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National Research Council of Canada / Institute for Research in Construction
Indoor Environment Research Program

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I responded to a query in a previous PPTG newsletter, saying that I'd like to hear more about what members' labs do, and now find myself having to provide the first contribution to this new column. I'm pleased to do so because this is an unusual setting that I suspect most members will find unfamiliar.

I'm a member of a multidisciplinary team that conducts research aimed at the provision of safe, comfortable, and healthy built environments. Indoor Environment is one of four research programs at the Institute for Research in Construction (IRC) of the National Research Council of Canada (NRC). NRC is the Government of Canada's principal research and development organisation for research and development. There's no direct US counterpart to NRC or IRC, but elements of IRC's mandate are paralleled at NIST and the national laboratories like Lawrence Berkeley National Lab or the Pacific Northwest National Lab. All of our research is multi- or interdisciplinary, combining competencies in physics, chemistry, engineering and psychology. Indoor Environment comprises about 32 continuing staff, of which approximately half are research officers (professional staff) and half are technical officers. We also have 6-10 visiting workers, graduate students, post-doctoral fellows and co-operative education students with us at any given time.

Both the Lighting and Acoustics sub-programs currently conduct research of interest to PPTG members; the Ventilation and IAQ group is developing capacity in this area. Our work generally aims at integrated models that encompass multiple dependent measures, with the aim of developing practical guidelines. We try to design experiments that examine practical questions but that also provide insight into fundamental processes. In two experiments we looked at the effects of varying the flicker rate of fluorescent light by controlling the lamps using electronic ballasts (which are energy-efficient) as compared to the old technology, magnetic ballasts. The light output from light fixtures with electronic ballasts oscillates at ~40kHz, versus 120 Hz for magnetic ballasts. In both experiments we noted improved visual performance using electronic ballasts (e.g., Veitch & McColl, 1995; Veitch & Newsham, 1998). This is consistent with the neuropsychology literature; it also suggests that adopting electronic ballasts is a win-win solution for people and the environment. We also have studied the effects of varying light spectra on visual performance, cognitive performance, and appearance judgements (e.g., Veitch & McColl, 2001; Veitch et al., 2002).

Most of my work is in the Lighting subprogram, but I have also collaborated with colleagues in the Acoustics sub-program on two experiments concerning the effects of varying speech:noise ratios on acoustic satisfaction and cognitive performance. These were applied experiments, in which we exposed participants in our open-plan office mock-up to pre-recorded speech simulating one side of a telephone conversation, and then overlaid varying simulated ventilation noises to determine both the spectrum and level that would provide the best masking. Thus far we have analysed only the satisfaction data, finding that masking sound is judged as too loud if it is above 48 dB(A), even though it is more effective at masking at higher levels. Masking noise spectra that have greater high-frequency components are also better maskers, but too much high-frequency sound is also unacceptable (Veitch, Bradley, Legault, Norcross, & Svec, 2002). In the coming months we will analyze the memory and cognitive task data to see whether the effects parallel the satisfaction findings. These experiments were part of a larger project called Cost-Effective Open-Plan Environments (COPE), which developed a web-based software tool for open-plan office design, based on interdisciplinary research into ventilation, acoustics, lighting, and human factors issues.

A big part of our work is making the results useful and available to people involved in the design, construction, and operation of buildings. We do the usual academic things like present at conference and publish in journals, but we also speak at trade and industry events and give targeted seminars to relevant

groups. Our web site is also an important tool, and I invite you to visit it at http://irc.nrc-cnrc.gc.ca/ie. All of the papers cited above are available on the site in pdf, and much more, including the output of our COPE project.

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