

The Concept of Workplace Performance and Its Value to Managers

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The question of how office workers are affected by features of the physical environment in which they work has preoccupied researchers as well as designers and building industry professionals for many years. However, in spite of a growing need for, and exposure to, workspace design decision making, managers still tend to see “space” as peripheral to their core activities and, indeed, to the mission of their companies. Our growing knowledge about environmental effects on building occupants’ productivity and morale is creating a need to integrate workspace considerations into core business decision making.

Increasingly, managers are required to make decisions that affect the quality of the environments in which people work. The range of workspace types is proliferating—open plan, teamspace, moveable furniture, personal harbors or personal environment modules, and gruppenraum (group office), to name but a few. The workspace in most companies today combines more than one type of space and, furthermore, is in a state of constant change. These changes can be small-scale (e.g., adding new desks or offices for new employees) or large-scale (moving the entire company into a new building) and anywhere in-between. Consequently, managers make decisions about space regularly and often, whether they are aware of it or not. Familiarity with the environmental psychology of the workspace will help managers in any organization make more cost-effective and beneficial workspace decisions.

Performance and Productivity

The concept of “workplace performance” means a workspace whose explicit objective is to support the performance of work: a performing workplace is designed to optimize worker productivity. However, worker productivity,

although meaningful in an economic context, tends to be applied in a vague and general way to a whole range of desired behavioral outcomes in the context of work. A recent review of studies of the effects of environment on productivity concluded that confusion about what productivity means has made it difficult to identify how environmental conditions affect worker performance.¹ Many studies use respondents' own self-reports of "improved" or "reduced" productivity, and we cannot accurately know what this measure means in spite of its presumed reliability. In order to make workplace performance a useful concept linking environmental design with workers' ability to perform tasks, it is useful to define worker productivity in terms of environmental design-relevant categories. These three categories are individual, group, and organizational productivity: each category denotes a variation in scale of environmental influence.

Individual productivity is typically evaluated at the scale of the individual workspace (desk, office) and on how the micro-environment influences individual task performance (ITP), that is to say, how fast and accurately a worker carries out his tasks at work.² In modern offices, individual tasks are often computer-based and involve the processing and flow of documents or information, either virtually or in hard copy. In a typical ITP workspace, each individual tends to sit in one place for most of the day and to perform the tasks assigned. Task performance is affected by environmental conditions such as lighting and visual conditions, variations in temperature and humidity, furniture ergonomics, and acoustics. Positive productivity outcomes mean improved speed and accuracy of the tasks performed, whereas negative outcomes might include a higher error rate, slower time for task completion, or adverse health effects on workers (such as sore eyes, fatigue, or respiratory problems).

The *productivity of workgroups* sharing a workspace is typically evaluated in terms of the quality and quantity of group processes, called collaborative teamwork (CTW). CTW corresponds to the scale of the mid-range environment, that of the work-group or team. CTW productivity is measured in tangible terms (such as time to market of a new product) or in terms of more qualitative out-

comes (such as number of useful new ideas or successful recommendations). Group process is affected by workgroup size and the relative proximity of team members.³

Other environmental determinants of

workgroup effectiveness include the positioning of work areas and shared space, as well as access to shared tools and equipment. The workspace makes CTW processes more or less effective through its effects on communication and the exchange of information, as well as on team member collaboration. In the 1990s, many companies (such as Digital, Zurich Insurance, and Hypertherm, Inc.) experimented with workspaces designed for teams (teamspace), where space occupancy is a function of the size, duration, and importance of team projects.

The *company or organization's productivity* is viewed in terms of the entire workspace or accommodation—the macro-environment.⁴ By identifying this

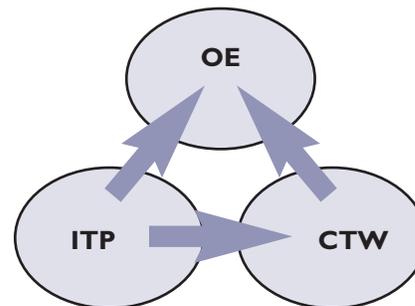
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level of productivity as organizational effectiveness (OE), it is possible to assess the degree to which the workspace helps (or fails to help) a company meet its business objectives and/or increase its competitive advantage. At this level, space is defined as an organizational resource and the environment is designed to further organizational goals.⁵ OE is affected by locational advantages and ease of access, balancing consolidation under one roof (centralization) with dispersion of different groups in different facilities over manageable distances, and by building amenities such as fast elevators, convenient restrooms, adequate parking, and attractive eating areas. The larger issue of recruitment and retaining trained staff is also affected by environmental factors; many companies (including Sears, Pfizer, Bloomberg, and Cabot Corporation) have invested in a high-quality work environment for this specific purpose. Studies have shown that both worker performance and organizational success is compromised “when the physical environment interferes with actions taken towards achievement [of objectives].”⁶

Figure 1 shows how the three categories of environment-related productivity, and the intermediate and combined sub-categories that might apply in different situations, are all linked and “nested.” The environmental effects on ITP (micro-workspace) affect CTW (midrange-workspace), and both interact with OE (macro-workspace). In order to understand how and to what degree the spaces where companies accommodate their workers make a contribution to their bottom line, it is useful to break down what we mean by productivity into these three categories in order to increase the precision with which we use the term “environment.”

A worker who has trouble concentrating on work at her desk because her team members seated in the vicinity keep up a constant stream of loud conversation might perform less well than others at the scale of ITP. However, the quality of the team process depends on rapid and impromptu exchanges of information; waiting to schedule meetings would reduce its CTW effectiveness. Thus although the midrange workspace enhances CTW productivity, the micro-environment is less effective for those team members who are easily distracted by noise. This team’s output might take longer than other teams doing similar work, and on occasion the quality of its product might be inferior. If enough teams are affected in this way, OE suffers. The figure indicates that workers are affected in different ways by workspace conditions, depending on whether their tasks are defined individually, in the context of a team, or with reference to overall company operations. Managers need to be aware that most workspace

FIGURE 1. Three-Way Breakdown of Worker Productivity in Relation to the Work Environment



design decisions affect more than one level of performance. Decisions about furniture, for example, affect ITP because of furniture's effect on ergonomic comfort and lighting, but they can also affect CTW in terms of how and where offices and workstations for team members are placed, whether or not there are tables and chairs placed where small groups can have unscheduled meetings, and how well issues of noise and privacy are managed.

Tools exist to measure environmental impacts on productivity in each of the three categories. ITP is the most often measured, using various tools for ergonomic analysis as well as a wide variety of questionnaire surveys that focus on the effects on building users of ambient conditions as lighting, noise levels, furniture comfort, temperature, and indoor air quality. CTW studies tend to be more dependent on anecdotal data, although indirect measures (such as analysis of social networks,⁷ "gaming,"⁸ and comparing outcomes among comparable workgroups in different environments⁹) have also yielded valuable results. A number of measures are available to study OE, although few were designed to look at the macro-workspace. A recent review of four of the most popular methods concluded that none is entirely satisfactory, OE being an elusive concept to define and measure.¹⁰ However, some researchers have been successful adapting the Balanced Scorecard to measure environmental effects on OE.¹¹

Effects of the Work Environment on Individual Productivity

As outlined above, analysis of how the physical environment for work affects performance varies in terms of the environmental scale at which productivity is being studied. The three categories—ITP, CTW, and OE—help guide us through what is known about this relationship.

One of the first research studies to demonstrate a measurable link between human productivity and office design was the BOSTI-Westinghouse study of the impact of a major office move on employees' attitudes and activities.¹² This study used employee self-reports of productivity (ITP) to measure the impact of features like open office design on task performance. It assessed the effects on OE productivity by quantifying employees' worth or value to the organization by using gross salary figures. Results indicated that a "better" workspace provided a better return on investment by helping people produce more work. "Better" in the context of this study referred to private offices instead of open workstations.¹³ At about the same time, an overview of studies measuring the impact of furniture and layout changes on teams working on assembly line-like paper processing tasks (CTW) in different organizations indicated extraordinary increases in process speed and results.¹⁴ These findings are reminiscent of the changes in task performance found in the 1940s in the famous Hawthorne studies of lighting in factories, and they lead to concerns that any environmental change improves team performance regardless of its actual effect on ITP.¹⁵ More judiciously, several recent studies conclude that workspace design can be supportive (have positive effects on work) or non-supportive (have negative effects

on work),¹⁶ as well as affect the less easily definable “organizational performance.”¹⁷

Early studies of the office environment were less concerned with employee productivity and more concerned with understanding how people are affected by the space and conditions in which they work.¹⁸ Steele identified the field of Organizational Ecology in which organizations are analyzed according to different aspects of their structure and function, including features of the workspace they occupy.¹⁹ The systems framework of Organizational Ecology strengthened the notion that the space it occupies is an integral part of how an organization functions. The later work of both Becker and Steele built on this concept, producing such ideas as “workscape” to indicate an inclusive approach both to the study of and to the planning and design of the work environment.²⁰ Field studies in the 1980s favored studies of the “open plan” concept and largely concluded that occupants were dissatisfied.²¹ As a result, and in parallel with research in other areas of environmental psychology, occupant satisfaction has become the main yardstick by which workspace features are assessed. A preponderance of studies has identified occupant satisfaction or dissatisfaction as the predominating outcome measure, with many assuming a direct link between users’ level of job or workspace satisfaction and their effectiveness or productivity.²²

Along with research on global concepts such as user satisfaction, an increasing number of ergonomically oriented studies have looked at specific environmental conditions in offices, such as ventilation and indoor air quality, lighting and “daylighting,” acoustics and noise control, and furniture placement and comfort. In these studies, user satisfaction tends to feature less as the single outcome measure; environmental effects on task performance, rates of absenteeism, and self-reported productivity are preferred. Lighting research, for example, has tended to distinguish between the effects on building occupants of artificial, interior lighting and of natural light or daylighting from windows. Daylighting research has linked increased comfort and self-reported productivity with window size and proximity, as well as with view out, control over blinds, and shielding from glare.²³ More significantly, research on daylight and views from hospital rooms has been shown to affect medication requirements and recovery rates.²⁴ In their recent overview of the effects of different kinds of artificial lighting on task performance and occupant satisfaction in a simulated office environment, where workers used controls to exercise their lighting choices, Boyce et al. concluded that current office lighting standards are preferred by most people carrying out typical individual office tasks.²⁵ The study results made a distinction between visual comfort (lighting needed to perform well on office tasks) and satisfaction (lighting judged to be aesthetic).

Current studies of noise in offices have adapted techniques for measuring noise levels in industrial environments. Workers in open plan workspaces tend to judge noise to be a primary source of discomfort and reduced productivity.²⁶ Acoustic comfort studies have focused on correlating physical measures (such as signal-to-noise ratios at different densities, background noise levels and intensi-

ties, and speech intelligibility under differing physical conditions) with occupant judgments of distraction and annoyance.²⁷ Efforts to control office noise through more absorbent surfaces, sound-masking systems, and behavioral controls have been weakened by increasing office densities and collaborative work in modern workspaces.

The largest number of environmental psychology studies of the workspace have focused on floor configuration and furniture layouts in the open plan office. Research indicates that these factors have the greatest influence on worker satisfaction and ITP and CTW.²⁸ Studies have tended to focus on the height and density of workstation partitions, the amount and accessibility of file and work storage, and furniture dimensions such as work-surfaces as being the elements of furniture and spatial layout that have the most effect not only on the satisfaction of individual workers, but on the performance of teams. One study indicated that the additional investment in ergonomic tables and chairs for workers, as well as ergonomic training, yielded a 5-month payback in terms of increased ITP productivity.²⁹ Several studies provide evidence that office workers are uncomfortable in open plan configurations and prefer private enclosed workspaces, which may work better for individual tasks but are less successful for teamwork.³⁰ In addition, aspects of psychological comfort such as territoriality and privacy are strongly affected by spatial layout: office size and location is linked with sense of status; partitioning influences acoustic as well as visual privacy; amount of work-related storage affects sense of territory and status.

In sum, a disproportionate amount of what we know about the effects of the workspace on the performance of work focuses on ITP at the scale of the micro-environment, and it defines effects on productivity in terms of individual preferences and satisfaction. However, other frameworks exist to guide workspace research, which have the effect of shifting the emphasis from the individual worker to the midrange and macro scales of CTW and OE.

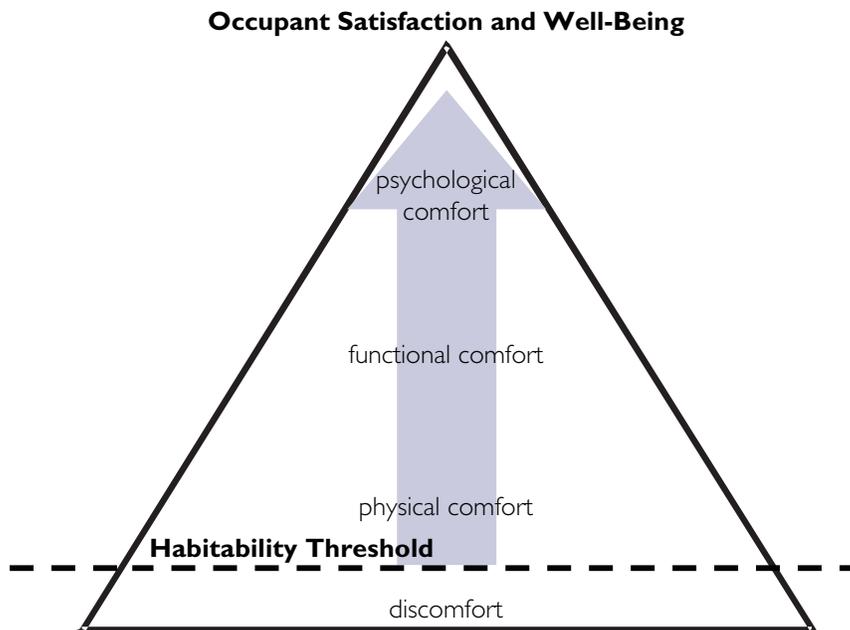
Effects of the Work Environment on Group and Organizational Productivity

Along with the satisfaction framework and the ergonomic model described above, two additional models have guided study of the environmental psychology of the workspace. These are Herzberg's "hygiene" model in the 1940s and the "stress/arousal" model of industrial/occupational psychologists in the 1970s.³¹ According to Herzberg, several key elements of the work environment influence worker motivation, and they can be negative, positive, or neutral. Among the elements he identifies, the workspace can be either a neutral or a negative influence on worker motivation, implying that if it is supportive of the performance of work, it is not noticed. Herzberg makes no distinction between the different scales at which the workspace affects performance, appearing to consider worker performance a direct correlate of organizational effectiveness. He describes a threshold effect, indicating that some work conditions that affect motivation, such as a workspace, can be measured in terms of their propensity

to move from a neutral, “no effect” category into “negative effect,” without passing through a “positive effect” category.³² Studies based on Herzberg’s theoretical framework measure productivity outcomes in terms of negative consequences avoided rather than the added value of a good work environment; the emphasis on worker motivation connects to OE or the macro-workspace.

Stress/arousal theory focuses on the cognitive and affective processes of office occupants and how these are influenced by environmental conditions. The stress argument states that some physiological arousal caused by environmental demands may be needed in order for people to feel challenged. However, if environmental demands expand (job complexity, employer expectations, less time available), the positive effects of stress on arousal are replaced by the negative effects of strain. The relationship of environmental factors to stress is complex, as sources of stress include a wide range of psychosocial influences on workers (such as job characteristics, employer relations, and social support networks) as well as the effects of the physical environment.³³ Moreover, recent research indicates that not only do employees’ cognitive and affective processes affect their perception and evaluation of their work environment, but also that their perception and judgment of their workspace affect their view and assessment of themselves as workers and of their effectiveness.³⁴ One study comparing open office users with enclosed office users showed that extroverts respond more positively to more possibilities for communication, and therefore do better in open office settings than workers with more introverted personalities.³⁵ McCoy and Evans point out that physical stressors in the workplace affect workers’ sense of control, with repeated negative environmental experiences generating a sense of “learned helplessness” and diminished motivation.³⁶ Physical stressors also affect social relationships, as the negative effects of stressor exposure reduce “cooperative behaviors, such as social support, altruistic behaviors, and teamwork.”³⁷ Whereas the motivational model emphasizes OE, the stress/arousal approach is scaled to CTW and ITP, midrange and micro-workspace.

The “environmental comfort” approach, focused on measuring workplace performance from the perspective of building users, creates connections among all three categories of productivity and all three scales of the work environment. Applied traditionally in architectural history research to shed light on the functional aspects of the dwellings and buildings of older and remote cultures, the concept of comfort has more recently been applied to defining standards for building systems’ performance in public spaces such as office buildings. Comfort as a basis for setting environmental standards developed out of the recognition that people need to be more than simply healthy and safe in the buildings they occupy. Once health and safety are assured, users need environmental support for the activities they are there to perform, called “functional comfort.”³⁸ Comfort links the psychological aspects of workers’ likes and dislikes (“satisfaction”) with concrete outcome measures such as improved task performance (ITP and CTW) and with organizational productivity through environmental support for worker motivation (OE). Managers and decision makers at all levels need to

FIGURE 2. Ranges of Environmental Comfort, from Basic Habitability to Optimal Well-Being

understand environmental comfort in order to benefit fully from the workspace in which they are investing.

Comfort and Workplace Performance

Environmental comfort involves three related categories that form a hierarchy and serve to set priorities on workspace change.³⁹ All three need to be considered if comfort is to be understood in context. At the base of the triangle is physical comfort: basic human needs such as safety, hygiene, and accessibility. These needs must be met to ensure that the environment is habitable. Once users' basic needs are met (usually through applying existing building codes and standards), functional comfort must be considered. Functional comfort is defined in terms of users' performance of tasks and activities in the work environment. Appropriate lighting for screen-based work, ergonomic furniture, and enclosed rooms available for meetings and collaborative work, for example, help ensure functional comfort. At the peak of the triangle, harder to measure—but playing an important role in workspace satisfaction—is psychological comfort, that is, feelings of belonging, ownership, and control over one's workspace. The model indicates that, although weakness in one area of comfort can be compensated for by strength in another, OE benefits are most likely when environmental support for ITP and CTW occurs at all three levels. The model is illustrated in Figure 2. The direction of the arrow indicates the cumulative positive effects of meeting users' comfort needs in all three categories.

As a decision-making tool, the three-part comfort framework helps designers and managers both assess comfort in the workspace they are responsible for and set priorities on investing in improvements. At each level, the social, economic, and management implications of design decisions are different.

At the base of the triangle is the threshold between space that is too uncomfortable to allow work to be performed, and space that is minimally physically comfortable. To ensure positive effects on individual and team performance, users' physical comfort must be assured and the negative impacts (e.g., unsafe, health-threatening conditions) must be avoided. This basic level of building habitability is called "building convenience."⁴⁰ Our research indicates that a building that scores low on building convenience is not physically comfortable and therefore not easily compensated for by the other comfort categories.⁴¹ When workers identify a physical comfort problem, it tends to have a negative effect on their overall assessment of their work environment.

Functional comfort, the second level of workplace performance, addresses how effective the workspace is in helping users perform their tasks and focuses on ways of ensuring that the workspace is both a support and a tool to help get work done. It speaks to the need to invest in good workspace design and management in order to add value to the work being performed. In terms of the stress/arousal and motivational models, studies have shown that inappropriate lighting, ventilation, and noise levels are environmental stressors that have negative effects on worker morale and productivity, as well as health.⁴² Ill-health affects organizational productivity (OE) through employee absenteeism, lateness, increasing health insurance premiums, and, through burnout, increased employee turnover. Thus the functional comfort of the workspace, by affecting ITP and CTW, also has a direct impact on OE—not only negatively, when people experience discomfort, but also positively, when people's work is environmentally supported.

Today's workspace has to facilitate a wide variety of tasks at an ever-increasing rate of change without causing buildings to be more complex and costly to build and operate. Users' own assessment of their functional comfort, using carefully constructed scales to measure the functional comfort dimensions in each work environment, provides a valid and reliable indicator to decision makers of how well workers feel the workspace is functioning, and whether or not improvements need to be made to help people perform their tasks better. Workers can, when questioned appropriately, define features that are and are not comfortable related to ITP, such as working at a computer screen. They can assess how CTW is affected by the availability of places to meet, acoustic conditions, and appropriate furniture and technology. Systematic feedback from building users is a way of ensuring continuous improvement in functional comfort and consequently in work performance. Because space that is functionally comfortable helps people get their work done, and space that is functionally uncomfortable can lead to increased stress levels, managers need feedback from building users on functional comfort to guide workspace design decisions.

At the top of the pyramid is psychological comfort, a concept that is only beginning to be measured in the office environment.⁴³ Psychological comfort links psychosocial aspects with the environmental design and management of the workspace through territoriality, privacy, and control. The primary component of psychological comfort is sense of territory, both individual territory (office, workstation, micro-workspace) and group territory (team, group, midrange workspace), with effects on both employee stress levels and motivation. Human territoriality at work has psychological value represented both by space for one's work and by one's place in the organization. It also affects employees' interaction with the environmental milieu.⁴⁴ Underlying territoriality is a human behavioral schema that expresses itself in the personalization and appropriation of space, marking territory, and constructing boundaries.⁴⁵ Workspace personalization and space appropriation behaviors have become more noticeable in offices where denser and more open office configurations have been installed.⁴⁶ The introduction and use of new technology and better virtual communications tools have also affected workers' perceptions of and attitude towards their physical environment and workspace configuration.⁴⁷

ITP and CTW productivity are affected by sense of territory. However, territory is not simply made up of the walls and doors that enclose space. Sense of privacy, sense of status, and sense of control are fundamental components of territoriality, and most people perceive and judge workspace, in part, according to these criteria. Studies have found that people moving out of private enclosed offices into open workstations judge their environment more negatively, citing lack of privacy, acoustic conditions, and confidentiality problems.⁴⁸ These reasons are given irrespective of whether or not their work is confidential, and whether or not they need to be alone to perform tasks effectively. This widespread finding seems to be independent of the actual physical features of the workspace, such as furniture configuration and partition height. On the other hand, careful interviewing and observation of professionals in open workstations who were not faced with an imminent or recent move yielded the finding that the demands of the job are more important than individual privacy.⁴⁹ The need for privacy seems to be only indirectly related to workspace design and to be dependent more on psychological factors at work, such as concerns about status and control.

Experimental efforts to increase users' environmental control provide evidence of the beneficial effects on workers, including one experimental design that found a clear association between participation in decision making and degree of workplace satisfaction following a move to a new facility.⁵⁰ Environmental control can be mechanical: chairs and work surfaces that are raised and lowered; work-tables on wheels to be moved around; switchable lights; and a door to open and close. Evidence indicates a positive psychological impact from this type of control in certain circumstances.⁵¹ Another form of environmental control is empowerment: increased opportunities for employees to participate in workspace decision making. This form of environmental control is a constructive response to the need for psychological comfort: it helps people cope with envi-

ronmental demands, and it encourages people to find new ways of solving problems, so that users increase their learning and knowledge about their building and workspace. Environmental empowerment is directly linked to psychological comfort. People who are informed about workspace-related decisions, and who participate in decisions about their own space, are more likely to feel territorial about their workspace and to have feelings of belonging and ownership.⁵² However, in many companies today, employees have little say in decisions about the design and management of their workspace, and no control over ambient environmental conditions.

All companies have the possibility of making their workspace more productive and supportive of the performance of work—some more than others. The productivity model described earlier breaks productivity out into three levels or categories that correspond to the scale at which the work environment is defined, thus making it easier and more logical to see the relationship between task performance and environmental design. The comfort model is composed of three categories of comfort, each of which addresses a different level of support for the performance of work. Putting these together indicates the building blocks of a corporate workspace strategy, as shown in Table 1.

In the context of today's business world, where the speed of changes in markets, organizational structures, and office technology almost makes the idea of occupying built space an anachronism, a performing workspace must also be responsive to time constraints.⁵³ Amenable to rapid change, planned on an interactive basis to help users adapt, and above all designed to be a tool for work, a performing workspace means that functional comfort is ensured through the processes of dynamic exchange between users and environment. The processes used today to plan and design workspaces for delivery to users, who then have to adapt to what they are given, will have to change, as will workspace concepts based on fixed points in space and time. The key to designing a performing workspace is ongoing and reliable feedback from users on their levels of physical, functional, and psychological comfort, and applying this feedback systematically to workspace planning and design.

IMS Health Canada Moves into a New Workspace

In 2003, IMS Health Canada, the Montreal office of the world leader in medical information gathering and analysis, decided to build new facilities to address present and future expansion needs. The company felt it had outgrown its leased, 3-story, suburban office building. Individual task performance was affected by the too-bright artificial lighting, poor indoor air quality and crowded working conditions, and collaborative team work could not take place as there were insufficient conference and meeting rooms and people could not find each other behind high partitions on crowded floors. Thus, organizational effectiveness was being affected by an overcrowded and task-inappropriate workspace. In order to determine what decisions to make for the new workspace and to assess the value to the company of various environmental alternatives, the tri-partite comfort model was applied to workspace design in the following way.⁵⁴

TABLE I. Elements of Organizational Space Planning Strategy

	Physical Comfort	Functional Comfort	Psychological Comfort
ITP	Basic health and safety; ventilation and IAQ standards; ergonomic standards (e.g., lighting, furniture); building convenience.	Ambient conditions defined by requirements of tasks performed in the micro-workspace (e.g., reading, writing, computer work) and assessed using feedback from building users.	Information about the workspace (e.g., adjustability of furniture, plans for moves and changes); territorial definition; participation in workspace decisions.
CTW	Basic health and safety; ventilation and IAQ standards; building convenience.	Space configured for teamwork: shared meeting-space, desks close or visible; team workspaces (such as project rooms, white-boards, shared technology); internal group processes used to make teamspace decisions.	Team has control over moving or changing its workspace; territorial definition; group informed about and invited to participate in corporate workspace decisions.
OE	Basic health and safety; ventilation and IAQ standards; building convenience.	Accommodation reflects corporate values; corporate space standards and planning procedures responsive to the way employees work; value of feedback from employees; decisions about the workspace based on organizational needs rather than image or cost.	Workspace as a tool for work, investment in work-force; organizational effectiveness outcomes linked to workspace assessment; environmental design of workspace responsive to operating procedures and business processes; employees kept informed about and invited to participate in corporate workspace decisions.

A professional team made up of the architect, cost estimator, interior designer, and contractor representatives was engaged to determine the basic parameters of the new building—size, site, cost, construction process and materials, and timing—such that physical comfort was assured. The company determined that the value of resources invested in physical comfort—that is, the health and safety of all personnel—could not be questioned. The client's participation on this team ensured that physical comfort not only remained a priority, but was placed first throughout the decision-making process. The company felt that the more the client participated, the more customized the building would be to users' needs. They were concerned that by following conventional processes, it was easy to make a mistake or an oversight that compromises physical comfort—no night-time illumination of outdoor or underground parking areas, fresh air intakes located next to the delivery dock, taking in the exhaust of idling trucks, insufficient or undersized bathroom facilities—with costly long-term consequences. If a decision was made that did not optimize physical comfort, such as to build windowless workspaces, it was made explicitly because other considerations (equipment needs, for example) predominated, and not by mistake.

To help determine priorities for users' functional comfort, IMS employees were surveyed using a survey form developed and tested to measure the twelve key functional comfort dimensions.⁵⁵ This highly structured and useable form of feedback from building users provides prioritized information on functional comfort concerns. At IMS Health, the survey results enabled value to be attributed to each investment in improving functional comfort of the new workspace. Feedback from workers indicated a need for more privacy (control over accessibility by others) to allow them to concentrate. They also expressed a need for more natural light. The lack of collaborative workspaces was ascertained, as well as stuffy air that made people sleepy, and poor acoustics in some areas. These, in addition to other factors affecting work performance (such as the discomfort of un-ergonomic workstation furniture, volatile thermal comfort, poor lighting quality, and lack of convenience and accessibility of some equipment), provided managers with a profile of what worked and what did not in the existing building. These became the basis for setting design priorities in the new building.

Investing in a company-wide user survey also affected psychological comfort because it was a step towards "environmental empowerment." Inviting staff to participate in workspace design is generally easiest for those corporate cultures that promote egalitarian values such as employee ownership of ideas and procedures, transparent decision making, flat hierarchies and self-managed teams. It is most challenging in those corporate cultures with hierarchical decision making, a competitive culture, control over information flow, and emphasis on tradition. One of the goals of IMS Health was to create a more open and collaborative workplace, which would provide the different work-groups with better accessibility to each other, to team leaders, and to senior managers. The company wanted to make full use of the process of workspace decision making to help open up the corporate culture and empower staff. In order to work towards this goal, they invested in information sharing and providing opportunities for participation in design decision making. Being adequately informed and having some say in or control over decisions, employees found constructive rather than defensive ways of meeting their territorial needs. A variety of techniques were used, including group brainstorming sessions and focus groups, a newsletter reporting on progress of the new building project to which employees were invited to contribute their questions and concerns, and plans and models displayed at different stages of construction in the cafeteria and around the elevators. Employees also received results of the functional comfort survey and were invited to discuss them. Each participation opportunity provides a different opportunity to share some amount of information and to invite some participation in certain decisions. IMS found that educating users about their workspace seemed to give them a sense of control that imparted a positive attitude towards the new workspace and enabled staff to feel they "owned" the changes that it represented.

The functional comfort survey was conducted a second time some nine months after moving into the new building. Results showed that five of the functional comfort dimensions improved in the new building and three stayed

the same. As well as better space for collaborative work, people appreciate the better daylighting, feel they have better air quality, and also feel their furniture better supports computer work. Only two key dimensions show some reduction in level of comfort. Acoustic comfort appears to have diminished, indicating that people need to manage noise-generating behaviors better in the more open space. In addition, users indicate less satisfaction with the aesthetic aspects of the new space. The colors used in the interior, and the look of the interior spaces, are less appealing in the new building. The results confirm that functional comfort in the new building is equal or superior to functional comfort in other, comparable office buildings.

IMS decision makers were satisfied that they had identified the right ITP and CTW priorities to invest in. By prioritizing improvements to those environmental aspects that affected functional comfort negatively in the older building, IMS Health provided a new workspace that supported work performance both functionally and psychologically. In short, the company added value through improved environmental quality that directly affected organizational effectiveness.

Conclusions

Managers need to understand the various ways in which workspace decisions affect workers and their productivity. The more this knowledge is applied to workspace design, the more the company will derive from its investment in accommodation. The environmental comfort model is one way to approach an analysis of users' relation to environmental conditions, not only to differentiate between the influences of different buildings, task types, and corporate cultures, but also to develop tools and techniques to measure different aspects of workspace comfort. The results can then be applied to a wide range of workspace decisions, in place of more typically hasty and uninformed decision making. Small changes, such as moving to another desk or floor, can affect workers, as can major changes such as moving into a new building.

One of the advantages of the tri-partite comfort model is to help assess the value of investments in the workspace. The notion of "value" or "worth" is in part context-dependent and in part absolute. The value of the workspace to a company is likely to be embedded in the cultural values of the organization. It cannot be determined without reference to workers needs, organizational expectations, and environmental comfort. It is at this stage in the development of the model that the relevance of organizational effectiveness as an objective and as a criterion for assessing value becomes obvious. Those environmental items that increase ITP as well as CTW increase the value of those workers' activities to the organization and thus are worth investing in. However, they are moving targets: people's tasks are changing, their technology is changing, and they themselves change through training and turnover. The comfort model shows how to determine the degree of environmental support employees are getting from their workspace and how to track this over time. The differentiation of environmental

comfort into three related categories also helps determine ways in which strengths in one may compensate—up to a point—for weaknesses in another.

The tri-partite environmental comfort model is one of the few systematic ways of accessing and addressing not only basic physical requirements of workspaces, but also the intangibles of people's relationship to their territory and feelings of ownership and belonging. Whereas building industry professionals have the knowledge to ensure physical comfort (and the staff themselves and trained designers can contribute to ensuring functional comfort), it is managers and decision makers who manage process in organizations that will have the most effect on psychological comfort.

Companies are constantly making decisions about their accommodations. The goal is to yield enough solid information to enable the model to be applied to practical decisions about the allocation of resources. In understanding the distinctions between physical, functional, and psychological comfort, we can begin to help companies determine what effects investment in the workspace has on individual, group, and organizational productivity and what these effects are worth to the company.

Notes

1. C.A.B.E., *Office Design and Business Performance: Technical Report*, London, U.K., D.E.G.W. (2004).
2. K.F.H. Murrell, *Ergonomics: Man in His Working Environment* (London: Chapman and Hall, 1971).
3. Leaman and Bordass consider workgroup configuration a determining factor in environmental design effects on productivity. A. Leaman and W. Bordass, "Productivity in Buildings: The Killer Variables," *Building Research and Information*, 27/1 (January 1999): 4-19.
4. I have written at length about the relationship between an organization, its growth and changes, and the accommodation it selects and occupies at different stages. For a description of the Organization-Accommodation Relationship (OAR), see J.C. Vischer, *Workspace Strategies: Environment as a Tool for Work* (New York, NY: Chapman and Hall, 1996), Chapter 1.
5. G.-N. Fischer, *Le Travail et Son Espace* (Paris: Dunod, 1983).
6. J.M. McCoy and G.W. Evans, "Physical Work Environment," in J. Barling, E.K. Kelloway and M.R. Frone, eds., *Handbook of Work Stress* (Thousand Oaks, CA: Sage Publications 2005), Chapter 9.
7. K. Stephenson, "What Knowledge Tears Apart, Networks Make Whole," *Internal Communication Focus*, 36 (1998).
8. T. Horgen, M. Joroff, W. Porter, and D. Schon, *Excellence by Design* (New York, NY: John Wiley and Sons 1999).
9. Mary J. Hatch, "Physical Barriers, Task Characteristics, and Interaction Activity in Research and Development Firms," *Administrative Science Quarterly*, 32/3 (September 1987): 387-399.
10. N. Bontis, N.C. Dragonetti, K. Jacobsen, and G. Roos, "The Knowledge Toolbox: A Review of the Tools Available to Measure and Manage Intangible Resources," *European Management Journal*, 17/4 (1999): 391-402.
11. K. Kampschroer, "Workplace Making: Experiment and Transformation," lecture, Harvard Design School Executive Education Program, August 2004.
12. M. Brill, S.T. Margulis, E. Konar, and BOSTI in association with Westinghouse Furniture Systems, *Using Office Design to Increase Productivity*, Volumes 1 and 2 (Buffalo, NY: Workplace Design and Productivity, Inc., 1984).
13. A more recent study by some of the original research team comes to the same conclusion. See M. Brill et al., *Disproving Widespread Myths About Workplace Design* (Jasper, IN: Kimball International, 2001).

The Concept of Workplace Performance and Its Value to Managers

14. T. Springer, *Improving Productivity In the Workplace: Reports from the Field* (St. Charles, IL: Springer Associates, 1986).
15. J.G. Adair, "The Hawthorne Effect—A Reconsideration of the Methodological Artifact," *Journal of Applied Psychology*, 69/2 (1984): 334-345.
16. See, for example, S. Klitzman and J. Stelman, "The Impact of the Physical Environment on the Psychological Well-Being of Office Workers," *Soc. Sci. Med.*, 29/6 (1989): 733-742; O.E. Stallworth and B.H. Kleiner, "Recent Developments in Office Design," *Facilities*, 14/12 (1996): 34-42; D. Clements-Croome, ed., *Creating the Productive Workplace* (London: E & FN Spon, 2000).
17. B.D. Ilozor, P.E.D. Love, and G. Treloar, "The Impact of Work Settings on Organizational Performance Measures in Built Facilities," *Facilities*, 20/1-2 (2002): 61-67; E. Davenport and I. Bruce, "Innovation, Knowledge Management and the Use of Space: Questioning Assumptions about Non-Traditional Office Work," *Journal of Information Science*, 28/3 (June 2002): 225-230.
18. E. Sundstrom and M.G. Sundstrom, *Work Places: The Psychology of the Physical Environment in Offices and Factories* (New York, NY: Cambridge University Press, 1986).
19. F. Steele, *Physical Settings and Organizational Development* (Reading, MA: Addison Wesley, 1973).
20. F. Becker and F. Steele, *Workplace by Design: Mapping the High Performance Workscape* (San Francisco, CA: Jossey-Bass, 1994).
21. E. Sundstrom, R.K. Herbert, D.W. Brown, "Privacy and Communication in an Open Plan Office," *Environment and Behavior*, 14/3 (1982): 379-392; A. Hedge, "Open Versus Enclosed Workspace: The Impact of Design on Employee Reactions to Their Offices," in J.D. Wine- man, ed., *Behavioral Issues in Office Design* (New York, NY: Van Nostrand Reinhold, 1986); G.R. Oldham, "Effects of Changes in Workspace Partitions and Spatial Density on Employee Reactions: A Quasi-Experiment," *Journal of Applied Psychology*, 73/2 (1988): 253-258; R. Sommer and K. Steiner, "Office Politics in a State Legislature," *Environment and Behavior*, 20/5 (1988): 550-575; A. Churchman, D. Stokols, A. Scharf, K. Nishimoto, and R. Wright, "Effects of Physical Environmental Conditions in Offices on Employee Stress and Well Being," paper presented at 22nd International Congress of Applied Psychology, Kyoto, Japan, 1990.
22. Studies from industrial psychology, however, indicate no systematic link between job satisfaction and employee performance. See R. Karasek and T. Theorell, *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life* (New York, NY: Basic Books, 1990).
23. P. Leather, M. Pyrgas, D. Beale, and C. Lawrence, "Windows in the Workplace: Sunlight, View, and Occupational Stress," *Environment and Behavior*, 30/6 (1998): 739-762; A. Hedge, "Where Are We in Understanding the Effects of Where We Are?" *Ergonomics*, 43/7 (2000): 1019-1029; S. Mallory-Hill, T. van der Voost, and A. Van Dortmost, "Evaluation of Innovative Workplace Design in The Netherlands," in W.F.E. Preiser and J. Vischer, eds., *Assessing Building Performance* (London: Elsevier Science Publishers, 2004), Chapter 15.
24. S. Verderber and D. Reuman, "Windows, Views, and Health Status in Hospital Therapeutic Environments," *Journal of Architectural and Planning Research*, 4/2 (1988): 120-133; R. Ulrich, "Effects of Interior Design on Wellness: Theory and Recent Scientific Research," *Journal of Healthcare Design*, 3 (1991): 87-109.
25. P. Boyce, J. Veitch, G. Newsham, M. Myer, and C. Hunter, *Lighting Quality and Office Work: A Field Simulation Study* (Ottawa: U.S. Department of Energy/National Research Council of Canada, 2003).
26. D. Stokols and F. Scharf, "Developing Standardized Tools for Measuring Employees' Rating of Facility Performance," in G. Davis and F.T. Ventre, eds., *Performance of Building and Service-ability of Facilities* (Philadelphia, PA: American Society for Testing and Materials, 1990), pp. 55-68; A. Mital, J.D. McGlothlin, and H.F. Faard, "Noise in Multiple Workstation Open-Plan Computer Rooms: Measurements And Annoyance," *Journal of Human Ergology*, 21 (1992), 69-82.
27. U. Ayr, E. Cirillo, and F. Martellotta, "An Experimental Study on Noise Indices in Air Conditioned Offices," *Applied Acoustics*, 62/6 (2001): 633-643; W.T. Chu and A.C. Warnock, *Measurement of Sound Propagation in Open Plan Offices* (Ottawa: Institute for Research in Construction, National Research Council of Canada, 2002).
28. J.C. Vischer, *Environmental Quality in Offices* (New York, NY: Van Nostrand Reinhold, 1989).
29. A.K. Miles, "The Ergonomics and Organizational Stress Relationship," Ph.D. thesis, Florida State University School of Business, micro. 9994574, 2000.

30. S.W. Ornstein, "A Post-Occupancy Evaluation of Workplaces in Sao Paolo, Brazil," *Environment and Behavior*, 31/4 (1999): 435-462; Y. Fried, L.H. Slowik, H.A. Ben-David, and R.B. Tieg, "Exploring the Relationship between Workspace Density and Employee Attitudinal Reactions: An Integrative Model," *Journal of Occupational and Organizational Psychology*, 74/3 (2001): 259-372; A. Brennan, J.S. Chugh, T. Kline, "Traditional versus Open Office Design: A Longitudinal Study," *Environment and Behavior*, 34/3 (2002): 279-299.
31. F. Herzberg, cited in F. Becker, *Workspace: Creating Environments In Organizations* (New York, NY: Praeger, 1981); G.W. Evans and S. Cohen, "Environmental Stress," in D. Stokols and I. Altman, eds., *Handbook of Environmental Psychology*, Volume 1 (New York, NY: John Wiley and Sons, 1987), pp. 571-610).
32. F. Herzberg, *Work and the Nature of Man* (Cleveland, OH: World Publishing Co., 1966).
33. J.C. Vischer, "The Effects of the Physical Environment on Job Performance: Towards a Theoretical Model of Workplace Stress," *Stress and Health* (in press 2006).
34. G.-N. Fischer, C. Tarquinio, and J.C. Vischer, "Effects of the Self-Schema on Perception of Space at Work" *Journal of Environmental Psychology*, 24/1 (2004): 131-140.
35. Jennifer Ann McCusker, "Individuals and Open Space Office Design: The Relationship between Personality and Satisfaction in an Open Space Work Environment," *Dissertation Abstracts International: Section B: The Sciences & Engineering*, 63/2-B (August 2002).
36. McCoy and Evans, op. cit.
37. McCoy and Evans, op. cit., p. 221.
38. Presenting comfort as a hierarchy of needs to be met recalls the model of human needs first proposed by Maslow and later applied to environmental design decisions by Preiser. A. Maslow, *Motivation and Personality* (New York, NY: Harper and Row, 1954); W.F.E. Preiser, "The Habitability Framework: A conceptual approach towards linking human behavior and the built environment," *Design Studies*, 4/2 (1983): 84-91.
39. Described in J.C. Vischer, *Workspace Strategies: Environment as a Tool for Work* (New York, NY: Chapman and Hall, 1996), and in G.-N. Fischer and J.C. Vischer, *Evaluation des environnements de travail: La methode diagnostique* (Montreal: Presse de l'Universite de Montreal/Brussels: DeBoeck, 1998).
40. J.C. Vischer, *Environmental Quality in Offices* (New York, NY: Van Nostrand Reinhold, 1989).
41. J.C. Vischer, *Workspace Strategies* (1996), op. cit.
42. G.W. Evans, *Environmental Stress* (New York, NY: Cambridge University Press, 1982); McCoy and Evans, op. cit.
43. J.C. Vischer, A. McCuaig, N. Nadeau, M. Melillo, and S. Castonguay-Vien, "Mission impossible ou mission accomplie? Résultats d'une étude d'évaluation du mobilier universel dans les édifices à bureau," Final Report, Montréal, Groupe de recherche sur les environnements de travail, Université de Montréal, 2003.
44. F. Steele, *Making and Managing High Quality Workplaces: An Organizational Ecology* (New York, NY: Teachers College Press, 1986).
45. E. Sundstrom and M.G. Sundstrom, *Work Places: The Psychology of the Physical Environment in Offices and Factories* (New York, NY: Cambridge University Press 1986); E. Sundstrom, J. Town, D. Brown, A. Forman, C. McGee, "Physical Enclosure, Type of Job, and Privacy in the Office," *Environment and Behavior*, 14/5 (1982): 543-559.
46. M. Wells and L. Thelen, "What Does Your Workspace Say About You? The Influence of Personality, Status, and Workspace on Personalization," *Environment and Behavior*, 34/3 (2002): 300-321.
47. W. Cascio, "Virtual Workplaces: Implications for Organizational Behavior," in C. Cooper and D. Rousseau, eds., *The Virtual Organization, Trends in Organizational Behavior*, Volume 6 (New York, NY: John Wiley and Sons, 2000), pp. 1-14; J. Lai, A. Levas, P. Chou, C. Pinhanez, and M. Viveros, "Bluespace: Personalizing Workspace through Awareness and Adaptability," *International Journal of Human-Computer Studies*, 57/5 (2002): 415-428.
48. P. Rishi, S.P. Sinha, and R. Dubey, "A Correlational Study of Workplace Characteristics and Work Satisfaction among Indian Bank Employees," *Psychologia*, 43/3 (2000): 155-164; Brennan, Chugh, and Kline, op. cit.; Vischer, McCuaig, Nadeau, Melillo, and Castonguay-Vien, op. cit.
49. V.W. Kupritz, "Privacy In the Workplace: the Impact of Building Design," *Journal of Environmental Psychology*, 18 (1998): 341-356.
50. R. Niemela, S. Rautio, M. Hannula, and K. Reijula, "Work Environment Effects on Labor Productivity: An Intervention Study in a Storage Building," *American Journal of Industrial Medicine*, 42/4 (2002): 328-335).

The Concept of Workplace Performance and Its Value to Managers

51. S.Y. Lee and J. Brand, "Effects of Control over Office Workspace on Perceptions of the Work Environment and Work Outcomes," *Journal of Environmental Psychology*, 25/3 (2005): 323-333; G. Newsham, J. Veitch, C. Arsenault, and C. Duval, "Effect of Dimming Control on Office Worker Satisfaction and Performance," NRCC-47069, Ottawa, National Research Council Canada, 2004.
52. J.C. Vischer, *Space Meets Status: Designing Workplace Performance* (Oxford: Taylor and Francis/Routledge, 2005).
53. J. Langhoff, "An Overview of Remote Virtual Teams and Productivity," New Ways of Working (NewWOW), <www.newWOW.net>, 2006.
54. See J.C. Vischer, "Measuring the Impact of Moving on Building Users: Can New Workspace Change Organizational Culture?" *EcoLibrium* (September 2005), pp. 22-27.
55. See Vischer (1989), op. cit; Vischer (1996), op. cit.