

In an attempt to overcome limitations characteristics of past evaluations, a conceptual model is presented as a guide to evaluators in collecting and analyzing data on office environments. A number of components of the model are then examined using data from a study of a new federal office building. Findings corroborate those reported by others in showing that conventional offices are viewed more favorably by people occupying them than workers in either open or pooled office arrangements. The amount of workspace available to the worker is the most important factor associated with work station satisfaction, even after taking into account the type of work station and the workers' ratings of specific work station attributes. It is also demonstrated that people's feelings about the ambience of the agency within which they work and the architecture of the building influence their reactions to the immediate workspace. It is suggested that space planners and designers who want their work appreciated by the user need concern themselves with the details of the workspace as well as the larger scale environment.

EVALUATING OPEN AND CONVENTIONAL OFFICE DESIGN

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In a period in which office technology is rapidly changing, the issue of performance on the job and how it is affected by the physical environment has attracted the attention of corporate executives and space planners alike. Concurrently, isolated findings from a number of studies have supported the contention that the design of

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the workplace can serve to impede job performance (e.g., Allen and Gertsberger, 1975; Louis Harris and Associates, 1978) and enhance the satisfaction of workers on the job (e.g., Lunden, 1972). In their efforts to develop a better understanding of the relative importance of the physical setting, a number of environmental researchers and designers have sought to isolate relationships between specific attributes of the workplace, on the one hand, and satisfaction and performance, on the other. Several have done so within the context of empirically based post-occupancy evaluations. Although many interesting and sometimes useful findings have resulted from these efforts, this article suggests that comprehensive and more systematic approaches are needed for examining relationships between the built environment and people's responses to it.

There are indications that, in the future, systematic evaluations of workplaces and other types of built environments will become an important part of the planning, design, and building process. The U.S. government, for example, has considered the need for evaluation as a requirement of all major public works projects (*Architectural Record*, 1978). Our own research has been in response to the National Bureau of Standards's interest in establishing an overall framework for evaluating built environments.¹ Private organizations have also taken positive actions toward evaluating people's responses to the workplace. One study, prepared under the sponsorship of the furniture manufacturer Steelcase, has examined a range of attitudes of office workers drawn from a national sample (Louis Harris and Associates, 1978). While the study makes a contribution to our understanding of people in the workplace, its significance lies in its national data that can serve as a basis for comparison of data from other studies of office environments.

Although several of the past evaluations show ingenuity and are worthy of examination by those who wish to conduct further research on built environments, many

are inherently weak in both execution and theoretical foundation. A major shortcoming, for example, has been their failure to specify the criteria to be used in determining the degree to which an environment is successful. Even if criteria are specified, valid and reliable measures of success are rarely used. Another failing has been the lack of a carefully constructed conceptual link between physical environmental attributes and various levels of worker responses to those attributes. In short, the things that are to be measured in the workplace, both objectively and subjectively, have either been poorly or incorrectly specified and measured by evaluators. Finally, numerous evaluations are characterized by their informality of execution and lack of clarity in communicating findings. Often, efforts at disseminating information are limited, and thus the research seldom benefits anyone other than the individuals involved in conducting it.

In an attempt to overcome some of these problems, this article presents a conceptual model for guiding evaluators in the collection and analysis of data on office environments. The model specifies the kinds of environmental conditions, and subjective responses to those conditions, that should be considered in studying work environments and suggests the manner in which they are interrelated and linked to job satisfaction and worker performance. A number of components of the model are then examined using data from a study of a new federal office building. Although the findings are useful in that they corroborate findings of other researchers, our central purpose is the presentation of a model which can serve as an organizing framework for thinking about and performing evaluations of work environments in other settings.

CONCEPTUAL MODEL

An underlying purpose of any environmental evaluation should be to develop a better understanding of how

the physical environment or place contributes to or impedes the goals or purposes of individuals or groups of individuals operating within that place. Specifically, the evaluation should attempt to clarify and supplement what is presently known about relationships between the physical environment, its specific attributes, and people's behaviors and subjective responses to that environment. Within any environmental context, there is clearly a multitude of interrelationships which require examination if this basic objective is to be fulfilled.

As a mechanism for understanding the interrelationships among data collected as part of any evaluation, a conceptual model is presented which serves two additional purposes. First, it provides the reader with a map showing how different sets of variables covering selected background characteristics of workers, their actions and feelings, and characteristics of their environmental settings might be interrelated. Second, it serves as an organizational framework for guiding the collection and analysis of quantitative data as part of environmental evaluations.

The conceptual model is derived in part from a framework previously developed by one of the authors for use in conducting research on relationships between objective conditions, subjective experiences, and residential satisfaction (Marans and Rodgers, 1975). Basically, that model suggests that satisfaction with the residential environment as expressed by an individual is dependent upon his or her evaluation or assessment of several attributes of that environment. How a person evaluates a particular attribute, in turn, is dependent on two factors: how that person perceives it and the standards against which he or she judges it. An individual's perception of a particular attribute is dependent on but distinctive from the objective environmental attribute itself. The possibility of bias, inaccuracy, or simply differences in perceptions among individuals in the same environment is recognized explicitly. Finally, the characteristics of an

individual are seen as affecting his or her perceptions and assessments of environmental attributes and the standards for comparisons that are used.

As an extension of this framework, it has been posited that satisfaction with the residential environment together with satisfaction with other domains of life can influence the quality of life as an individual experiences it. Similarly, residential satisfaction is seen as contributing both to selected behaviors of residents and to the extent to which these behaviors occur within the residential settings.

From the perspective of the environmental designer, the core of the model is represented by the direct and indirect links between objective environmental attributes, people's subjective responses to these attributes, overall environmental satisfaction, and some specific behavior or sets of behaviors.

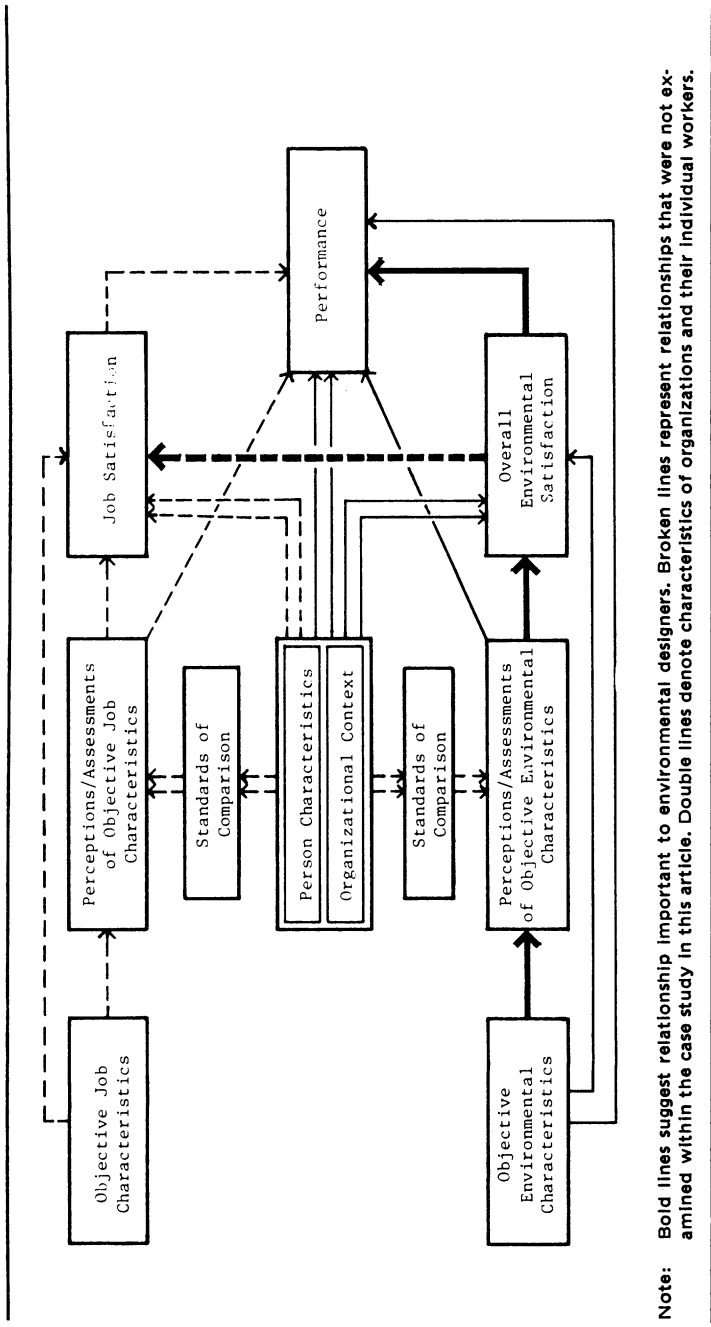
Of course, not every evaluation of a physical environment or place would operate with the same set of variables. Places differ in their purposes, and the variables to be considered are usually determined after these purposes are identified and prioritized. Nor, for that matter, are all evaluations undertaken for the same reasons or with the same level of funding and sophistication. Nonetheless, place evaluations conducted from the perspective of users can operate from a common analytical framework, irrespective of the type of physical environment which is being evaluated. Evaluations of each type of physical environment have operated under the assumption that any particular place is made up of component parts or environmental attributes. Furthermore, each attribute can be assessed by people who use that place, and the sum of any individual assessments contributes both to an overall evaluation of the place and to specific behaviors that take place within it. The kinds of overall evaluations and specific behaviors to be considered differ, depending on the type of place being evaluated and the particular outcomes or indicators of success

that are considered to be important. For example, in evaluations of residential environments, outcomes may have to do with dwelling satisfaction, neighborhood satisfaction, or the desire to move from a particular locale. Or in an evaluation of hospital wards, outcomes may be related to patient comfort or the ability of doctors and nurses to give care to patients.

The issue of appropriate outcomes or indicators of success in work environments has received considerable attention in recent years. At the same time, research on the quality of working life, whether conducted in office or industrial settings, has viewed the physical environment as one of several factors contributing to that quality. Much of this research has treated overall job satisfaction as a key outcome measure, while organizational studies of work environments have considered worker performance as an indicator of success.

In evaluations of work environments, it seems reasonable to consider both job satisfaction and job performance as appropriate outcome measures. No doubt other criteria could be identified in evaluating any particular work setting, and their selection generally reflects factors such as the purposes of the study, the interests of the client, the qualifications and interests of the evaluators and the study sponsor, and what resources are brought to bear on the work.

Figure 1 graphically depicts a conceptual model for evaluating work environments. In this model, three key outcomes are suggested—overall environmental satisfaction, job satisfaction, and worker performance. As noted above, overall environmental satisfaction is the common ingredient of all place evaluations; it is the outcome of greatest interest to architects and the one receiving the most attention in this work. The model suggests the manner in which conditions or attributes of the workplace are linked to the satisfactions and experiences of workers.



Note: Bold lines suggest relationship important to environmental designers. Broken lines represent relationships that were not examined within the case study in this article. Double lines denote characteristics of organizations and their individual workers.

Figure 1: Conceptual Model for Evaluating Work Environments

Overall environmental satisfaction for an employee is dependent upon four factors. First, the characteristics of the employee, including his or her position or job type, influence how he or she evaluates a work environment. A clerical worker and a manager both working in an open office may have very different feelings about their work environment. Second, overall environmental satisfaction is dependent upon the organizational context in which employees operate. The organizational context encompasses but is not limited to the mission of the organization, the activities which take place within it, the morale of the organization, and the general nature of employee/ employer relations. An employee requiring privacy may not view the workplace favorably if the organizational requirements also necessitate its being used for group meetings. Third, overall environmental satisfaction is also dependent on the individual's perceptions and assessments of several specific attributes. Finally, the objective attributes themselves contribute to overall environmental satisfaction. Excessive noise and stuffy air, aside from a person's perceptions of these attributes, could influence that individual's feelings about the office in which he or she works.

The model also shows that an individual's perception and assessment of a particular attribute are dependent on two factors: the standards against which he or she judges that attribute and the objective attribute itself. The standards for comparison may include the level of a particular attribute that has been previously experienced (less noise), the level of the attribute assigned to coworkers (closer to the boss), or the level of the attribute to which he or she aspires or expects to receive along with a promotion (more space).

As we noted a moment ago, an individual's perception or assessment of an environmental attribute is related to but distinct from the objective attribute. For example, an employee operating in a very high-density workspace may not necessarily feel crowded or lacking in privacy.

From the point of view of researchers and the environmental designer, a central purpose of evaluation research is to explore such connections between specific environmental attributes and people's perceptions of them. By understanding these relationships, the designer will ultimately be in a better position to judge the ways in which prosperous users of the built environment are likely to respond.

Individual perceptions and assessments of specific environmental attributes and the attributes themselves also contribute to a worker's job performance. High noise levels and feelings about being crowded can be distracting and can affect the quality and quantity of work produced. At the same time, the characteristics of the individual and his or her organizational context are likely to have some bearing on job performance.

Another set of relationships implied by the model and suggested by the literature dealing with the quality of work life has to do with specific job characteristics, worker's perceptions and assessments of them, and their relationship to overall job satisfaction. One specific job characteristic is the quality of the physical environment. In our model, a worker's responses to the quality of the physical environment are represented by the box labelled Overall Environmental Satisfaction and is seen as providing a unique contribution to overall job satisfaction. Finally, job satisfaction—like job performance—is likely to be influenced by the characteristics both of the individual worker, such as age and seniority, and of the organization within which he or she operates.

While it is possible to develop appropriate measures for each element of the model within the context of any work environment evaluation, limitations will no doubt be placed on the researchers which prevent them from doing so. In our study of a federal office building, no attempts were made to measure the full range of employee job characteristics or the ways in which these characteristics were assessed by individual employees.

Nor was there any effort made to measure their overall job satisfaction. In part, these limitations were imposed by individuals whose cooperation was essential to the successful completion of the research. Similar limitations were placed on the researchers in their efforts to measure worker performance. Finally, the identification of specific characteristics of each organization within the building was considered to be beyond the bounds of our investigation. At best, we were able to differentiate between organizations by indicating the particular agency in which the individual employees worked.

TESTING THE MODEL—A CASE STUDY

The new federal office building in Ann Arbor, Michigan, offered a unique opportunity to test the conceptual model. The building was constructed under new federal guidelines calling for architectural excellence and has been recognized for its design by the architectural profession. Within the first few years of completion, it received numerous design awards and extensive publicity in newspapers and in the architectural press. Nevertheless, it was reputed to have problems; it was the focus of controversy in Ann Arbor since its downtown site had been announced in the early 1970s. An evaluation of the building also offered the potential for adapting both the findings and the approach used to the evaluation of other built environments, including those built under federal sponsorship.

At the time the evaluation began (fall 1979), the building housed 14 separate government agencies and approximately 270 federal employees.² Except for the Post Office located on the ground floor, the interior contained large open-office spaces with north windows and continuous overhead lightwells. All floors were connected to one another with an open lightwell located below the over-

head skylight. The building represents one of the first attempts by the federal government to plan for flexibility by instituting an open-office arrangement. However, several conventional, private offices and pool arrangements were planned as part of the design.³

The federal building evaluation was made from a single perspective—that of the building users. The major users were the federal employees who worked in the building; the residents of Ann Arbor and its surrounding communities were the second group of building users. Information about these two groups and how they interacted with the building was obtained through questionnaires administered to all federal employees and to samples of community residents. Additionally, data were collected on a number of specific environmental characteristics or attributes of the building. Finally, systematic and impressionistic observations were made of both user groups and the physical environment. The self-administered questionnaire for federal employees focused on their activities, on how they felt about the building as a place to work, and on how they rated specific environmental attributes of the work space.

FINDINGS

The evaluation of the Ann Arbor federal building produced a number of significant findings, many of which support relationships suggested by the conceptual model. One of the more general and perhaps the most important finding is that people's assessments of the larger environmental settings (the building and the agency space) were influenced by their feelings about their immediate workplace. And feelings about the immediate workspace were by no means consistently positive. More than one-third of the federal employees in Ann Arbor expressed some level of dissatisfaction with their office environment.⁴

Not surprisingly, it was found that people with a greater degree of control over their immediate environment were more satisfied than those having a diminished amount of control. Occupants of conventional, private office space expressed greater satisfaction with their workspaces than those working in open or pool arrangements.

Differences in responses were also related to the kinds of offices people had previously experienced. More than three-fourths of the workers who formerly worked in a conventional office and moved to an open or pool arrangement in the federal building rated their new workspace as worse than their previous conventional office; less than a third (29%) of the federal workers who moved from an open or pool arrangement to a private office said their new work area was worse.

Specific attributes of open and pool office arrangements were also rated poorly relative to attributes found in conventional offices. As seen in Figure 2, workers of conventional offices were consistently higher in their ratings than workers in either the open or pool arrangements. A comparison between our data and those from the Harris study shows that the profiles of responses to specific work station characteristics are consistent for the two data sets. However, the federal building employees were generally more dissatisfied than were the office workers in the national sample. This latter finding can be explained, in part, by the fact that governmental workers generally tend to be more critical of their work environment than those in private industry (Louis Harris and Associates, 1978).

It can be seen that the most negative ratings of the workspace are those related to conversational and visual privacy. This is especially true of office workers occupying open or pool offices in both samples. In order to more fully explore these relationships, we examined several specific attributes of the work station vis-à-vis employee evaluations. Figures 3 and 4 show bivariate relationships be-

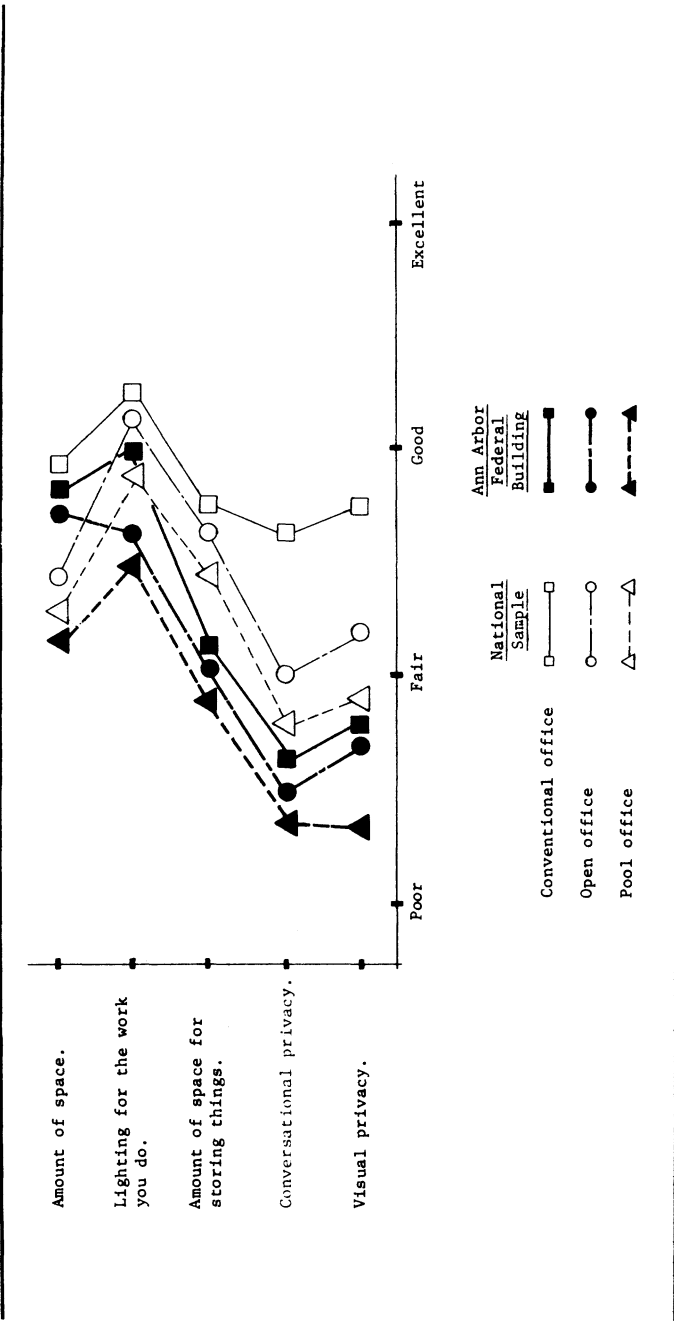


Figure 2: Average Ratings of Personal Work Station Characteristics of a National Sample of Office Workers (Harris, 1978) and the Ann Arbor Federal Building

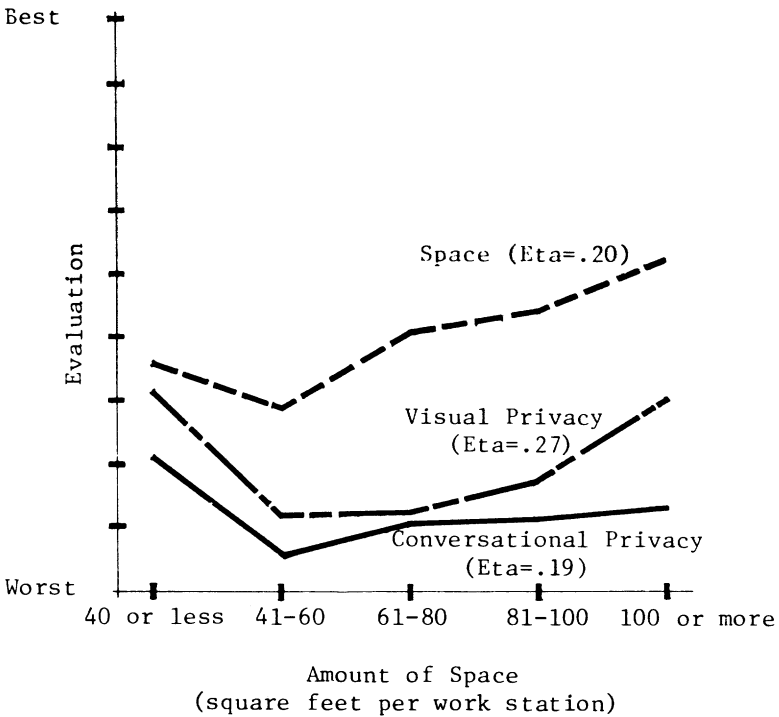


Figure 3: Relationships between the Amount of Space and Evaluations of Space, Conversational Privacy, and Visual Privacy

tween three types of worker evaluations and the amount of workspace and the specific type of work station.

As seen in Figure 3, worker evaluations of conversational and visual privacy and the amount of workspace increase, logically, as the amount of actual workspace increases. This relation holds for work stations with *more* than 40 square feet of space; for very small work stations, a relatively higher rating was found for each of the three evaluative items. When the structure of our conceptual model is taken into account, these relationships are not anomalous but, in fact, predictable. Our model has suggested that individual evaluations depend as much on job characteristics—such as job content—as on environmen-

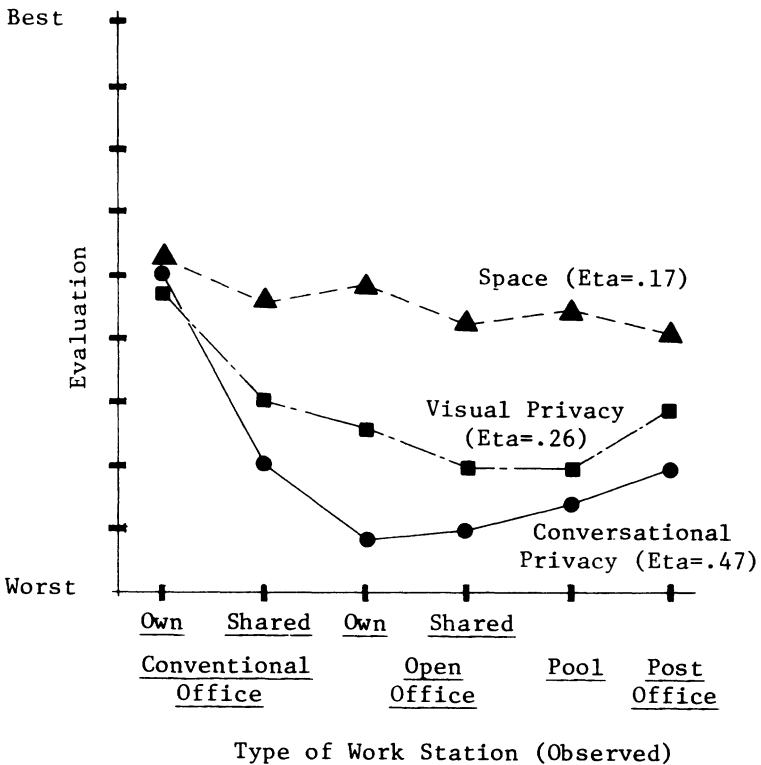


Figure 4: Relationships between Type of Work Station and Evaluation of Space, Conversational Privacy, and Visual Privacy

tal attributes. In other words, the relationship between privacy and the amount of space cannot be viewed in isolation of the functions that are performed in that space. In the case of the federal building, work stations with less than 40 square feet were concentrated in the Post Office and were occupied only periodically during the day. Conceptually, therefore, one would not expect the lack of space to be as critical for postal workers, many of whom are carriers, as for people who perform more desk-related clerical or technical tasks. This hypothesis is reinforced in Figure 4, where the responses of the postal workers to the privacy question are compared to those of

TABLE 1
Satisfaction with Work Station, Predicted by
Objective Work Station Attributes and Evaluation of Work Station Attributes
(multiple classification analyses—194 employees)

Predictors	Beta Coefficient (ranking of importance)			
	Eta Coefficient	Employee Characteristics Only	Employee Characteristics and Attribute Ratings	Employee Characteristics and Objective Attribute Ratings and Attribute Ratings
<u>Employee Characteristics</u>				
Agency	.28	.34(1)	.17(5)	.39(2)
Job classification	.24	.26(2)	.28(2)	.27(5)
<u>Objective Attributes</u>				
Amount of workspace	.39		.20(3)	.50(1)
Chair type	.33		.19(5)	.16(8)
Work station type	.25		.25(2)	.36(3)
Window condition	.26		.14(6)	.31(4)
<u>Attribute Ratings</u>				
Aesthetic quality	.38		.18(4)	.15(9)
Space	.33		.29(1)	.26(6)
Conversational privacy	.30		.15(6)	.14(10)
View outside	.21		.19(3)	.17(7)
Percent of variance explained (adjusted multiple R ²)		11.2	30.6	25.5
				41.1

people working in conventional, open, and pool arrangements.

In order to further examine the relationship between a global assessment of the work environment and specific worker evaluations of individual work stations, several multivariate analyses were performed. In a model predicting work station satisfaction using a number of objective environmental attributes, subjective evaluations, and employee characteristics, 41% of the variance was explained. Although the actual amount of workspace, the type of work station, and the agency in which the station was located were the most important predictors, workers' ratings of several environmental attributes were also important to the prediction of work station satisfaction (see Table 1). As implied by the model, the extent to which federal employees were satisfied with their work stations was a function of not only who they were and where they worked but also of the level of specific environmental attributes available to them *and* how they evaluated these attributes.

Finally, in another multivariate analysis predicting workers' responses to the larger environment (i.e., the ambience of their agency), satisfaction with the individual work station was the predominant predictor, accounting for two-thirds of the total variance explained (46.6%).

SUMMARY

This article has posited that most postoccupancy evaluations of office environments are inherently weak in both execution and theoretical foundation. In an attempt to overcome some of these limitations, we have presented a conceptual model for guiding evaluators in the specification, collection, and analysis of salient data covering office environments. The model suggests the kinds of environmental conditions and subjective responses to

those conditions that require consideration when studying job satisfaction and office worker performance.

Using data from a study of a new federal office building in Ann Arbor, Michigan, selected relationships suggested by that model were examined. Specifically, we have considered the extent to which satisfaction with the individual's workspace is a function of a number of environmental attributes, the worker's assessments of those attributes, and characteristics of the worker and his/her organization. Our findings have corroborated those reported by others in showing that conventional offices are viewed more favorably by the people occupying them than workers in either open or pool office arrangements. Furthermore, the amount of workspace available to a worker is the most important factor associated with satisfaction, even after taking into account the type of work station and the worker's ratings of specific work station attributes.

It has also been shown that people's feelings about the ambience of the agency within which they work and the architecture of the building are a function of their reactions to their immediate workspace. Under the circumstances, space planners and designers who want their work appreciated by the user should concern themselves with the details of the workspace as well as the larger scale environment.

NOTES

1. The study was supported by a grant from the Center for Building Technology, National Bureau of Standards, U. S. Department of Commerce, Grant G8-9020.

2. Since the completion of the evaluation, several major changes in the building design and occupancy have taken place. For a complete discussion of the building, the changes, and the entire evaluation, see Marans and Spreckelmeyer (1981).

3. A conventional office is defined as a space surrounded by full-height, fixed partitions and occupied by one or two workers. An open office is one

which is separated from the surrounding workspace with head-high, movable partitions. A pool arrangement houses workers in a large, open space with no visual separation at all.

4. Despite their relative low assessments, office workers in the Ann Arbor Federal building are no different than government workers nationally; according to the Harris study, one-quarter of all office workers were not very or not all satisfied with their individual work stations; among government workers, one-third were dissatisfied.

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