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집회소음 노출시간에 따른 성가심도 연구

Study of Annoyance in Relation to Exposure Time to Demonstration Noise

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요 약 오늘날 도시의 규모가 커지고 기능이 복잡해지고 있으며, 다양한 사람들이 다양한 활동을 하며 살아가고 있다. 또한 도시에서의 사람의 삶은 많은 부분에서 주변의 사람과 연관되어 있다. 그리고 도시의 생활은 다양한 인공적인 활동을 하고 있음을 뜻하며, 이에 따른 소리의 발생이 주변사람에게는 소음공해가 되기도 한다. 이러한 이유에서 사람들로 만들어진 인공소음은 특히 서울의 도심 4대문 안의 도로 주변의 소음은 평균 73dB가 될 정도로 크다. 그리고 도시에 사라는 사람들은 소음공해에 쉽게 노출되며 특히 집회나 시위현장 또는 홍보를 위해 사용되는 확성기들은 상당한 소음을 발생시키며 이는 다른 사람들에게 스트레스를 유발한다. 더욱이, 집회 및 시위에 관한 법률 등에서 지정하는 확성기 사용 및 규제는 있지만 잘 지켜지지 않는 것이 현실이다. 그리고 최근 법령을 -5dB를 낮추는 등의 법령기준을 강화하였지만, 여전히 스트레스가 되고 있다.
따라서 집회 및 시위현장의 소음의 크기를 제한하고 규제하는 것 뿐만 아니라, 노출되는 시간을 고려하여 피해를 줄이는 것이 더 효과적인 방법이다. 소음으로 인한 스트레스는 짧은 시간만 노출되더라도 오래도록 지속되며, 이러한 환경에 위치한다면, 소음공간에서 빠르게 벗어나는 것을 권장 하는 것도 본 연구에서 제시하는 피해저감 방안이다.

Abstract The size of urban areas is currently growing and the functions of cities are becoming increasingly complicated. Furthermore, more people are living in cities. The life of urban is getting closer and linked with neighboring people in many parts. In particular, people are making artificial noise, even though it might not consciously be noticed, in their daily live. Seoul is the most crowded place in Korea and the noise levels are 73dB or higher. People living in cities are exposed to noise pollution. In particular, loudspeakers used during demonstrations or to generate publicity, cause considerable noise, which in turn can be related to stress. Moreover, the noise restrictions defined by law are not adhered to. If enhanced noise regulations, no matter how residents are not forced to be a great stress field close to the noise and reduces the loudness -5dB do not feel well if the difference.
Limiting the duration of noise rather than reducing the volume thus is a much more plausible way of reducing the damage caused by noise pollution. If the stress caused by the noise, you will see people or vehicles holding a megaphone at the roadside is not good for health if it may be a wise way to live that is getting rid of the noise pollution so quickly out of the area.

Key Words : unsupervised term weighting schemes, supervised term weighting schemes, inverse category frequency, text categorization, term weighting

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Ⅰ. Introduction

The size of urban areas is growing and the functions of city are becoming increasingly complicated. Furthermore, more people are living in cities. The life of urban is getting closer and linked with neighboring people in many parts. In particular, people are creating noise, even though it might not consciously be noticed, during their daily life. Seoul is the most crowded place in Korea and the noise levels are 73dB or higher. In particular, accounts for about 30% of complaints due to noise vibration in the city, in which complaints by loudspeaker amount to 8%, and are showing an increasing trend.[1-4]

Recently, Koreans have shown increasing interest in comfortable residential environments. Noise and vibrations fall under noise pollution, and people wish to lead comfortable lives free of such noise. In cities, complaints related to noise and vibrations account for 30% of environment-related complaints. Among these, about 8% of complaints are related to megaphones. The proportion of noise and vibration complaints has continuously increased over the years.[2][3]

To ensure systematic control over noise sources in daily life, the Ministry of Environment established comprehensive policies to reduce community noise. Article 20-3 of the 'Enforcement Decree of the Noise and Vibration Control Act' defines noise from loudspeakers as part of community noise. However, this general prohibition of noise from loudspeakers is impractical considering their increasing variety. As such, noise pollution is also regulated according to time, which is again subject to several restrictions in terms of realistic control.[2][3]

[1] and [2] state that noise levels naturally increase when people gather, and the growing awareness of noise leads to complaints. [3] and [4] measure the extent of damage from loudspeaker noise and present guidelines for practical use. These studies, however, lack objective indices such as degree of annoyance, stress level, and brain wave analysis. The resulting guidelines are based on related laws on noise control, protests, and demonstrations. The majority of past research does not include measurements on the extent of damage and merely relies on general industrial standards of noise pollution without presenting practical guidelines or countermeasures.

In this study, we analyze the degree of annoyance according to the exposure time to noise of a demonstration created by using a loudspeaker and use the results to determine the appropriate exposure time. Chapter 2 looks at the environment the noise of the crowd in the city center. Chapter 3 analyzes the degree of noise annoyance. Conclusions are presented in chapter 4.

Ⅱ. The Environment Noise of in City

Noise and vibration complaints according to the Ministry of Environment have increased by roughly 11% each year, with vibration noise complaints accounting for 30% of complaints, and the rate of megaphone noise complain was increased by 5% and continues to increase.

In figure 1, according to the Ministry of Environment's report in [2], there were 56,244 noise and vibration complaints in 2011, translating to a ratio of 33%. These complaints accounted for one-third of environment-related complaints, a 158% increase from 2002. The ratio of vibration noise complaints has continuously increased since then [3]. In figure 2, an examination of the cause of everyday noise in 2011 shows that construction accounted for 65% while megaphones took up 8%. The World Health Organization (WHO) cited noise as one of the top three factors affecting quality of life, trailing behind air and water pollution.[4]

The definition of noise is unpleasant to hear any sound. According to the Noise and Vibration Control Act, noises refer to strong sounds produced by machines, tools, facilities, the use of other objects, and

human activities. Among the various sounds produced, those that are unpleasant to the ear are regarded as noise. While noise is regulated by law based on noise level and time, the degree of annoyance caused by noise is subjective, which results in different experiences depending on the parties involved. And there is a lot of noise that occurs with human life, which is loath to hear the sound becomes noise to others. Noise can be a somewhat subjective criterion, but the management and use of the size of the sound annoyance may appear slightly different exposure.[5-6]

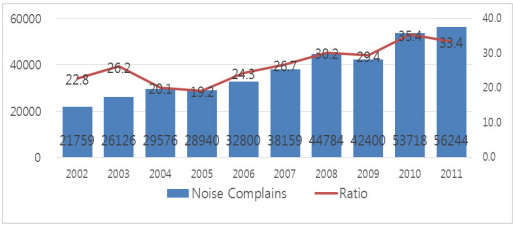

그림1. 소음진동 관련 민원 현황
Fig. 1. Compliant occur Trends of noise and vibration

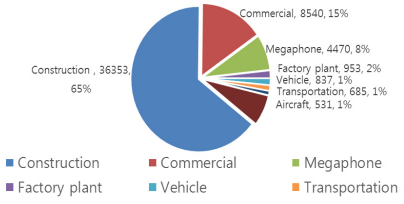

그림 2. 소음민원 현황 비율
Fig. 2. Cause-specific Noise vibration Compliant occur Trends

Today, the most frequent source of noise are the traffic noise, aircraft noise and industrial and factory / business site. The current South Korea classified as such Factory Noise, life noise, traffic noise and aircraft noise in Noise and Vibration Control Act. In this section, the city and life convenience noise, construction site noise and it explains separated by traffic noise and so on. On the other hand, In South Korea, which is closely related with the daily noise of life that is loudspeaker noise during rallies and demonstrations has emerged as a serious social problem.[7]

Acoustic equipment, radio, TV, loudspeakers, musical instruments sound, voice, sound, sound operation, the operation sound, etc. are regulated by law. Individuals care must be taken not to generate noise when they are doing things. On the other hand, the law in accordance with the type of noise is as follows.

- Noise caused by loudspeakers
- Noise emissions from the plant facilities have not been installed
- Noise from construction sites
- Factory noise in the workplace, except a construction site

The impact of noise on humans affect to hearing, or a person cannot concentrate on his work that because of the loud noise, or disturbed to see the TV. And the physical and mental damage is received. This effect will vary depending on the physical properties of sound, a human listening to the sound may be changed according to whether a certain condition. The higher noise level greater impact we receive. In addition, according to the different frequency components of the noise effect and the longer the duration given more influence. The influence of the noise and the impact of noise is continuously repeated to that condition.[6]

Noise health effects are the health consequences of regular exposure, to consistent elevated sound levels. Elevated workplace or other noise can cause hearing impairment, hypertension, ischemic heart disease, annoyance, and sleep disturbance. Changes in the immune system and birth defects have been attributed to noise exposure.[4]

Although some presbycusis may occur naturally with age, in many developed nations the cumulative impact of noise is sufficient to impair the hearing of a large fraction of the population over the course of a lifetime. Noise exposure also has been known to induce

tinnitus, hypertension, vasoconstriction, and other cardiovascular adverse effects.[6]

Beyond these effects, elevated noise levels can create stress, increase workplace accident rates, and stimulate aggression and other anti-social behaviors. The most significant causes are vehicle and aircraft noise, prolonged exposure to loud music, and industrial noise. In Norway, road traffic has been demonstrated to cause almost 80% of the noise annoyances reported.[8]

In this paper, we analyzed the noise. The measurement point is 1m from the speakers, and the average sound pressure level for five minutes is exceeded exceeds the measured noise 80dB. This sound level can be harmful to people who are exposed for long periods of time. The figure shows a frequency analysis of the measured noise sources. Most of the energy is not more than 1000Hz. In particular, the sound of 350Hz has the highest value. Features of this noise are particularly disturbing when people have a conversation. Furthermore, a higher SNR is required for clear communication.[7-9] In addition, people are sensitive to 1 ~ 4 ㎑ sound and thus the annoyance level of this sound is also high.

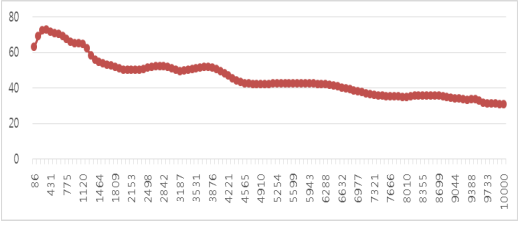

그림 3. 집회시위 현장 소음 주파수분석 결과
Fig. 3. Frequency analysis of loudspeaker noise in demonstration

Ⅲ. Annoyance Study

In this paper, we measure the stress level that humans receive in response to noise pollution. We simulate loudspeaker noise conditions with 2 men and 2 women, who are approximately 20 years old and healthy. The noise volume fluctuates in a range of 70 to 90 dB, and the subjects recorded their stress level on a scale from 0 to 10. We also measured the brain-waves of the participants.

To analyze the degree of annoyance caused by noise pollution, this study measured the stress levels and analyzed brain waves of human participants subjected to noise. The tests involved recordings of noise from loudspeakers and a total of four subjects: two males and two females in their mid-twenties. Tolerance tests, stress level measurements, and a brain wave analysis were performed. Noise recorded from a protest was played through monitor speakers in a laboratory with 30 dB background noise while varying the noise level and time.

The noise tolerance test measured the participants' time of tolerance to the noise from loudspeakers. The participants were asked to tolerate noise set at an average of 80 dB while engaging in reading or other learning activities and to leave the laboratory when they felt the noise to be unbearable. All participants showed changes after one minute, and one of them left the laboratory at three minutes. The remaining participants left within five minutes. For the two repeated sessions, all participants were unable to tolerate the noise for more than five minutes.

In the stress test, the time taken for the stress level to increase to the next level (out of 10 levels) was measured while increasing noise by 5 dB increments from 70 to 90 dB in a laboratory with 30 dB background noise. The level of stress was measured in the form of a questionnaire. When the participants were subjected to noise during reading or other learning activities, all of their stress levels increased by at least one level within three minutes. Even when the noise level was reduced, the participants' stress levels did not decrease. In other words, lowering the sound does not alleviate the stress of those suffering from noise pollution.

In the third test, changes in brain waves were measured using an EEG monitoring system. Similar to the previous tests, noise was increased by 5 dB

increments from 70 to 90 dB in a laboratory with 30 dB background noise. Brain waves were analyzed during noise exposure and rest, and the time taken to return to the normal state was measured. The figure 4, shows the results of the brain waves. The raw columns indicate the point where the noise starts, and the green columns indicate a quiet condition. In the experiment results there was a weak correlation between noise and alpha waves and a stronger correlation theta and beta waves. The brain waves of the participants in the noisy environment are converted to the form of stress. Conversely, in the quiet environment, they show a break.

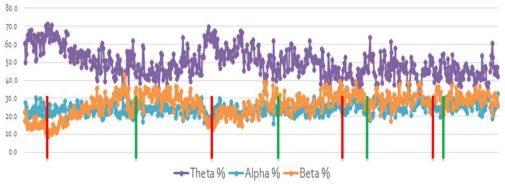

그림 4. 집회소음 노출에 따른 평균 뇌파 분석결과
Fig. 4. Average brain wave(EEG) In noisy environments.

In the experiment, we varied the noise exposure time, and checked the stress index and brain waves. Natural result, when exposed to the noise of short duration, low stress level, and brain wave is also stable. The recovering recovery time from stress to a stable state, and the time to restore calm brain wave conditions was shorter.

Under condition, the stress increased during 3 min for all participants. Furthermore, even when the noise was reduced, the stress ratio did not decrease. However, in a similar test, 1 min. noise exposure did not lead to increased stress.[10]

Ⅳ. Conclusion

People living in cities are exposed to noise pollution. Unfortunately, our sense of hearing cannot simply be shut like our eyes. In other words, sounds can easily become noise pollution and disturb others. In particular, during demonstrations people typically use a megaphone to make louder sound. Although the people must bear when they are on speaker noise condition. In particular, residents are subjected to high stress from such noise.

In this paper, we measured the stress levels and brain waves of human participants subjected to noise pollution. The changes in participants subjected to noise from loudspeakers were measured using noise tolerance, stress levels, and brain waves. The experimental results demonstrate that limiting the duration of the noise is a better way to reduce the damage caused by noise pollution than reducing the volume. If the stress caused by the noise, you will see people or vehicles holding a megaphone at the roadside is not good for health if it may be a wise way to live that is getting rid of the noise pollution so quickly out of the area.

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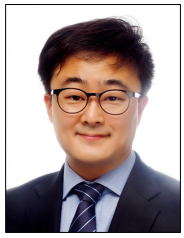

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