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ID 1386 | AN INDOOR SOUNDSCAPE SURVEY ON THE USER’S COPING METHODS FOR NOISE ANNOYANCE, DISTURBANCE AND LOSS OF CONCENTRATION IN PUBLIC STUDY AREAS

Volkan Acun[1]; Semiha Yilmazer[1]
[1]Bilkent University
volkan.acun@bilkent.edu.tr

1 INTRODUCTION

During last decades, group study areas has started to be a common feature, especially in libraries. Unlike a traditional library, where the students are delivered library services, these spaces are encourage students to take command of their own (Bennett, 2007). These spaces are also popular especially among undergraduate students as they incorporate academic work and social activities by providing informal grounds (Applegate, 2009; Bryant, et. al., 2009). The flexibility of usage allowed open learning spaces to be used for both collaborative and individual study. In contrast with the strict silent zones of traditional library study areas, these informal study areas are prone to possible issues regarding the sound environment.

In silent study areas, sound levels can become a source of frustration (Çankaya & Yilmazer, 2016; Harrop & Turpin, 2013), but in the informal public study areas, the students can get to adapt the sound levels even though it possible gets much higher than silent zones (Bryant et al., 2009). It was also expressed by the students that sound levels expressed a positive contribution to the social identity of space in open learning areas (Harrop & Turpin, 2013). This positive contribution to the place identity is not solely caused by the sound levels but by the expectation which is highly related with the context of sound environment. With this regard, the acoustic environment of the public study areas should not be evaluated solely based on the sound levels, but also with the individuals’ perception of the soundscape.

According to the ISO, soundscape is defined as the "the acoustic environment perceived or experienced and/or understood by a person or people, in context" (ISO, 2014). Soundscape approach has become popular during the last decade. Numerous case studies showed that it is not always the sound levels that matter, but also individuals' interpretation and the content of sound (Acun & Yilmazer, 2015; Acun, et. al., 2016; Bora & Yilmazer, 2015; Brown, Kang, & Gjestland, 2011; Davies et al., 2013; Mackrill, Cain, & Jennings, 2013).

Public study areas are mostly found within the libraries but it does not mean that they are limited to the library building. Especially in last couple of years, public study areas are created in various locations in Bilkent University Campus. One of the aims of this research is to explore the acoustical environment of four distinct public study areas, compare students' satisfaction with the sound environment, perceived loudness and overall satisfaction for each area. The second objective is to identify the sound sources and their contribution to the sound environment and satisfaction. Finally, to identify the coping methods employed by the students when the sound environment causes disturbance or dissatisfactory.

2 METHODOLOGY

The research was conducted at four public study areas located within the Bilkent University Campus. These study areas were located within the 77th dormitory, the library, the Faculty of Science (SA building), and the Faculty of Fine Arts Design and Architecture (FC building) (Figure 1). Each of these locations has slight differences. The FC building housed a Starbucks right next to the study area. The study area of SA building was located in the atrium of the building and had a small fountain. Setting chosen within the library was the common study area, which was crowded most of the time. In contrast to this, the dormitory study area was more of a desolate space.

In-situ measurement of sound levels (LAeq) were held in each study area to provide a brief information about sound levels of these spaces. Bruel & Kjaer Sound Level Meter type 2230 was used to measure the LAeq. Sound level meter is placed at central locations of all areas, at the height of 125 cm, and measured over 15 minute time intervals. Number of measurement locations differed for each space, based on the shape and floor area. All measurements are conducted simultaneously with the questionnaire survey.

Questionnaire survey was conducted with 30 student from each study area, with a total of 120 students. The age of the sample group ranged from 18 and 26, 45% being male and 55% female. All the participants are chosen among those who were studying and those that were performing unrelated activities were avoided. It took participants average of 5 minutes to complete the questionnaire.

In order to conduct a perceptual of the public study areas' soundscape, a questionnaire was prepared. The questionnaire used a 5 point Likert scale and started with demographic information, the frequency and length of visit. For the second part, participants were responded to statements such as " I am satisfied with this study area", " This sound environment is not loud" and "Sound environment of this study area does not disturb my concentration" (1-Strongly Disagree, 5-Strongly Agree). These are followed up by questions regarding the indoor environmental quality of the area (natural lighting, ventilation, etc.) with emphasis on the satisfaction with the acoustic environment (1-Very dissatisfied, 5-Strongly satisfied). This part also included questions concerned with the methods employed by the students to cope with an unsatisfactory sound environment. For the last part, participants were asked to rank the given sound sources based on how frequently they hear them (1= Very rarely, 5= Constantly) and based on disturbance (1= Very disturbing, 5 = Not disturbing at all).

Figure 1: Locations of the case study setting shown on the Bilkent University Central Campus.

3 RESULTS

3.1 THE SOUND ENVIRONMENT

Statistical analyses were conducted using IBM SPSS Statistics 21. The Cronbach's α obtained for the questionnaire is 0,706. According to the descriptive statistics 57,5% of the participants are satisfied or very satisfied with their study environment while 24,2% is neutral and only 18,3% are unsatisfied or very unsatisfied. However, total of 28,3% of the participants expressed that they are dissatisfied and 10% expressed that they are very dissatisfied with the sound environment (Figure 1). Also, 47,5% of the participants disagreed with the statement of "This study area is not noisy"(Figure 2).

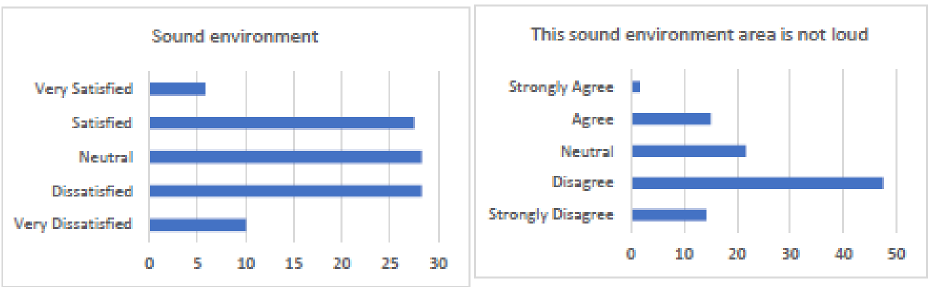

Figure 2: On the left, participants' satisfaction with the sound environment. On the right, participants response to the statement of "This sound environment is not loud".

In-situ measurements showed that mean Equivalent Continuous A Weighted Sound Levels (LAeq) for all the study areas are; 55.7 dB(A) for SA building, 57.2 dB(A) for FC building, 62.2 dB(A) for library, and 47.2 dB(A) for 77th dormitory. ANOVA F-Test is used to compare whether there is any difference between the study areas in terms of perceived loudness and satisfaction with the sound environment. In terms of perceived loudness, no statistically significance is found between the study areas ($F(3,116) = 2.681$, $p > 0.05$). Similarly, no statistical difference has been found among the study areas in terms of the satisfaction with the soundscape ($F(3,116) = 2.412$, $p > 0.05$). It was interesting to see no difference between these study areas, in terms of satisfaction and perceived loudness, even though there was almost 14 dB(A) difference between the quietest (77th dormitory) and the loudest (library) study area.

Overall satisfaction with the study areas were also compared by ANOVA F-Test. However, Levene's test for equality of variances was found to be violated for this variable ($F(3,116) = 2.818$, $P = 0.042$). Therefore, analysis continued by using Kruskal-Wallis H-Test, as it is the nonparametric equivelent of one way ANOVA F-Test. Kruskal-Wallis test indicates that there is a statistically significant difference between the study areas in terms of overall satisfaction ($\chi 2(3) = 8.133$, $p = 0.043$). Tamhane's T2 post hoc test suggest significant differences in overall satisfaction were obtained between library and 77th dormitory ($p = 0.023$).

3.2 ASSESMENT OF THE SOUND SOURCES

Sound sources found within each study area were identified through open ended questions during the pilot study. Based on this, nine types of sound sources are identified. These sound sources were, intelligible speech, unintelligible speech, laughing, footsteps, ventilation, water sound, music, computer sound (keyboard, mouse, fan), and environmental sounds (door, chair, etc.).

As part of the interview, participants were asked to rank frequency of perception for each sound source, from "1 – Very rarely" to "5 – Constantly". The most frequently heard sound source in the study areas are all human generated sounds (Figure 2). Unintelligible speech is the most frequently heard sound, with 32% of the participants stating that they heard it constantly. It is followed very closely by intelligible speech (30%) and laughing sound (29.2%). Water sound (74.2%) and ventilation (63.3%) sound are the least heard sounds, with vast majority of the participants saying that they heard them very rarely. However, the water sound coming from the fountain is exclusive to the SA building. Therefore, ventilation is the least heard sound in reality.

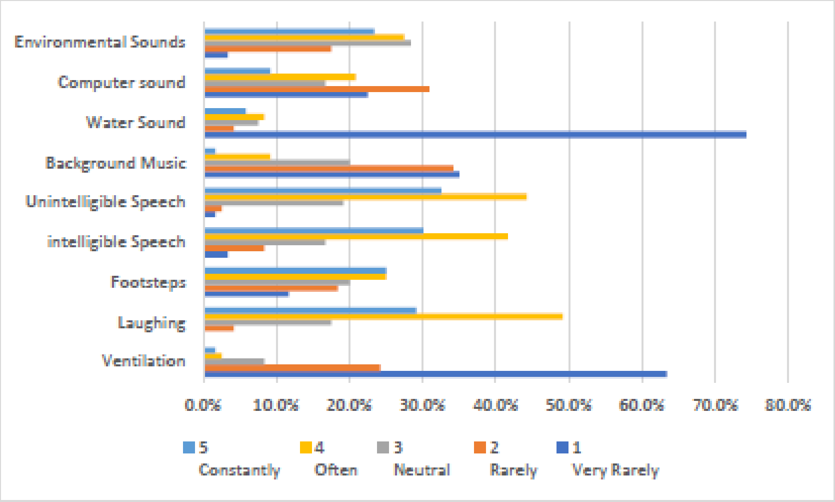

Figure 3: Frequency of perception of the sound sources for all four study areas

When the participants were asked to evaluate the sound sources based on disturbance, intelligible speech is most disturbing sound (Figure 3). One fifth of the participant found intelligible speech very disturbing and 43,3% said that it is disturbing. Laughing sound is also very close to intelligible speech, with 15.8% of the participants stating that it is very disturbing and 45.8% disturbing. Consistent with the literature, unintelligible speech is found to be less disturbing then the intelligible speech(Pierrette, Parizet, Chevret, & Chatillon, 2014).

The disturbance caused by the sound sources and students' perceived loudness are compared with their satisfaction with the sound environment. Calculated Spearman's rank correlation coefficients can be seen at Table 1. Based on these results, a statistically significant relation is observed for 7 of the items. When we consider the correlation between the satisfaction with the sound environment and the statement of "this sound environment is not loud", there is a moderate positive association. In order to properly interpret this result we need to consider that the Likert scales for satisfaction is "1 = very dissatisfied and 5 = very satisfied", and Likert scales for loudness is "1= strongly disagree, 5= strongly agree". This indicates that satisfaction increase as they perceive the sound environment less loud (r(120)=0.540, p< 0.01).

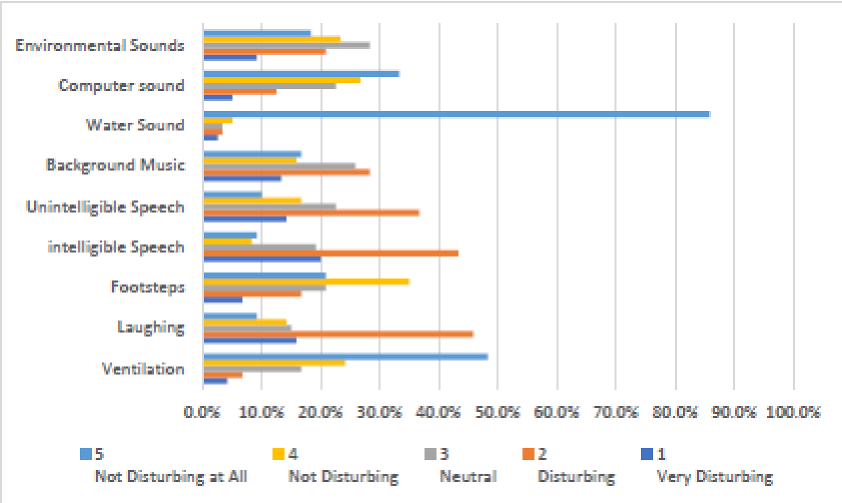

Figure 4: Disturbance caused the sound sources.

Strongest amount of relation has been observed for laughing sounds, among all sound sources. There is a moderate strong positive association between the disturbance caused by the sound of laughing and satisfaction with the sound environment (r(120)=0.511, p< 0.01). This can be interpreted as, the students get more satisfied with the sound environment (1-Very dissatisfied, 5-Very satisfied) as they get less disturbed by laughing sounds (1 – Very disturbing, 5- Not disturbing at all). Laughing is very closely followed by the unintelligible speech (r(120)=0.502, p< 0.01) and intelligible speech (r(120)=0.471, p< 0.01), with both having moderate positive association. No significant relation has been observed for background music, ventilation and water sounds (Table 1).

	Satisfaction with the sound environment	Self-rated concentration
Loudness	-0.540**	0.472**
Ventilation	-0.027	0.051
Laughing	0.511**	0.531**
Footsteps	0.250**	0.357**
Intelligible Speech	0.471**	0.529**
Unintelligible Speech	0.502**	0.538**
Background Music	0.076	0.177
Water Sound	0.067	0.093
Computer sound	0.192*	0.308**
Environmental Sounds	0.237**	0.279**

Table 1: Spearman's rho correlation coefficients for disturbance caused by sound sources (*p<0.05, **p<0.01).

Loss of concentration caused by the sound environment is self-rated by the participants. They were asked to respond to the statement of "Sound environment of this study area does not disturb my concentration" from "1= Strongly disagree" to "5=Strongly agree". Their response to this statement is correlated with disturbance caused by each sound source (Table 1). Moderate positive association is found between the perceived loudness and self-rated concentration (r(120)=0.472, p< 0.01). Possible reasons why this relation is not stronger will be discussed in the discussion chapter. Similarly with the satisfaction, highest correlations are observed for unintelligible speech, laughing sound, and intelligible speech. However, this time unintelligible speech has the highest correlation coefficient (r(120)=0.538, p< 0.01), and having moderate positive association. This indicates that self-rated concentration increases as participants get less disturbed by the unintelligible speech.

3.3 COPING METHODS

During the pilot study, students were asked what they do when they are unsatisfied with the sound environment. Based on their responses, five coping methods were identified. These methods are, putting on earphones (to listen to music, etc.), moving to a quieter place, leaving the study area, intervening to the sound source, and not doing anything at all. Afterwards, as part of the questionnaire survey participants were again asked to choose from “1= strongly disagree” and “5= strongly agree” for each condition.

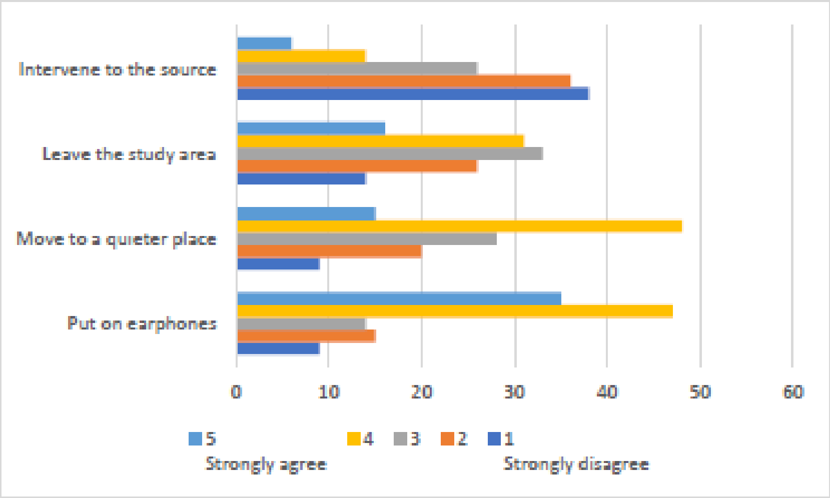

Figure 5 - Coping methods employed by the participants

As seen in Figure 4, majority of the students stated that they would put on earphones (39.2% agree, 29,2% strongly agree). Another common method of coping is relocating to a quieter place within the area (40% agree, 12.5% strongly agree). Leaving the study area is another common method, with 25.8% agreeing and 13.3% strongly agreeing. In contrast, intervening to the sound source is absolutely not favoured among the participants with 31.7% strongly disagreeing and 30% disagreeing.

4 DISCUSSION

This study investigated the sound environment of four public study areas found within the Bilkent University Campus. The study areas are compared in terms of overall satisfaction, perceived loudness and satisfaction with the sound environment. In-situ measurements of the LAeq are also conducted. The statistical comparison of perceived loudness and satisfaction with the sound environment showed no difference between study areas, even though there are differences between the spaces in terms of sound levels. Only difference is observed for the overall satisfaction in two of the study areas.

The most frequently heard and disturbing sounds are all caused by human activities such as, laughing, walking, intelligible and unintelligible speech. When these are compared with satisfaction with the sound environment, results indicated moderate associations. Same activities also caused moderate effect on self-rated concentration. When exposed to negative or dissatisfying sound environment, the most common coping method is found to be putting on earphones.

One of the issues that came up during the research is regarding the fountain in the SA building. As the other three study areas do not a water element, the descriptive statistics regarding the water sound is very limited. Although, according to the ANOVA F-test results there is no difference between the SA building and the other study areas in terms of overall satisfaction, perceived loudness and satisfaction with the sound environment.

An interesting finding is related with the loudest (Library) and the quietest (77th dormitory) study areas. Even though the inferential statistics found a difference between this areas, this difference is not regarding the satisfaction with the sound environment or with the perceived loudness but with the overall satisfaction. The in-situ measurements also found average of 14 dB(A) LAeq difference between these two study areas. These findings support those found within the literature. It is clearly seen that sound energy alone is not enough to make a judgement about the perception of soundscape (Brown, et. al., 2011)

Even though the option of “leaving the study area” is stated as a coping method during the pilot study, it should not be considered as an actual method of coping with the soundscape. As the setting is an indoor space when you leave the area you also leave that sound environment. Thus, it is more like not coping with the unsatisfying sound environment.

The option of intervening the sound source is spread into two types of intervention. First one is to verbally intervene a human generated sound (such as laughing). Other option is to physically intervening a non-human sound source, such as the sound of the ventilation system or the coffee machine. One of the reasons why this option is strongly opposed by the participants is that it is not always possible to actually intervene the source. This could either be due to practical or social concerns.

Putting on ear phones, the most commonly accepted coping method, raises some issues. Earphones cause an isolation from the sound environment. It was even mentioned by a number of participants (even written on the questionnaire) that they do not have too much to say about the sound environment as they use earphones almost the whole duration of their study period. This situation can possible be the reason of relatively low strength of association between the self-rated concentration and perceived loudness ($r(120)=0.472$, $p< 0.01$). If the sound environment is loud, students put on earphones during concentration demanding tasks. Thus, loudness does not effect their concentration as much as it should. During the survey, it was observed that earphones are most commonly used during individual study. Those engaging in a collaborative study do not use earphones and as it was also indicated by the literature do not easily get distracted by loud sound environments with exception of peak sounds (Bryant et al., 2009).

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ID 1412 | ARTS AND CULTURE STRATEGIES FOR ACTIVATING NEIGHBOURHOOD PUBLIC SPACES: BRINGING ARTS TO THE HEARTLANDS OF SINGAPORE

Zdravko Trivic[1], Beng Kiang Tan[2], Nina Mascarenhas[3], Quyen Duong[4], Rita Padawangi[5]
[1]Department of Architecture, School of Design and Environment (SDE), National University of Singapore (NUS),
[2]Department of Architecture, SDE, NUS; [3]Center for Sustainable Asian Cities (CSAC), SDE, NUS
[4]CSAC, SDE, NUS; [5]Asia Research Institute (ARI), NUS
akizt@nus.edu.sg ; akitanbk@nus.edu.sg ; ninamascy@nus.edu.sg ; ritapd@nus.edu.sg

1 INTRODUCTION

In 2011, the National Arts Council (NAC) Singapore started an initiative of establishing the 'Community Arts and Culture Nodes' in Singapore's heartlands that extend beyond the traditional art venues, such as museums, art galleries or theatres to incorporate various public spaces and facilities. The objectives of this initiative are to provide greater access to arts through regular quality arts programmes in the local housing neighbourhoods, to activate neighbourhood public spaces through arts and culture and to increase the opportunities for social interaction and community bonding. 25 of such nodes are envisioned to be established island-wide by 2025.

With reference to 'Community Arts and Culture Nodes' strategy, this paper discusses the capacities of five Singaporean neighbourhoods to create culturally rich and vibrant environments through unique art experiences and participation opportunities for the local residents. The key focus is the neighbourhood spatial opportunity analysis that involves mapping and assessing available neighbourhood spaces, their characteristics, strengths and weaknesses, as well as the symbiotic relationship between the quality and capacity of space design and programming in relation to arts and culture events and activities. The process and findings of neighbourhood analysis provide a guide for choosing the most suitable spaces for the arts as well as the strategies to activate community spaces through arts and culture activities.

1.1 WHAT CAN ARTS DO FOR SPACE AND COMMUNITY? - ARTS AND PLACEMAKING

The concept of placemaking has emerged as a response to the systematic destruction of human-friendly and community-centric spaces of the early 20th century. In a reaction to top-down planning, scholars and urban sociologists, since 1960s, began questioning how public space was appropriated (and by whom) and for what it was used (Gehl, 2010; Stern and Pray, 2014; Whyte, 1980). According to Silberg and colleagues (2013), the practice of placemaking concerns the deliberate shaping of an environment to facilitate social interaction, improve community's quality of life, increase public engagement, boost civic pride and empower urban dwellers. In this view, public arts, which is defined as all work of art that is displayed or performed in the public realm, including community arts (Artscape, 2016a; Cartiere and Willis, 2008), is considered a particularly fruitful means of placemaking.