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EFFECTS OF VISUAL FACTORS ON NEIGHBOR NOISE REACTIONS

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ABSTRACT

Neighbor noise in multifamily housing is a major social issue in South Korea. It not only causes complaints but also disputes between residents. While a great deal of subjective noise reactions are influenced by non-acoustic variables, little attention has been paid to the role of visual factors. Thus, this study aimed to investigate the effects of visual stimuli on neighbor noise perception and physiological responses. Conducting laboratory experiments, the study presented participants with an identical neighbor noise stimulus of footstep noise from upstairs, while it varied the visual stimuli. The visual stimuli consisted of living rooms that differed in the type of space or the size of windows and floor area. The study measured participants' noise perception and physiological responses. The findings provide new insights into the complex nature of neighbor noise perception and suggest that visual factors play a significant role in how residents respond to neighbor noise.

Keywords: *noise reaction, neighbor noise, visual factors*

1. INTRODUCTION

Neighbor noise transmission in multifamily housing is a significant social issue in South Korea, leading to noise complaints and neighbor disputes. Despite the development of various noise reduction technologies and relevant policies, the problem remains unsolved. Given that non-acoustic factors play a crucial role in explaining one's noise perception, there are needs for investigating moderating effects of other factors on neighbor noise perception. In light of this, this presentation aims to introduce a laboratory study which varied visual factors and examined the effects.

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2. METHODS

The study aimed to investigate the impact of changes in visual indoor spaces on an individual's perception and response to neighbor noise. The experiment took place at a laboratory of the Korea Institute of Civil Engineering and Building Technology. In a previous study [1], we utilized a Virtual Reality Head-Mounted Display (VR-HMD) and identified its advantages and limitations. Our findings indicated that while the VR-HMD provided an immersive experience, the device's tight fit around the participant's head resulted in discomfort and fatigue. To address this issue, the current study employed a large curved screen (5.3 m width x 2.6 m height), as depicted in Figure 1, to provide a wide-angle view.

Figure 1. The curved screen used in the study

Table 1 details the various types of indoor spaces presented on the large curved screen, which included variations in visual elements such as area size, window size, and level of exposure to external landscapes.

Table 1. The visual elements presented in the study

No.	Type of house	Floor area	Balcony	Window size or number	Height
1	Apartment	42 m^2	No		
2				Enlarged	
3			Yes		
4				Enlarged	
5		52 m^2	No		
6				Enlarged	
7	Studio	38 m^2	No	Two	High
8				Four	
9				Two	Low
10				Four	

The study employed three loudspeakers (Genelec 8030) and a woofer to project adult footsteps noise. Participants' noise annoyance levels were measured using an 11-point scale (0 "not at all" ~ 10 "extremely"), and their heart rates were monitored using a wearable device (Polar Verity Sense). The device was worn on the forearm of the non-dominant hand. Participants were recruited from residents of multi-family housing in South Korea, with normal hearing and no restrictions on measuring physiological responses. A total of seven participants, aged between 29 and 46, were recruited for the study.

3. RESULT

The study's results can be categorized into two types of housing: apartments and studios. Firstly, when presented with indoor spaces in apartments, participants reported higher annoyance levels when viewing smaller living rooms or smaller windows, resulting in a lower level of exposure to external landscapes. Conversely, lower annoyance levels were reported when viewing larger living rooms, a house with a balcony, or an enlarged window, resulting in a higher level of exposure to external landscapes. Secondly, when presented with indoor spaces in studios, higher annoyance levels were reported when the house was located on a lower floor or had fewer windows. Participants reported lower annoyance levels when the house was located on a higher floor or had more windows. Regarding the heart rate measurements, the small number of participants made it difficult to discern any clear trends in the data.

Each participant's general feedback on the experiment was collected when each of the experiments was completed. The participants mainly provided feedback about the outside view seen through the window and the river view seen from the window of the apartment. However, it was interesting that nobody mentioned or even noticed whether the size of the space or window had changed. Additionally, participants reported that the presented indoor spaces were realistic and resembled their own houses, but some found it boring to keep viewing the screen.

4. DISCUSSION

The findings of the study indicated that certain visual factors can affect individuals' perception of noise. However, due to the limited sample size, additional experiments are necessary to obtain more definitive conclusions regarding the impact of visual factors on neighbor noise perception. Moreover, participants' feedback suggested that they may not have consciously perceived subtle visual changes, such as variations in window size, although the outdoor view potentially influenced their level of annoyance. Future research could explore the potential benefits of unnoticed visual modifications in enhancing residents' satisfaction with the acoustic environment at home.

5. CONCLUSION

The study investigated subjective noise reactions when visual factors were changed. The study carried out a laboratory experiment to measure participants' noise perception and physiological responses when an identical neighbor noise stimulus and various visual stimuli were presented. The study found that noise annoyance decreased when the participants viewed larger living rooms, a house with a balcony, a house located on a higher floor, or a higher level of exposure to external landscape views. Further studies need to be performed to generalize the results since the number of participants was still small.

6. ACKNOWLEDGMENTS

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7. REFERENCES

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