propinsi Daerah Istimewa Yogyakarta. (2019). Retrieved from http://bappeda.jogjaprov.go.id/dataku/data_dasar/cetak/105-penyandang-masalah-kesejahteraan-sosial-dan-sarana-kesejahteraan-sosial
Basto, M., & Pereira, J. M. (2012). An SPSS R-menu for ordinal factor analysis. *Journal of Statistical Software*, *46*(4), 1–29.
Bech, S., & Zacharov, N. (2007). *Perceptual audio evaluation-theory, method and application*. West Sussex: John Wiley & Sons.
Belir, O., & Onder, D. E. (2013). Accessibility in public spaces: Spatial legibility for visually impaired people. In *Ninth International Space Syntax Symposium*, Seoul.
Berglund, B., Lindvall, T., & Schwela, D. H., & World Health Organization. (1999). *Guidelines for community noise*.
Bhattarai, A. (2019). Malls are dying. The thriving ones are spending millions to reinvent themselves. *The Washington Post*, November 22. Retrieved from https://www.washingtonpost.com/business/2019/11/22/malls-are-dying-only-these-ones-have-figured-out-secrets-success-internet-age/
Boya, Y., Jian, K., & Hui, M. (2014). Effect of design factors on soundscape perception in urban pedestrian street. *New Architecture*, *5*: 3-12.
Brambilla, G., Gallo, V., Asdrubali, F., & D'Alessandro, F. (2013). The perceived quality of soundscape in three urban parks in Rome. *The Journal of the Acoustical Society of America*, *134*(1), 832–839.
Çankaya, S.. (2016). The effect of soundscape on the students' perception in the high school environment. In INTER-NOISE and NOISE-CON Congress and Conference Proceedings (Vol. 253, No. 8, pp. 139–146). Institute of Noise Control Engineering.
Chen, B., & Kang, J. (2004). Acoustic comfort in shopping mall atrium spaces—a case study in Sheffield Meadowhall. *Architectural Science Review*, *47*(2), 107–114.
Crawford, M.. (1992). The world in a shopping mall. In *The City Cultures Reader* (pp. 125–140). Routledge.
Cybriwsky, R. (1999). Changing patterns of urban public space: Observations and assessments from the Tokyo and New York metropolitan areas. *Cities*, *16*(4), 223–231.
Davis, M. (1992). *City of Quartz*. New York: Vintage.
Dokmeci Yorukoglu, P. N., & Kang, J. (2016). Analysing sound environment and Architectural characteristics of libraries through indoor soundscape Framework. *Archives of Acoustics*, *41*(2), 203–212.
Ergin, N. (2008). The soundscape of sixteenth-century Istanbul mosques: Architecture and Qur'an recital. *Journal of the Society of Architectural Historians*, *67*(2), 204–221. Retrieved from Retrieved from https://www.jstor.org/stable/10.1525/jsah.2008.67.2.204
Ergün Kocaili, B. (2010). Evolution of shopping malls: Recent trends and the question of regeneration (Doctoral dissertation).
Eskytė, I. (2014). The 'blind area' of the city: Drawing shopping boundaries for people with vision impairments. In *Conference proceedings: Universal Design 2014: Three Days of Creativity and Diversity*.
Fahmy, S. A., Alablani, B. A., & Abdelmaguid, T. F. (2014). Shopping center design using a facility layout assignment approach. In *9th International Conference on Informatics and Systems* (pp. ORDS-1). IEEE. doi:10.1109/INFOS.2014.7036689.
Field, A. P. (2000). *Discovering statistics using SPSS for windows*. London: SAGE.
Filipan, K., Boes, M., Oldoni, D., De Coensel, B., & Botteldooren, D. (2014). "Soundscape quality indicators for city parks, the Antwerp case study." *Proceedings of Forum Acusticum* 2014. Presented at the Forum Acusticum 2014.
Flagg-Williams, J. B., Rubin, R. L., & Aquino-Russell, C. E. (2011). Classroom soundscape. *Educational and Child Psychology*, *28*(1), 89.
Gilley, W. F., & Uhlig, G. E. (1993). Factor analysis and ordinal data. *Education*, *114*(2), 258–264.
González-Mora, J. L., Rodriguez-Hernandez, A., Rodriguez-Ramos, L. F., Díaz-Saco, L., & Sosa, N.. (1999). Development of a new space perception system for blind people, based on the creation of a virtual acoustic space. In International work-conference on artificial neural networks (pp. 321–330). Berlin, Heidelberg: Springer.
Hellström, B., Sjösten, P., Hultqvist, A., Dyrssen, C., & Mossenmark, S. (2011). Modelling the shopping soundscape. *Journal of Sonic Studies*, *1*(1). http://journal.sonicstudies.org/vol01/nr01/a04
ISO 12913-1: 2014. (2014). Acoustics–soundscape–part 1: Definition and conceptual framework.
ISO 12913-2: 2018. (2018). Acoustics–soundscape–part 2: Data collection and reporting requirements.
Jacoby, J., & Matell, M. S. (1971). Three-point Likert scales are good enough. *Journal of Marketing Research*, *8*(4), 495–500.
James, G. A., & Armstrong, J. D. (1975). An evaluation of a shopping centre map for the visually handicapped. *Journal of Occupational Psychology*, *48*(2), 125–128. doi:10.1111/j.2044-8325.1975.tb00306.x
Jeon, J. Y., & Hong, J. Y. (2015). Classification of urban park soundscapes through perceptions of the acoustical environments. *Landscape and Urban Planning*, *141*, 100–111. doi:10.1016/j.landurbplan.2015.05.005

Jeon, J. Y., Hong, J. Y., Lavandier, C., Lafon, J., Axelsson, Ö, & Hurtig, M. (2018). A cross-national comparison in assessment of urban park soundscapes in France, Korea, and Sweden through laboratory experiments. *Applied Acoustics*, *133*, 107–117.

Jeon, J. Y., Lee, P. J., You, J., & Kang, J. (2012). Acoustical characteristics of water sounds for soundscape enhancement in urban open spaces. *The Journal of the Acoustical Society of America*, *131*(3), 2101–2109. doi:10.1121/1.3681938

Kaihatu, T. S., & Spence, M. T. (2016). The relationship between shopping mall image and congruity on customer behaviour: Evidence from Indonesia. *Australasian Marketing Journal*, *24*(2), 141–145.

Kang, J., & Zhang, M. (2010). Semantic differential analysis of the soundscape in urban open public spaces. *Building and Environment*, *45*(1), 150–157.

Kementerian Negara Lingkungan Hidup. (1996). *Tentang: Baku Kebisingan. Surat Keputusan Menteri Lingkungan Hidup*. Nomor: Kep-48/MENLH/1996/25 November 1996. Jakarta: Kementerian Negara Lingkungan Hidup (State Minister for the Environment).

Kiser, B. H., & Lubman, D. (2008). The soundscape of church bells-sound community or culture clash. *Journal of the Acoustical Society of America*, *123*(5), 3807.

Kitzinger, J. (1995). Qualitative research: Introducing focus groups. *BMJ*, *311*(7000), 299–302.

Lessard, N, Paré, M., Lepore, F, & Lassonde, M.. (1998). Early-blind human subjects localize sound sources better than sighted subjects. *Nature*, *395*(*6699*), 278–280. http://dx.doi.org/10.1038/26228

Liu, J., Kang, J., Behm, H., & Luo, T. (2014). Effects of landscape on soundscape perception: Soundwalks in city parks. *Landscape and Urban Planning*, *123*, 30–40.

Ma, H., & Shu, S. (2018). An experimental study: The restorative effect of soundscape elements in a simulated open-plan office. *Acta Acustica United with Acustica*, *104*(1), 106–115.

Ma, K. W., Wong, H. M., & Mak, C. M. (2018). A systematic review of human perceptual dimensions of sound: Meta-analysis of semantic differential method applications to indoor and outdoor sounds. *Building and Environment*, *133*, 123–150.

Mediastika, C. E. (2016). Understanding empathic architecture. *Journal of Architecture and Urbanism*, *40*(1), 1–1. DOI: 10.3846/20297955.2016.1165385

Mediastika, C. E., & Sudarsono, A. S. (2020). Sound matters while enjoying movies; a soundscape study of visually impaired people. In *INTER-NOISE Conference Proceedings* (Vol. 260). The Korean Society for Noise and Vibration Engineering.

Mediastika, C. E., Sudarsono, A. S., & Kristanto, L. (2020). The sound perceptions of urban pavements by sighted and visually impaired people – A case study in Surabaya, Indonesia. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*. https://doi.org/10.1080/17549175.2020.1834436 .

Mediastika, C. E., Sudarsono, A. S., Kristanto, L., Tanuwidjaja, G., Sunaryo, R. G., & Damayanti, R. (2019). Recalling the sonic perception of visually impaired people of Surabaya's urban parks. *MATEC Web of Conferences*, *280*, 02007. EDP Sciences. doi:10.1051/matecconf/201928002007

Mediastika, C. E., Sudarsono, A. S., Kristanto, L., Tanuwidjaja, G., Sunaryo, R. G., & Damayanti, R. (2020). Appraising the sonic environment of urban parks using the soundscape dimension of visually impaired people. *International Journal of Urban Sciences*, 24(2), 216–241. https://doi.org/10.1080/12265934.2020.1713863

Meng, Q., & Kang, J. (2013). Influence of social and behavioural characteristics of users on their evaluation of subjective loudness and acoustic comfort in shopping malls. *PloS one*, *8*(1): e54497

Mohamad, M. Y., Al Katheeri, F., & Salam, A. (2015). A GIS application for location selection and customers' preferences for shopping malls in al Ain City; UAE. *American Journal of Geographic Information System*, *4*(2), 76–86.

Muthén, B. O., & Kaplan, D. (1985). A comparison of some methodologies for the factor analysis of Non-normal Likert variables. *British Journal of Mathematical and Statistical Psychology*, *38*, 171–189.

Nee, L. Y. (2015). Shopping malls here are 'too many, too similar'. *Today online Singapore*, 17 March, 2015.

Nilsson, M., Botteldooren, D., & De Coensel, B. (2007). Acoustic indicators of soundscape quality and noise annoyance in outdoor urban areas. In *Proceedings of the 19th International Congress on Acoustics*.

Nilsson, M. E., & Schenkman, B. N. (2016). Blind people are more sensitive than sighted people to binaural sound-location cues, particularly inter-aural level differences. *Hearing Research*, *332*, 223–232.

Park, H. K., Song, H., Song, M. J., Jang, G. S., & Kim, S. W. (2004). Soundscape in bus station. *18th International Conference on Acoustics*, *1*, 433–436.

Pattarakitham, A. (2015). The influence of customer interaction, variety, and convenience on customer satisfaction and revisit intention: A study of shopping mall in Bangkok. *Journal of Economics, Business and Management*, *3*(11), 1072–1075.

Payne, S. R. (2009). *Soundscapes within urban parks: Their restorative value*. Manchester: The University of Manchester (United Kingdom).

Pusdatin. (2010). Retrieved from http://pusdatin.kemkes.go.id

Ritzer, G. (2004). *The globalisation of nothing*. Thousand Oaks, CA: Pine Forge Press.

Rohrmann, B.. (2003). Soundscapes in restaurants. In World forum acoustic ecology: Proceedings of the international symposium of acoustic ecology (pp. 01–09). Melbourne.

Rychtarikova, M., & Vermeir, G. (2011). Soundscape in Restaurants. *DAGA Düsseldorf*, (1): 271–272.

Schafer, R. M. (1977). *The soundscape: Our sonic environment and the tuning of the world*. Rochester: Inner Traditions International.

Shaukat, S. S., Rao, T. A., & Khan, M. A. (2016). Impact of sample size on principal component analysis ordination of an environmental data set: Effects on eigenstructure. *Ekológia (Bratislava)*, *35*(2), 173–190.

Shin, S. B. (2014). Acoustic measurements based on a soundscape analysis in an open-plan classroom in a primary school. *The Journal of the Acoustical Society of America*, *135*(4), 2148–2148.

Southworth, M. (1969). The sonic environment of cities. *Environment and Behavior*, *1*(1), 49–70.

Sowmya, K., Tharun, G., Yeshwanth, C., & Srinivas, N. (2020). Development of blind assistive device in shopping malls. *International Journal of Research in Engineering, Science and Management*, *3*(5), 698–700.

Tardieu, J., Susini, P., Poisson, F., Lazareff, P., & McAdams, S. (2008). Perceptual study of soundscapes in train stations. *Applied Acoustics*, *69*(12), 1224–1239.

Torresin, S., Aletta, F., Babich, F., Bourdeau, E., Harvie-Clark, J., Kang, J., … Albatici, R. (2020). Acoustics for supportive and healthy buildings: Emerging themes on indoor soundscape research. *Sustainability*, *12*(15), 6054.

Tse, M. S., Chau, C. K., Choy, Y. S., Tsui, W. K., Chan, C. N., & Tang, S. K. (2012). Perception of urban park soundscape. *The Journal of the Acoustical Society of America*, *131*(4), 2762–2771. doi:10.1121/1.3693644

UNDP. (2017). Retrieved from https://www.id.undp.org/content/indonesia/en/home/presscenter/articles/2017/08/31/_leave-no-one-behind–undp-aims-to-champion-the-rights-of-visual.html

Veitch, J.. (2017). Soundscape of the street: Architectural acoustics in Ostia. In *Senses of the Empire* (pp. 54–70). Routledge.

Voyce, M. (2006). Shopping malls in Australia: The end of public space and the rise of 'consumerist citizenship'? *Journal of Sociology*, *42*(3), 269–286.

Wang, B., Kang, J., & Zhao, W. (2020). Noise acceptance of acoustic sequences for indoor soundscape in transport hubs. *The Journal of the Acoustical Society of America*, *147*(1), 206–217.

Weixiu, L. (2008). *A study and design of composition element in tactile directional map for public area*. Degree Thesis of Department of Industrial Design, Datong University.

Wong, C. B., Ng, H. C., Wong, K. K. L., & Wong, M. H. (2012). The relationship between shopping mall attributes, customer satisfaction and positive word-of-mouth: China visitors in Hong Kong. *Global Journal of Management and Business Research*, *12*(3). https://www.journalofbusiness.org/index.php/GJMBR/article/view/654

Xiao, J., & Aletta, F. (2016). A soundscape approach to exploring design strategies for acoustic comfort in modern public libraries: A case study of the Library of Birmingham. *Noise Mapping*, *3*(1), 264–273.

Yang, W., & Kang, J. (2005). Soundscape and sound preferences in urban squares: A case study in Sheffield. *Journal of Urban Design*, *10*(1), 61–80. doi:10.1080/13574800500062395

Zaidan, E. A. (2016). Tourism shopping and new urban entertainment: A case study of Dubai. *Journal of Vacation Marketing*, *22*(1), 29–41.

Zhang, X., Ba, M., Kang, J., & Meng, Q. (2018). Effect of soundscape dimensions on acoustic comfort in urban open public spaces. *Applied Acoustics*, *133*, 73–81.

Zhang, S., & Kang, J. (2016). The influence of crowd density on evaluation of soundscape in typical Chinese restaurant. *INTER-NOISE and NOISE-CON Congress and Conference Proceedings*, *253*(8), 155–160. Institute of Noise Control Engineering.

Zhang, D., Zhang, M., Liu, D., & Kang, J. (2016). Soundscape evaluation in Han Chinese Buddhist temples. *Applied Acoustics*, *111*, 188–197.