Variation of evaluation of signal sound in the public place with several kinds of noise

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INTRODUCTION

Signal sound is used as a mark that indicates emergency or something important in the public place. It is expected that the signal can be easily heard and draw one's attention successfully. However, loud signal sound can cause annoyance. Therefore, signal sound in the public place should be planned appropriately. In the present research, one experiment is carried out to investigate the effects of frequency and sound pressure level with several kinds of noise on psychological evaluation of signal sound from the viewpoint of efficiency of drawing attention and annoyance.

MEHODS

Ten persons (male = 9, female = 1) participated in the experiment. Pure tones of three frequencies (300; 800; 1,300 Hz) are used as signal sounds. Recorded noises at five kinds of sound environment and pink noise are used as back ground noise. L_{Aeq} of recorded noises and pink noise are shown in Table 1.

Table 1: L_{Aeq} of recorded noises and pink noise

Noise No.	L_{Aeq} [dB)]	kind of noise	included sound
1	77	inside a train	railway track noise, A/C noise, announcement, talking
2	50	pink noise	pink noise
3	64	shopping mall	talking, footsteps, A/C noise, BGM
4	74	street crossing	talking, footsteps, BGM, road traffic noise, cell phone, honker sound
5	74	station concourse	talking, footsteps, guide signal, road traffic noise, honker sound, ticket vender, cell phone
6	79	station platform	railway track noise, announcement, ringing bell, talking, footsteps

Signal sound has time length of one second, and there are 4.5 seconds between one signal and the next. Three signal sounds constitute of one set of signal. Each signal sound that has two conditions of sound pressure level (64, 84 dBA) is added to each noise. In this way, 36 experimental sounds are created. Each subject experiences all of the experimental sounds through headphone.

Evaluation method

After listening each experimental sound, subjects are asked about three types of questionnaire. Firstly, they are asked whether they can hear the signal sounds or not. Secondly, they are asked about impression of signal sound comparing to noise by five steps. Finally, they are asked about impression of whole sound environment that consists of signal and noise. Evaluation items are shown in Table 2 and 3.

Table 2: Evaluation items on the impression of signal sound

No.	evaluation item	No.	evaluation item
A	easy to hear	G	loud
B	bothersome	H	easy to recognize
C	secure	I	high
D	comfortable	J	urgent
E	anxious	K	favorite
F	easy to attend to	L	good

Table 3: Evaluation items on the whole impression of sound environment

No.	evaluation item
M	annoying
N	noisy

RESULTS

Audibility

No subject can hear signal sound of 300 Hz and 64 dBA under the noise condition of "inside of a train", "street crossing", and "station concourse". It is because succeeding noise that has large amount of low frequency masks the signal sound. Besides, no subject also can hear signal sound of 800 Hz and 64 dBA under "street crossing" noise condition.

Impression of signal sound

In all noise conditions, there are similar evaluation tendency. Results show that higher and louder signal sound can easily draw subject's attention and be easily recognized. However, varieties of signal have few effects on secure feeling, comfort, or preference of signal sounds. Results are shown in Figure 1, 2, 3, 4, 5, and 6.

Whole impression of sound environment

Figure 7 and 8 shows the results. They shows that sound environment that has signal of 1,300 Hz and 84 dBA is comparatively annoying and noisy. At the same time, sound environment with signal of 800 Hz is evaluated not so noisy.

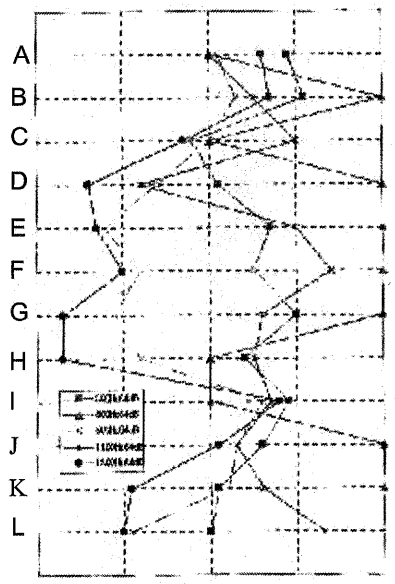

Figure 1: Noise No. 1

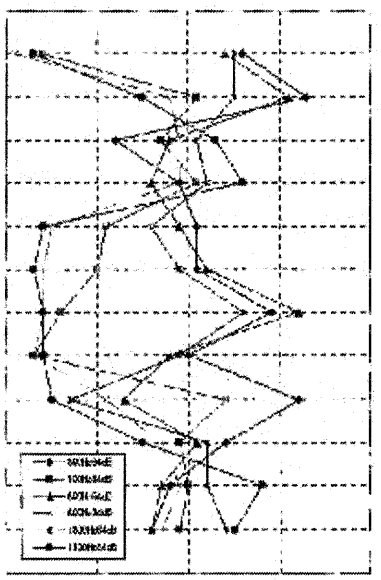

Figure 2: Noise No. 2

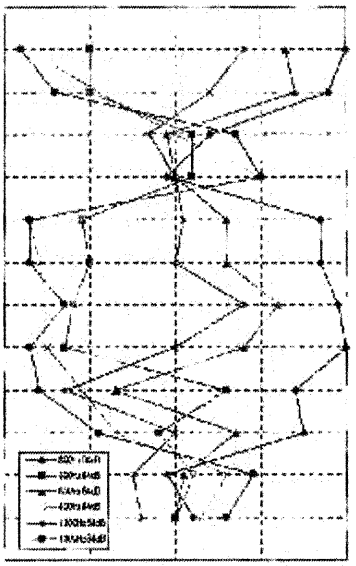

Figure 3: Noise No. 3

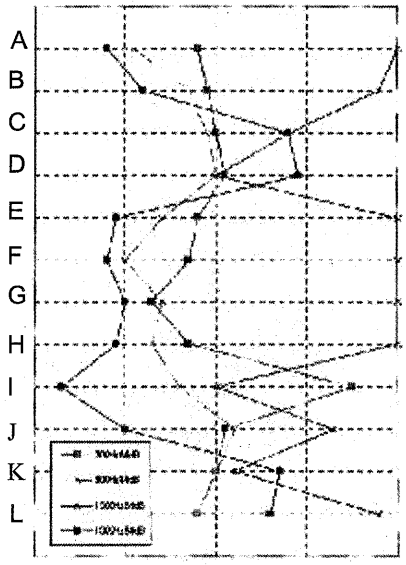

Figure 4: Noise No. 4

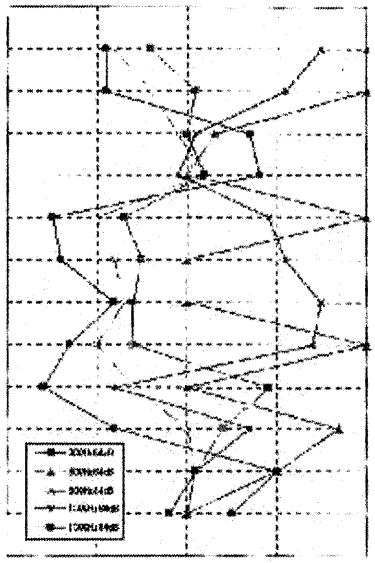

Figure 5: Noise No. 5

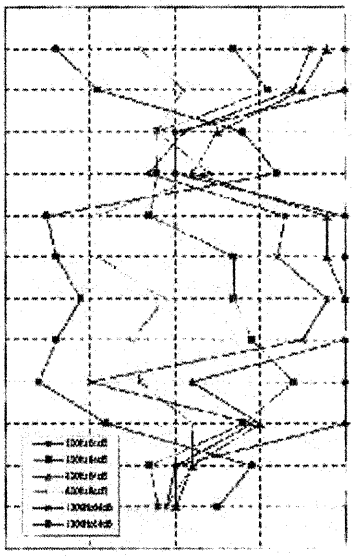

Figure 6: Noise No. 6

Vertical axis shows the evaluation items in Figure 1 to 6. Lateral axis shows the evaluation steps. Left side means "Yes" and right side means "No".

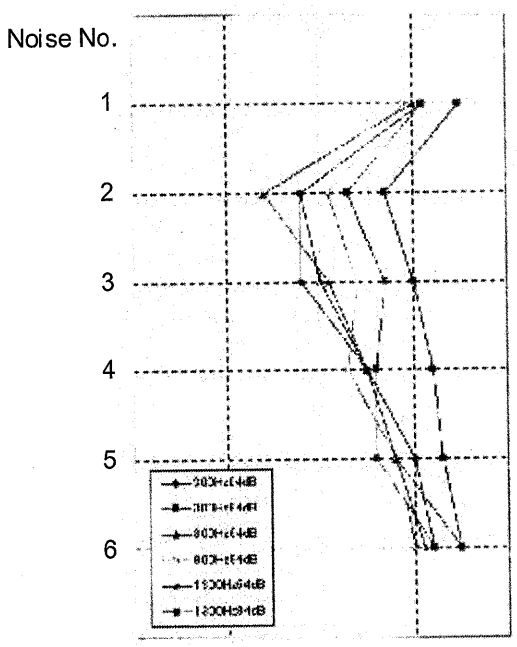

Figure 7: Annoying impression

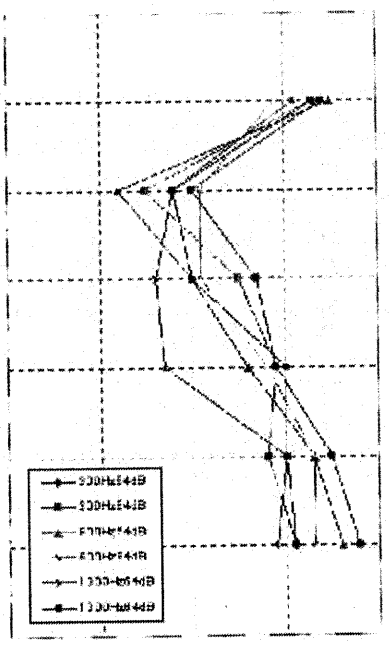

Figure 8: Noisy impression

Vertical axis shows noise conditions in Figure 7 and 8. Lateral axis shows annoying and noisy impression.

CONCLUSIONS

It is suggested that signal sound of 1,300 Hz can easily draw person's attention, and louder signal can be recognized more easily. However, such recognizable signal sound can cause annoying and noisy feeling when it becomes a part of back ground noise. Signal sound should be designed as a recognizable mark for people who need the information, but it should not be noisy sound for people who do not need it. The present research indicates that signal sound may become noise in some situations. Moreover, results suggest that signal sound with frequency around 800 Hz has a good balance of noticeable and not so noisy impression in the public place.

REFERENCES

Akita T (2000). Investigation of sound information that affects person's attention and behaviour. Proc. of INTER-NOISE 2000, pp 2801-2804.

Noise and health-related quality of life in people living near a motorway

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INTRODUCTION

There is scientific evidence linking community noise to health problems (WHO 2009; Dratva et al. 2010; Kaltenbach et al. 2008). The WHO reports that chronic noise-induced annoyance and sleep disturbance can compromise health and health-related quality of life (HRQOL) (Berglund et al. 1999; Niemann & Maschke 2004; WHO 2009). However, there has been little research examining the relationship between noise and HRQOL. An exception is Dratva et al. (2010), who, using the Short Form (SF36) health survey, reported an inverse relationship between annoyance from traffic noise and HRQOL. They argued that HRQOL would be expected to co-vary more with annoyance than with noise level as level is a poor predictor of the human response to noise, and its role in health is commonly over-emphasized. As alternatives to noise level, other factors associated with the listener should be considered (Lercher, 1996), including the perceived control a person has over the noise, as well as their attitudes, personality, and age.

Noise sensitivity considered a stable personality trait that is relatively invariant across noise level (Zimmer & Ellermeier 1999), and is a strong predictor of noise annoyance (Pedersen & Waye 2008; Miedema & Vos 1999; Paunović et al. 2009). Stansfeld (1992) identifies two key characteristics of noise sensitive individuals. First, they are more likely to attend to sound and evaluate it negatively (e.g. threatening or annoying) and second, they have stronger emotional reactions to noise, and as a consequence, greater difficulty habituating. Noise sensitivity has a large impact on noise annoyance ratings, lowering annoyance thresholds by up to 10 dB (Miedema & Vos 1999). On the other hand, a 'third variable' hypothesis has been developed (Fhyri & Klaeboe 2009) suggesting that noise sensitivity does not moderate the effects of noise annoyance, but rather that it marks the presence of susceptibility to health problems and also to annoyance from noise.

Health may be assessed in terms of health related quality of life (HRQOL). The constituent domains of quality of life have different names depending on the measurement tool but they include physical health, psychological wellbeing, social relationships, and salient factors of the environment. HRQOL is normally assessed via a questionnaire. Each question in HRQOL questionnaires is selected on the basis that it discriminates between those who are sick and those who are well. Candidate questions with apparent relevance, or face validity, are used in the development of HRQOL scales; if they do not satisfy the discriminative criterion they are dropped from the final instrument. The World Health Organization developed its HRQOL measure (WHOQOL) in conjunction with 15 member states and it has now been adapted into use by over 50 countries globally. The full version is long, and for epi-