

Productivity: Impacts of Ambient Noise, Speech Privacy & Acoustical Conditions on Worker Performance -- A Review of Independent Research

David M. Sykes PhD, IAPP, HFES - Copyright The Remington Group 2004

Economists focus on productivity as an important driver of profitability and economic growth. In fact, CEO's and CFO's often set specific targets for productivity growth. While "high technology" (computers & networks) is frequently trumpeted as the engine of this growth, numerous studies have also shown that general workplace conditions—noise, temperature, light, air quality--*have even greater and more immediate impacts* on worker productivity. This is certainly true in factories, but has also been proven in offices and hospitals in numerous independent and reputable studies over several decades.

Noise levels are clearly a culprit in factories—OSHA sets specific limits to prevent hearing damage or loss. In hospitals, EPA recommends specific noise limits to reduce stress among both patients and health workers as well as to improve patient outcomes. Similarly, in offices, since 1972 (following introduction of "open landscaping"), the U.S. General Services Administration (GSA) has worked with standard-setting organizations (ANSI, ASTM, ISO, etc.) to establish objective standards for "workplace performance" that enable people to work productively--without isolating them behind walls.

Beginning two decades before that (1955) numerous studies have identified the principle deterrent to productive office work as *not* machine noise but rather noise from "conversational distractions" (i.e., overheard conversations). Broad literature has emerged *over five decades* on this subject under the technical heading of "speech privacy" (defined in the technical standard ANS T1.523-2001 and by the U.S. Department of Commerce NTIA under its Information Systems Security program [INFOSEC]).

This term is further defined and measurement methods described in a host of technical standards from ANSI, ASTM, ISO and others. "Speech privacy" is an expression of the ratio of signal to noise, i.e., the relationship between overheard conversation (signal) and background or ambient sound (the noise). Here are examples from recent, measured, independent studies of the impact of appropriate "speech privacy" and related acoustical conditions on office workers:

1. Ability to focus on tasks – *48% improvement*
2. Elimination of distractions (especially overheard conversations) – *51% improvement*
3. Reduction of stress (measured physical symptoms of stress) – *27% improvement*
4. Error rates/accuracy (performance of standard "information work" tasks) – *10% improvement*

Following is a selection of 22 independent studies of this subject between 1955 - 2004:

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Evans, G.W. and Johnson, D. (2000). Stress and open-office noise, *Journal of Applied Psychology*, 85:5, 779-783.

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Markham, B. (2003). A survey of the acoustical quality of seventeen libraries at Princeton University. *Report presented at the 146th Meeting of the Acoustical Society of America. Abstracted in The Journal of the ASA, V.114, No. 4, Pt. 2, p. 2316, 2aAA11.*

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Ouye, J.A. (1996). Improving Productivity through Integrated Workplace Planning. *Paper presented at the World Workplace 96.*

Sundstrom, E., J.P. Town, R.W. Rice, D.P. Osborn and M. Brill (1994). Office noise, satisfaction and performance. *Environment and Behavior* 26(2): 195-222.

U.S. General Services Administration/Geiger & Hamme. (1975). *Public Building Service standard method of test method for the sufficient verification of speech privacy potential (SPP) based on objective measurements*. Washington, D.C. PBS (PCD): PBS-C.2.

Veitch, J.A., Bradley, J.S., Legault, L.M., Norcross, S. Svec, J.M. *Masking speech in open-plan offices with simulated ventilation noise: noise level and spectral composition effects on acoustic satisfaction*. National Research Council Canada, Institute for Research in Construction, IRC-IR-846.