



Facility Planning and Management NOTES

Department of Design and Environmental Analysis, College of Human Ecology, Cornell University

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Noise in the Office Workplace

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Noise, defined as unwanted sound, is a common complaint in offices. In fact, studies indicate that noise is the most frequent complaint among office workers. Today many companies use an open-office design intended to increase teamwork, communication, and productivity. Studies indicate, however, that these open, interactive spaces augment noise in the workplace. Researchers studying the effects of noise on office workers have found that prolonged exposure to noise may have serious health ramifications, such as increased illnesses (e.g., elevated blood pressure), accidents (both inside and outside the workplace), and stress. Physiological indicators of stress have been noted as a consequence of exposure to noise in offices even when self-reports of stress have been negative (Evans, 2000).

When do sounds become noise?

The American Society of Heating and Air Conditioning Engineers recommends that open office plans have a noise range criterion between 49 and 58 dBA so as not to interfere with verbal communications and complex mental tasks. (Hemp, Glowatz, and Lichtenwalner, 1995). Several studies of noise in workplaces with open office plans have documented noise levels from a low of 42 dBA to a high of 60 dBA. Office workers themselves, however, have chosen sound levels between 48 and 52 dBA for ideal work settings (Fan, 1989). Office conversation is interfered with at 50 dBA.

Some Common Sounds

Noise Source	Decibels (dBA)
Whispering	34
Conversation	60
Vacuum cleaner	69
Heavy traffic	90
Jet aircraft (overhead)	115
Human pain threshold	120

(Hirschorn, 1989)

When does noise become disruptive?

Determining when noise becomes disruptive is difficult because noise is not simply an unwanted sound; it consists of several physical properties: duration (how long the sound lasts), frequency (high-pitch noise or low-pitch noise), and intensity (loud or quiet). Of the three physical properties of noise, intensity is the most common and convenient method used to describe noise. According to standards set by the Occupational Safety and Health Administration and the Environmental Protection Agency, noise is measured in

decibels on the A scale of a sound meter (dBA) where higher frequencies are weighted more heavily. This scale most closely represents how humans perceive sound (Sanders and McCormick, 1993). The decibel scale is also a log scale; thus, a sound registered as ten points higher on the scale is perceived as twice as loud.

That leads us back to the question: when does noise become disruptive in the office? Sound intensities greater than 65 dBA are believed to distract office workers. Distraction is more likely when workers do not have control of the noise source and it is unpredictable. The elevated noise in the work environment is caused by common office equipment such as telephones, copiers, computers, printers, heating and air conditioning units, and conversations of office workers. One study found that conversations and computer/printer beeping sounds were reported to be the most annoying by 90 percent of the survey respondents who considered the noise levels to be annoying. Other major noise sources were people arriving/departing, keyboard sounds, and ventilation equipment (Mital, McGlothlin, and Faard, 1992).

What are the effects of noise on the individual?

Noisy offices may increase a worker's feelings of negative mood. In addition, studies have shown that certain levels of noise can incapacitate a person's ability to concentrate on a particular task, thereby leading to a stress response (Hedge, 1982). Increased stress leads to the release of certain chemicals, such as epinephrine and norepinephrine, which are found in both blood and urine. Prolonged exposure to stress has serious health effects. A recent study in the *New England Journal of Medicine* (McEwen, 1998) found that stress could cause insulin resistance, heart disease, memory loss, immune system dysfunction, and decreased bone mass density.

Effects of Noise on the Individual

- Decreased productivity, especially for difficult or complex tasks
- Increased illness
- Increased hormone levels
- Stress
- Lower job satisfaction
- Lower morale
- Fatigue
- Interference with speech

Cornell researchers (Evans and Johnson, in press) found increased levels of epinephrine in office workers exposed to "low levels" of office noise (55 dBA) as compared to workers in a quieter environment, indicating that these workers were under some stress.

Performance studies indicate that tasks requiring reading comprehension and memory are the most sensitive to noise, especially noise sources related to co-workers' speech (Kjellberg and Skoldstrom, 1991). Studies demonstrate that noise may affect task performance by office workers. Workers were found to have a hard time concentrating on a difficult task when exposed to noise. Other studies reveal that noise increased the amount of errors made in a particular task, such as typing. Research indicates that prolonged exposure to noise reduces office workers' motivation to persist at a difficult task (Evans and Johnson, in press). These findings can have serious consequences in the workplace where employees and organizations are expected to compete in a rapidly changing economy.





Sound solutions

The effect of noise on health and task performance should be of concern to employers. Acoustical control is a critical problem confronting contemporary office planners. Architects and office design and furnishing companies are developing several noise reduction strategies. Their approach includes remedies at one of the three points in the system: the source, the path, or the receiver. The American Society of Interior Designers recommends that solutions to noise in the work environment be focused on four design elements: ceiling systems, systems furniture, sound-masking systems, and carpeting. Ceiling systems can be

designed to absorb sound and prevent it from reflecting back into the workplace. Cushioned carpeting can absorb airborne sound, reduce surface noise generation, and help block sound transmission to rooms below. Systems furniture can also block or absorb sound. The installation of partitions made of porous material such as cork or thick fabric can reduce noise levels in the office, as can the placement of plants around the office. Such noise reduction systems in office environments can provide employees with a quieter workplace, and workers may be more productive and feel less stressed.

Sound-masking systems such as music, nature sounds (e.g., flowing water), or active sound cancellation may be appropriate for some settings. Care should be taken with the installation of such systems, however, because for some workers these sounds may be just as bothersome as other sound sources. What is music to one person may be noise to another. The issue of control of the sound source is especially relevant here.

Space management solutions

Open office settings are not likely to disappear in the workplace. They offer workers the ability to work better in teams and they are an efficient use of space that is attractive to management. However, providing workers with a variety of workspaces can



help reduce the negative aspects of these open office environments. One solution is to provide acoustically private spaces for telephone calls or face-to-face meetings. Small individual offices may be used part of the day, and open spaces may be used when individuals must work together. If workers are in an open office setting all day, spaces should be provided that give some respite from the typical office noises.

Investing in solutions that manage noise in the workplace will prove cost effective to employers. Such solutions should reduce worker complaints, illnesses, and levels of stress. In turn, employee concentration, motivation, creativity, and efficiency may be improved.

Sound Solutions

- Sound-absorbing materials
- Rubber mats under computers, printers, or typewriters
- Lowering high ceilings
- Quieter ventilation systems
- Antivibration machine mountings
- Acoustical enclosures for noisy equipment

Space Management Solutions

- Small private offices
- Enclosed workrooms (to protect other workers)
- Conference rooms
- Lounges
- Variety of work spaces during the day

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Additional information sources

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If you have suggestions for other topics related to facilities that you would like to see covered in this newsletter or you have questions about this topic, please contact Lorraine E. Maxwell, Associate Professor, Department of Design and Environmental Analysis, lem3@cornell.edu or 607-255-1958.

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