ASJ-ASK Kyushu Youngnam '11
Joint Conference on Acoustics 2011
Acoustical Society of Korea Youngnam Chapter / Acoustical Society of Japan Kyushu Chapter
January 22, 2011 Kumamoto University Kumamoto Japan

SURVEY ON THE USE OF PORTABLE AUDIO DEVICES

Mariko HAMAMURA, Shin-ichiro IWAMIYA

Kyushu University
4-9-1, Shiobaru, Minami-ku, Fukuoka, 815-8540 Japan
Fax: +81-92-554-4557
E-mail: mariko@hamamura.biz, iwamiya@design.kyushu-u.ac.jp

ABSTRACT

Many people enjoy listening to music in various places using portable audio devices. A questionnaire survey on the usage of portable audio devices for university students was conducted to clarify the attitudes of listeners toward music and environmental sounds. The optimum listening level of music was measured in both quiet and noisy conditions to clarify the preferred listening environments of portable audio device users. The questionnaire survey showed widespread and long-term use of portable audio devices among younger generations; they listened to music on trains and buses, while walking, and when bike riding. Twenty-nine percent of the users typically listened to music for longer than 3 hours. Sixteen percent experienced dangerous situations while listening to music via earphones. Thirty percent felt annoyed by environmental sounds. The reasons for listening to music for these users were mainly to pass time, to refresh the mind, and to mask environmental noise; however, some also used their audio devices to avoid conversation with others. Although the optimum listening level was found to be around 58 dB in a quiet condition, it rose to over 70 dB when environmental noise was present. These results suggest that listening to music via portable audio devices causes difficulty in hearing environmental sounds. Music might therefore mask not only warning sounds necessary to inform people of dangerous situations, but also aesthetically pleasing environmental sounds.
KEYWORDS: Portable Audio Player, Music, Environmental Sound, Questionnaire Survey, Optimum Listening Level

INTRODUCTION

Many people enjoy listening to music in various places using portable audio devices, such as iPods (Apple, USA) or Walkmans (Sony, Japan). However, serious accidents have been reported for users of earphones in public places. Furthermore, listening to music in such ways affects the perceptibility of environmental sounds [1]. Risk of damage to the hearing organs by loud music via earphones has also been indicated [2]. Finally, such listening habits

might affect the relationship between human beings and environmental sounds; that is, people may start to lose their aesthetic sensitivity to everyday sounds.

In the present study, a questionnaire survey on the use of portable audio devices for university students was conducted to clarify the attitudes of listeners toward music and environmental sounds. The optimum listening levels of music were measured in both quiet and noisy conditions to clarify the optimal listening environments of portable audio device users.

QUESTIONNAIRE SURVEY ON THE USE OF PORTABLE AUDIO DEVICES AND LISTENERS' ATTITUDES TOWARD MUSIC AND ENVIRONMENTAL SOUNDS

A questionnaire survey on the usage of portable audio devices and listeners' attitudes toward music and environmental sounds was conducted. The questionnaire was composed of questions about the possession of portable audio devices, duration of their use, experiences of dangerous situations, reasons for listening to music, and attitudes toward environmental and other sounds. The respondents were 40 university students, aged 18 to 26 years old.

The results of the survey showed that 95% of respondents owned portable audio devices. The most popular device was the iPod, which was owned by 42% of device users. Furthermore, 26% of device users noted that their mood often changed when they had forgotten to carry their portable audio device with them. As for the period of ownership, 76% of users had used their devices for longer than 5 years, with the type of device ranging from portable cassette players to MiniDisc (MD) and Compact Disc (CD) players.

The situations in which portable audio devices were used included transit (34), work (19), and shopping (6). The types of transit were train (26), subway (19), bus (27), car (3), bicycle (11) and walking (23).

The purposes for listening to music included to pass time (27), refresh the mind (32), concentrate (5), work harder (8), mask environmental noise (17), and avoid conversation with others (7). In addition, 11% of respondents frequently listened to music to mask ambient noises, while 29% often did it.

Figure 1 shows the daily listening durations of portable audio device users. While 34% of users listened to music for 1 to 2 hours every day, 13% listened for more than 5 hours.

Figure 2 shows the weekly frequency of portable audio player use; 42% of the users used their devices every day.

Seven respondents (16%) had experienced dangerous situations while listening to music via earphones; for example, some did not notice approaching bicycles or cars and almost had an accident, while others failed to notice changing traffic auditory signals. (Sighted people also rely on auditory traffic signals.)

The respondents' answers to the questionnaire item on attitudes toward environmental sounds showed that 5% felt very annoyed by environmental sounds, while 24% felt slightly annoyed. Moreover, 26% admitted to losing interest in, and paying less attention to, environmental sounds.

These results illustrate the widespread, long-term, and frequent use of portable audio devices among the younger generation. For such users, listening to music via earphones is a daily behavior, which may be a factor in their losing interest in and lack of attention toward environmental sounds.

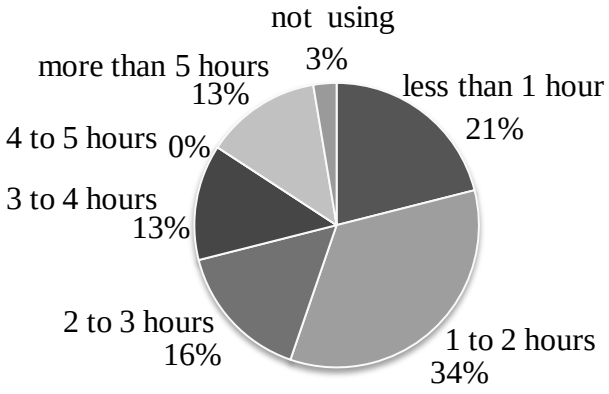

Fig. 1 Daily listening durations of portable audio device users.

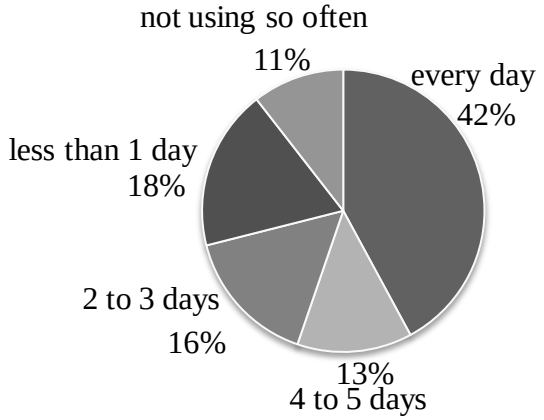

Fig. 2 Weekly frequency of portable audio player use.

MEASUREMENT OF OPTIMUM LISTENING LEVELS OF MUSIC VIA EARPHONES IN QUIET AND NOISY CONDITONS

The optimum listening level of music via earphones was measured by a method of adjustment. The participants were 10 students, aged 22 to 26 years old, all of whom were respondents of the questionnaire survey. The sound stimuli were six music excerpts (approximately 90 s in length) of the following genres: classical, American pop and Japanese pop. They listened to music via open-air type headphones. They adjusted the volume of an iPod to what they considered to be the optimum listening level for enjoying each tune. Each optimum listening level was measured using an artificial ear and a sound level meter. The experiments were conducted in both quiet and noisy conditions. The noisy condition included two types of conditions: traffic noise and train noise. The ambient noise level was 33 dB (A-weighted sound pressure level) for the quiet condition, 63 dB and 73 dB for the two traffic noise conditions, and 73 dB for the two train noise conditions (with the variable being not the loudness, but the presence or absence of an in-train announcement). The traffic and train noises were presented via a loudspeaker.

The average optimum listening levels (L_{Aeq}: equivalent continuous A-weighted sound pressure level) and their standard deviations for each tune for each noise condition are shown in Table 1. A two-way analysis of variance was applied to the data. The effect of the ambient noise condition was statistically significant ($p=0.01$). The effect of tune type and the interaction between ambient noise and tune were not statistically significant.

The differences in average optimum listening levels between the quiet condition and the other noise conditions were found to be statistically significant ($p=0.01$) by Tukey's HSD (Honestly Significant Differences) test. The differences in listening levels among the four noise conditions were not statistically significant for any pairs. These results indicate that listening to music via portable audio devices may interfere with the ability to hear environmental sounds. The sound of music might mask the environmental sounds necessary to inform users of dangerous situations. Furthermore, some participants in our study were found to listen to music at very high volume levels. Such users might risk damaging their hearing organs.

The average optimum listening level for the 63 dB traffic noise condition was 71.1 dB, while that for the 73 dB traffic noise condition was 73.2 dB. Despite a 10 dB difference in the ambient noise level, the difference in optimum listening levels was not statistically significant. Thus, there seems to be a kind of saturation point for sound values when listening to music. Some participants reported that they adjusted the sound volume within their threshold for pain. On the other hand, participants tended to abandon further raising the volume of music when environmental noise became too loud.

Table 1. Average optimum listening levels and standard deviations (L_{Aeq}: dB).

	Tune 1	Tune 2	Tune 3	Tune 4	Tune 5	Tune 6
Quiet condition	57.9 (9.1)	60.2 (10.1)	62.4 (9.5)	56.9 (8.2)	56.0 (10.9)	54.7 (11.2)
Traffic noise (63 dB)	72.8 (5.3)	71.4 (6.4)	72.5 (6.3)	70.5 (6.3)	71.8 (6.1)	69.8 (7.2)
Traffic noise (73 dB)	74.0 (5.6)	71.4 (6.7)	75.2 (6.8)	72.6 (6.3)	73.2 (6.1)	72.8 (6.4)
Train noise with announcement	71.6 (6.4)	71.2 (6.2)	73.9 (7.6)	71.5 (6.7)	71.6 (6.7)	71.6 (5.8)
Train noise without announcement	73.7 (6.2)	71.2 (7.0)	74.0 (7.2)	73.4 (5.5)	73.4 (6.3)	71.4 (7.4)

CONCLUSIONS

The results of this study illustrate the widespread, long-term, and frequent use of portable audio devices among the younger generation. Portable audio devices have become an integral accessory in their daily lives, with most users listening to music for extended periods of time.

The adjusted volume levels of music were high enough to mask environmental sounds necessary for safety. Consequently, such listening situations may be a factor in causing dangerous accidents. Furthermore, such listeners may become oblivious to opportunities to notice aesthetically pleasing environmental sounds, such as sounds that signal the changing of the seasons. Finally, such listeners may also have increased risk of hearing damage.

ACKNOWLEDGEMENT

This study was partially supported by the Ministry of Education, Culture, Sports, Science and Technology, Grant-in-Aid for Scientific Research (C), 22615027, 2010-2012.

REFERENCES

[1] Kazuhiro Hara, Kaoru Ashihara, Noboru Miura, Perceptibility of environmental sounds by earphone wearers listening to pop and rock music, Technical report of IEICE, EA2009-21, 2009, (In Japanese).
[2] P. A. Hellström and A. Axelsson, Sound levels, hearing habits and hazards of using portable cassette players, J. Sound Vib. 127, 521–528, 1988.