

Implications

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Making the Cubicle a Better Place to Work

Open-Plan Offices and Productivity

The single most common workplace in North America is the open-plan office, with partial height furniture panels separating workers into cubicles. It is estimated that more than 40 million North Americans spend their working lives in cubicles, with many of them passing more waking hours in the open-plan office environment than in any other—even their own living rooms. There is abundant evidence that cubicle dwellers are not generally satisfied with this environment, a malaise perhaps best represented in our popular culture by Dilbert™ and his colleagues.

Nevertheless, recent trends in open-plan office design are likely to make environmental satisfaction even worse. Over the past two decades cubicles have been getting smaller, which is driven primarily by a desire to reduce real-estate costs. But, without careful design, smaller cubicles can mean more noise and less privacy, a greater concentration of pollutant sources, and more obstructions to absorb light.

Another trend has been towards lower panels between cubicles, the management theory being that this will increase valuable communication between co-workers. Lower panels mean better daylight pen-

etration, but they also decrease privacy and increase the incidence of acoustic and visual distractions.

Skeptics might suggest that negative effects on environmental satisfaction are unimportant to an organization's bottom line, but recent research suggests differently. Several studies have shown a significant positive link between environmental satisfaction and general job satisfaction; workers who are more satisfied with their environment (e.g., lighting, privacy, acoustics, ventilation) are more satisfied with their jobs. And, particularly in a white-collar setting, what could be more important for job performance than job satisfaction? In fact, research shows that organizations with higher job satisfaction tend to have lower rates of employee turnover, higher customer satisfaction, greater corporate commitment, better safety records, and better earnings, all of which have a big effect on organizational financials.

Therefore, the effects of changes in the design of an organization's office space on their bottom line are complex. Employers are increasingly aware of this complexity, and are increasingly willing to value environmental satisfaction as well as simple real estate performance indicators.



A productive work setting?

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Is this the perfect panel design? With windows to the right, the use of transparent panels makes the panel low enough for daylighting purposes and also high enough for speech privacy. Note that to really improve daylight penetration into the second row of workstations from the window, the upper panels of the panels to the left should also be transparent.

A desire to unravel this complexity and to provide design advice that benefits an organization and its workers as a whole is stimulating activity in this area. More organizations are willing to invest in up-front planning around these issues, and in post-occupancy evaluations (POEs) of spaces. The “green building” movement is also helping to bring these issue to the fore; rating schemes such as Leadership in Energy and Environmental Design for Commercial Interiors (LEED™-IC) place a high value on Indoor Environment Quality (IEQ).

Design Advice

So, an important way to increase organizational productivity in an office is to increase job satisfaction. Although job satisfaction is influenced by many things (e.g., management, training, salary), we also know that job satisfaction can be improved by increasing environmental satisfaction. A list of ways in which this might be done, divided into theme areas follows.

Satisfaction with Lighting

- Provide as many people as possible with a window, or at least a view of one.

- Reduce panel heights and use lighter-colored surfaces to increase daylight penetration, and to increase illuminance and lighting uniformity from electric lights.

- Use luminaires that have low brightness when viewed directly and that do not create reflections on a computer screen; this will reduce glare. Reflected glare is less obvious on a computer screen with a light

background and on an LCD screen; anti-glare filters can also be helpful.

- Use electronic ballasts with fluorescent lights to eliminate flicker. Electronic ballasts are also more energy efficient than magnetic ballasts.
- Provide individual dimming control over lights so that occupants can choose their own preferred light level. In the open-plan office, this requires aligning and assigning luminaires to workstations.

Satisfaction with Privacy and Acoustics

Studies show that the majority of office workers spend most of their time doing individual work where they need to concentrate without distraction. Another big chunk of time is spent conducting one-on-one conversations, either in person or on the phone, where they would likely prefer not to be overheard. Therefore, the focus of good design for privacy and acoustics is to increase speech privacy. This runs counter to current design trends, which seek to increase the propagation of speech.

- Specify panels that are higher than the heads of seated occupants—the higher the better for acoustic privacy. Panels that are high enough so that most people standing cannot see someone seated in their workstation also increase visual privacy.



A full-scale office laboratory for human factors study at the Institute for Research in Construction, National Research Council Canada.(NRC/IRC).

- Choose highly absorbent ceiling tile (absorption of 0.9 or higher) to reduce the level of reflected speech sounds. Increasing the absorption of other surfaces also helps.
- Emphasize the importance of office etiquette; ask people to be considerate of others' acoustic privacy when holding conversations.
- Increase the size of workstations; this improves privacy because it increases the distance between neighbors.
- Use a well-designed masking-noise system to “drown out” speech from other parts of the office, but limit masking noise levels to 45-48 dBA to reduce the chance that the system will become annoying in itself.
- Locate workstations, particularly entrances to them, away from high-traffic areas to improve both acoustic and visual privacy.

Satisfaction with Ventilation and Temperature

- Ensure that the heating, ventilation, and air conditioning (HVAC) system is well maintained, and that it meets outdoor air delivery rates and thermal comfort guidelines specified by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- Adjust supply air diffusers to avoid discomfort from localized drafts.

- Avoid very high panels (over 72” or 1.8 m), which can create an impression of poor air flow.
- Give individuals control over one or more of the following: air-flow rate, direction, or temperature.
- Choose windows with high insulation values, provide shading devices, and offer local sources of additional heating or cooling to offset thermal comfort problems near windows.
- Use low-emission materials and ensure regular cleaning of office furniture and carpets to reduce the effects of pollutants.

Interrelationships and Trade-Offs Affecting Workplace Satisfaction

The recommendations above clearly indicate achieving satisfaction in one area may be incompatible with achieving it in another—the most obvious example is related to panel height. While lower panels improve daylight penetration, the view to windows, electric light distribution, and satisfaction with ventilation, they also increase noise and reduce visual privacy. There is no such thing as a perfect solution, but full consideration of the most important factors in each situation, specific to the jobs people are trying to do, can improve the chances of a good compromise. This yields the final two recommendations:

- Consult with occupants of the space to discover what tasks they perform and which aspects of the office environment are most critical to this. Consultation should begin as early as possible in the design process.
- Form multi-disciplinary design teams to find appropriate compromises between the various effects of design choices on the workplace environment.



A typical open-plan office.

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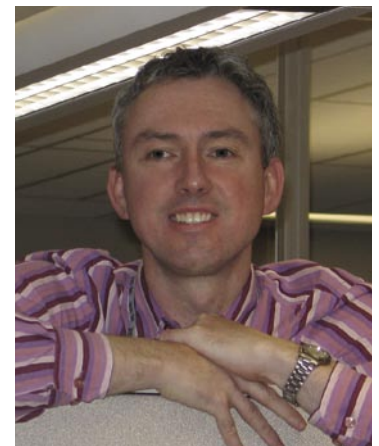
Other Recommended Sources:

- Detailed information on NRC/IRC's COPE (Cost-effective Open-Plan Environments) project, and software tools to aid designers, can be found at <http://irc.nrc-cnrc.gc.ca/ie/cope/index_e.html>
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About the Author

Guy Newsham, Ph.D., has more than 15 years experience researching indoor environments, and has published more than 100 articles on his work. He currently heads the Lighting Research Group at the Institute for Research in Construction, National Research Council Canada (NRC/IRC), and has also managed Cost-effective Open-Plan Environments (COPE), a multi-disciplinary investigation of cubicle environments. He joined Informedesign's Technical Review Board in October, 2005. Guy has a bachelor's degree in physics from the University of St. Andrews in Scotland, and a Ph.D. in Building Science from the University of Cambridge in England



Office Environments Research

The Institute for Research in Construction, National Research Council Canada (NRC/IRC) is a Canadian federal government research organization focused on buildings and the construction sector, and has conducted research on office environments for many years. Multi-disciplinary teams involving physicists, chemists, engineers, architects, and psychologists conduct this research. Several research approaches are used:

- Advanced computer simulation of various design choices on the physical conditions in office environments,
- Human factors studies in full-scale office laboratories on the effect of different physical environments on occupant mood, satisfaction, and task performance, and
- Field studies, in which the physical conditions, and occupant reaction to them, are evaluated in real buildings; these studies are less controlled than lab studies, but offer a more realistic setting and a longer exposure to conditions.

This research is conducted with the support of, and in collaboration with, both public- and private-sector organizations with a stake in office buildings. These supporting organizations are based in Canada, the US, and in other countries. More information is available at: <http://irc.nrc-cnrc.gc.ca/ie/index_e.html >

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Related Research Summaries

InformeDesign has many Research Summaries about open-plan office design and other, related, pertinent topics. This knowledge will be valuable to you as you consider your next design solution and is worth sharing with your clients and collaborators.

“Ventilation Influences Worker Productivity and Health” —*Indoor Air*

“Age Affects Perceptions of Workplace Design”
—*Journal of Industrial Teacher Education*

“Background Noise in Open Offices”
—*Ergonomics*

“Lighting Preferences in the Office Environment”
—*Lighting Research and Technology*

“Privacy is a Crucial Element in Workplace Design”
—*Journal of Environmental Psychology*

“Workplace Personalization”
—*Environment and Behavior*

“Office Lighting Controlled by Occupants” —*Lighting Research and Technology*

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