Introduction

A successful open-plan office design requires "acceptable" or "normal" privacy corresponding to AI ≤ 0.15 and an ambient noise level of close to 45 dBA. This can only be achieved by careful attention to all important design details. If any key design parameters are ignored, AI ≤ 0.15 will not be reached, and the office will not be a success. To ensure that changes systematically improve speech privacy, it is helpful to have in situ objective measurements to give unbiased assessments of conditions. Although this has been difficult to do using conventional measurements, the new SPMSoft program makes possible convenient in situ assessments.

New Speech Privacy Measurement Software

SPMSoft is new measurement software intended to measure privacy in open-plan offices during occupied conditions without unduly disturbing the occupants. Sound attenuations between locations in an office are determined from impulse response measurements. Daytime ambient noise levels can also be measured and speech privacy measures calculated in situ at each measurement location. SPMSoft calculates values of the Articulation Index (AI), the Speech Intelligibility Index (SII), the Speech Transmission Index (STI) and an A-weighted signal-to-noise ratio (SNR(A)). The user sees immediately how close the measured conditions are to the goals of AI ≤ 0.15 and an ambient noise level of 45 dBA.

The program displays the envelope of the measured impulse response and the spectrum of the measured ambient noise as illustrated in Fig. 1. These displays give the user the key information required to diagnose the cause of acoustical problems. The two most important paths are usually the initial ceiling reflection and the initial screen diffracted path (whereby speech sound diffracts over the separating partial height panel). After the user enters some dimensions, the program indicates the components of the impulse response that are due to the sound arriving by the initial ceiling reflection path and via the initial panel diffraction path (red and blue boxes respectively in the lower graph on Fig. 1). The relative heights of these two components of the impulse response relate to the relative importance of increasing either the panel height or the ceiling absorption for improving speech privacy of the measured condition.

An ambient noise level of close to 45 dBA is an optimum compromise between being too loud and disturbing and too quiet and not masking unwanted speech sounds. It is typical of ventilation system noise levels found in many offices. Privacy measures can be recalculated with a more ideal ambient noise spectrum, than that measured, to explore the importance of changes to ambient noise levels. From the impulse response display and ambient noise level effects, the user gets an immediate indication of the relative importance of improvements to the key parameters: panel height, ceiling absorption and ambient noise levels, for improving speech privacy.

Software Operation

Fig. 2 illustrates a typical measurement setup and a block diagram of the external hardware required. A portable computer is connected to an external sound card. The program outputs sine-sweep test signals via the sound card and power amplifier to a small loudspeaker located in one workstation. A microphone is typically located in the adjacent workstation and connected to the computer via the external sound card.

The user simply proceeds, from top to bottom, through the 8 measurement buttons shown in Fig. 1. New measurement information is entered using the first button and the microphone is calibrated using the second button. The third button starts the measurement of ambient noise levels for a user-specified duration. The results are stored as 1/3-octave band levels but displayed on the upper part of the main screen as octave band levels.
without window reflections. The reflections from windows could be identified on the measured impulse response envelopes.

Surprisingly the furniture arrangements in workstations were also found to systematically effect privacy. Where there were tables or desks near the centre of the workstations, AI values were increased by 0.1 to 0.15 due to the added reflection energy from these flat horizontal surfaces.

**Conclusions**

The new SPMSoft program makes it possible to systematically identify and solve acoustical problems in open-plan offices and to better improve acoustical conditions in the offices. This complements existing acoustical design software for open-plan offices.

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**References**


