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By J.A. Veitch, K.E. Charles and G.R. Newsham

Well-designed workstations in an open-plan office will assure a comfortable, satisfying working environment for occupants. This Update reviews some of the key design issues and provides guidance for achieving a successful outcome, based on research conducted at NRC's Institute for Research in Construction and elsewhere.

Figure 1. Millions of North Americans work in regular grids of cubicles like these.

Open-plan offices began to replace enclosed offices in the 1960s. The early designs emphasized efficient workflow and communication, eliminated status markers, and rejected grid systems for layout. Curved panels and natural elements such as plants marked paths through the space and denoted work groups. Over time, the pressure to cut costs has led to a shift from freestanding desks and complex paths, to interlocking, modular furniture that can be reconfigured as necessary. The grid designs allow more employees to be housed in a given space, reducing real estate costs. Today, modular open-plan offices dominate North American commercial interiors (Figure 1), accounting for over 60% of offices.

Despite their widespread use, open-plan offices are the subject of many occupant complaints. Among the most common complaints are loss of visual privacy, distraction from nearby noise and conversation, and the lack of status markers. These and other problems suggest that modern workstation design has often failed to accommodate occupants' needs.

Before attempting a design, it is important to understand the issues involved and how they relate to one another. This Update summarizes occupants' needs with regard to workstations in the open-plan office, and provides guidance on workstation design for improving occupant comfort and satisfaction.

This Update expands on Update No. 60, which summarized the findings of the Cost-effective Open-Plan Environments (COPE) project. IRC's partners in COPE were: Public Works and Government Services Canada, the Building Technology Transfer Forum, USG Corporation, Ontario Realty Corporation, British Columbia Buildings Corporation, Steelcase Incorporated, and Natural Resources Canada. For more information on COPE, see http://irc.nrc-cnrc.gc.ca/ie/cope. Three related Updates address lighting, acoustics, and ventilation and air quality.
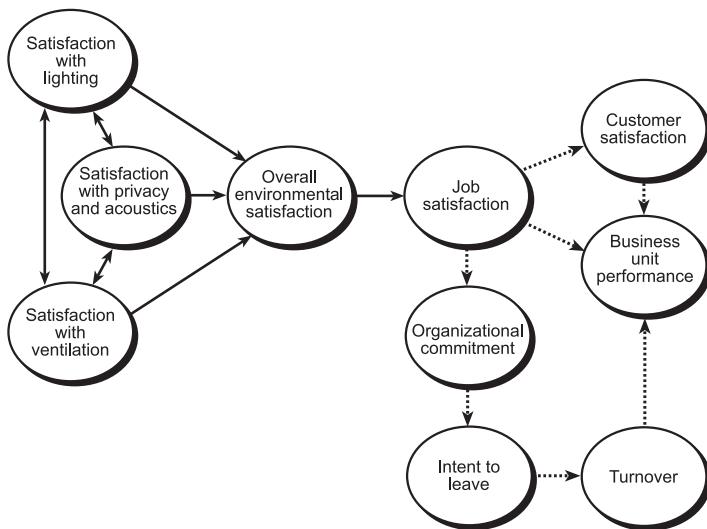
Figure 2. *Satisfaction with the environment contributes to organizational success. The solid lines represent findings from the COPE project; the dotted lines represent findings from other research.*

Why Satisfaction is Important

Offices are provided to enable employees to work in support of organizational goals. It follows that employers must ensure that these offices are well designed and conducive to employee comfort and satisfaction in order to maximize performance in pursuit of those goals. Satisfying employee needs is not an extraneous or frivolous concern; indeed, research at NRC's Institute for Research in Construction (IRC) and elsewhere indicates clearly that open-plan office design influences the attitudes and actions of employees in ways that have important financial consequences for the organization.

IRC's research included a field study of the effects of the physical conditions in open-plan offices on occupant satisfaction. The study was unique in its combination of detailed physical measurements and simultaneous occupant satisfaction data. The questionnaire results showed that there are predictable, positive relationships between satisfaction with the physical work environment, overall environmental satisfaction, and job satisfaction.[1] People who are more satisfied with the physical set-up of their workstations have higher job satisfaction. Findings were the same for both public- and private-sector employees, and both U.S.-based and Canadian organizations.

The findings are in agreement with other studies, indicating that changes to the physical environment can pay off if they improve satisfaction (Figure 2). For example, a U.S. study of white-collar and blue-collar employees found that people who were satisfied with their physical work environ-

ments reported higher job satisfaction, greater organizational commitment, and lower intent to leave the organization than those who were not satisfied.[2] A study of 8,000 business units in 36 U.S. organizations found that those units with greater job satisfaction had lower employee turnover, higher customer satisfaction and better unit profitability.[3] The effect on employee turnover was particularly strong.

It must be kept in mind that buildings and furnishings are a small part of the cost of running an organization. The capital and operating costs for buildings account for 8%, while the human resources costs (salaries and benefits) represent 82%.[4] In relative terms, office design choices are inexpensive and the costs of sound investments in design can be recouped quickly in the form of enhanced occupant satisfaction and performance.

Job Functions and Working Style

Sound investments in the open-plan office can be made only if the design takes into account the functions of the job and the needs of the employee. Employees are more satisfied when they have the proper equipment to perform their tasks, adequate storage for materials and tools, and a workstation layout that is suited to their size, height and reach.[1]

Although the importance of satisfying employee needs might seem obvious, there is a tendency to simplify office design by giving every employee the same furnishings and physical layout. In fact, job functions and work styles vary widely and can result in different furnishing requirements. Some people work best with plenty of horizontal desk space on which to place their files; others prefer to stack files vertically on shelves.[1] Only by consulting employees to understand the nature of their jobs and their personal work styles can space planners provide workstations suitable for their needs. Truly special requirements will require unique solutions.

Just as they want their tools and equipment to be close by, employees also like their offices to be located close to others in the same work group.[1] To arrive at a suitable arrangement, planners need to know how groups relate to and interact with one another, and how work flows from one group to another.

Controls and Adjustability

Allowing individuals to customize their environmental conditions is an effective way to accommodate the variability in needs and functions.[1] Adjustable chairs and keyboard trays are simple examples in this regard. Controls for lighting and ventilation are examples of systems that can be put in place to allow occupants to tailor these major environmental conditions to their liking. Giving them this measure of control yields many benefits to the organization: it improves their mood, enhances their creativity and intellectual performance, and leads them to solve interpersonal problems co-operatively.[5] Moreover, if the conditions are so adverse as to be stressful, the availability of controls can reduce the ill effects.

Care must be taken not to make the controls themselves problematic. They must be accessible, easy to use, well maintained, and responsive.[6] People want controls to be available so that adverse conditions may be eliminated, but they would prefer that conditions be suitable and comfortable in the first place. In other words, providing controls does not remove the need to aim for comfortable conditions.

Employee participation in office design decisions can also be considered an element of control and a contributor to satisfaction.[1]

Workstation Size and Boundaries

The most common complaints about open-plan offices relate to the size and boundaries of workstations. These may reflect conflicts between individual needs and management theories. For example, the desire to improve communication leads some organizations to have low panels or none at all. However, whether this design strategy promotes relevant communication or simply increases unwanted noise and distractions is questionable. More than half of professionals' time is spent at the computer and in quiet work requiring concentration, which requires that they not be distracted by extraneous conversations.[4]

As the number of people per office (regardless of its floor area) rises, environmental satisfaction tends to fall.[1] More people means more possible social interactions, more sources of distraction and less privacy. Unless the nature of the work requires that there be a completely open layout, or "bullpen," for constant information sharing—for example, a large control room, where people work as
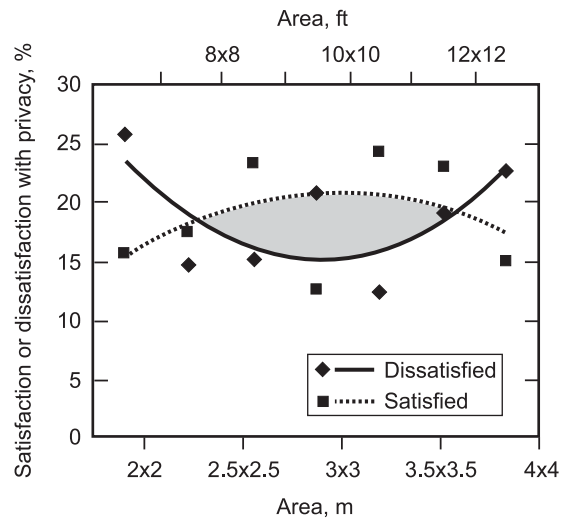

Figure 3. The shaded area indicates the range of workstation sizes with which people are most likely to be "satisfied" as opposed to "dissatisfied" with privacy.

a team—avoid designs that place many people in an unbounded area. Also avoid layouts that require people to pass through an unrelated work group's office space on the way to their own.

Larger workstations, with more floor area, assure more privacy and greater environmental satisfaction. However, there is a point at which the size might become too large to be considered satisfactory, as seen in Figure 3.[1] There is a middle range of workstation size—between 2.4 m and 3.6 m on a side (8 and 12 ft)—for which more people are satisfied than dissatisfied.[1] Outside that range, there is more dissatisfaction than satisfaction. Very large areas that occupants consider unsatisfactory result in longer travel distances to shared resources, and might contribute to feelings of social isolation.

When the panel height is lower than 1.37 m (54 in.), dissatisfaction with privacy rises.[1] This is consistent with many other studies that have found that people prefer to be enclosed rather than exposed. The 1.37-m height provides visual privacy to the extent that a seated person can not be seen by a seated person in the next cubicle, although higher panels are needed to establish good acoustical privacy (see Update No. 63).

Not surprisingly, many studies have found that access to a window makes a difference to a person's satisfaction.[7] Having a window in the cubicle has a particularly positive effect on satisfaction with lighting. A high percentage of occupants that do not have a window wish they had.[1] The window view connects the occupant to the outside world and contributes to one's ability to cope with stressful situations.

When it is not possible to give everyone a window directly, lower panels or panels with a transparent section can provide better daylight penetration and greater access to views (see Update No. 62), although this can conflict with the need for higher panels to provide visual or acoustical privacy. Finding the right balance between competing requirements for each project is a design challenge; there is no generic answer.

Detailed recommendations on workstation layout are provided by the Canadian Standards Association.[8]

Status and Recognition

Open-plan office designs that provide a single, standard cubicle fit-out fail to provide needed markers for conveying the status of office occupants. Satisfaction is greater when designs match employees' expectations for their positions.[1] Furthermore, environmental satisfaction, job satisfaction, and well-being are greater when employees are permitted to personalize their workstations. Regardless of status issues, an investment in well-built, attractive furniture will pay off in increased comfort and satisfaction. Regular maintenance and cleaning are also important contributors to a good office environment because they influence aesthetic impressions of the space and show regard for employee well-being.

Summary of Recommendations

There are many factors to consider in designing a suitable open-plan office environment. Designers, sensitive to varying needs, must weigh the options for each project, taking into account the individual and organizational needs and the practical possibilities in the space. Some design guidelines are as follows:
• Avoid generic solutions:
  – Design and furnish for specific job requirements
  – Enable adjustability and control
  – Provide status markers suited to rank and occupation
  – Allow personalization
• Consider the boundaries:
  – Avoid large unbounded groups of workstations
  – Keep workstation area in the range of 2.4 m x 2.4 m to 3.6 m x 3.6 m

  – Keep panels above 1.37 m where visual privacy is important
  – Maximize access to windows and daylight
• Clean regularly and perform ongoing maintenance.

IRC developed a web-based software tool to assist in evaluating the merits of various design choices. The COPE Office Design Evaluator software can be found at the following URL: http://irc.nrc-cnrc.gc.ca/ie/cope/COPE-ODE/pre_scenario.php.

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