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Aoife Brennan, Jasdeep S. Chugh and Theresa Kline

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TRADITIONAL VERSUS OPEN OFFICE DESIGN
A Longitudinal Field Study

AOIFE BRENNAN *is a Ph.D. student at the University of Calgary specializing in industrial-organizational psychology. She received her M.Sc. from the University of Calgary in 1999 and her B.A. from Saint Mary's University in 1994. Her research interests include organizational change, career development, personality, and organizational justice. She has published in the* Psychologist-Manager Journal *(2000) and recently completed an internship at IBM in Armonk, New York.*

JASDEEP S. CHUGH *earned his M.Sc. degree in 1999 from the University of Calgary with a specialization in cognitive ergonomics. His master's thesis examined drivers' approaches to railway crossings and the impact on driver behavior of false alarms at railway crossings. He is currently a senior human factors engineer at Mobileum, Inc., located in Austin, Texas. Prior to working for Mobileum, he was a member of the technical staff at SBC Technology Resources, Inc., also located in Austin.*

THERESA KLINE *is a professor of psychology at the University of Calgary and director of the research unit for creating organizational excellence. She has an active research program in the area of team performance and other research interests in psychometrics, organizational effectiveness, and work attitudes. Her book,* Remaking Teams *(1999), published by Jossey-Bass, is the culmination of several years of research and practice with teams in organizational contexts. Another book she is currently working on is due out in 2002, published by Lawrence Erlbaum. It will focus on team leadership. Theresa teaches organizational psychology and statistics-methods at the undergraduate and graduate levels.*

ABSTRACT: Research in open office design has shown that it is negatively related to workers' satisfaction with their physical environment and perceived productivity. A longitudinal study was conducted within a large private organization to investigate the effects of relocating employees from traditional offices to open offices. A measure was constructed that assessed employees' satisfaction with the physical environment, physical stress, coworker relations, perceived job performance, and the use of open office protocols. The sample consisted of 21 employees who completed the surveys at all three measurement intervals: prior to the move, 4 weeks after the move, and 6

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months after the move. Results indicated decreased employee satisfaction with all of the dependent measures following the relocation. Moreover, the employees' dissatisfaction did not abate, even after an adjustment period. Reasons for these findings are discussed and recommendations are presented.

The purpose of this study was to determine the effects of relocating employees from traditional to open offices. The organization in which this study was conducted requested a longitudinal study to assess the long-term impact of office redesign on their employees' satisfaction with the physical environment and productivity. Employees' satisfaction with their work environment is important to organizations, as it has been shown to be directly related to employees' job satisfaction and indirectly related to commitment and turnover intentions (Carlopio, 1996).

There are many different types of office designs, ranging from traditional, private offices to open offices. Open offices also range in their design complexity from the "bull pen" in which the desks are arranged in neat rows to "landscaped"—or Bürolandschaft—offices that include "systems furniture" and panels of varying heights. In open offices, people who work together are physically located together with the geometry of the layout reflecting the pattern of the work groups. The various areas can be separated by plants, low movable screens, cabinets, shelving, or other furniture (Sanders & McCormick, 1993). Thus, within the broad category of open office, fine-grained differences can be rendered. For example, the number of partitions surrounding employees' workspaces, spatial density (the amount of usable space per employee), openness (the overall openness of the office or the ratio of total square footage of the office to the total length of its interior walls and partitions), and architectural accessibility (the extent to which an employee's individual workspace is accessible to the external intrusions of others) (Oldham, 1988; Oldham & Rotchford, 1983) can all vary. For example, Marans and Yan (1989) divided their national sample of offices into six different design categories based on the number of walls and partitions surrounding the employees' workspace. For purposes of this study, offices were classified into one of the following five categories: (a) private closed, (b) private shared, (c) individual open, (d) shared open, or (e) bull pen.

Open offices were designed in the 1950s and reached their height of popularity in the early 1970s, when many companies converted to these types of designs. Original claims by the designers of open offices were that they created flexible space, allowing layout to be more sensitive to changes in organizational size and structure. Workstations can be easily reconfigured at minimal cost to meet changing needs. It was also believed that the absence of internal physical barriers would facilitate communication between

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individuals, groups, and even whole departments, which consequently, would improve morale and productivity. In addition, there was an estimated 20% savings in costs associated with creating and maintaining this type of office space (Hedge, 1982). Although many claims have been made regarding improvements in communication and productivity with open office designs, research findings have been mixed, with some studies reporting positive outcomes such as increased communication among coworkers (Allen & Gerstberger, 1973; Hundert & Greenfield, 1969; Ives & Ferdinands, 1974; Zahn, 1991) and supervisors (Sundstrom, Burt, & Kamp, 1980), higher judgments of aesthetic value (Brookes & Kaplan, 1972; Riland, 1970), and more group sociability (Brookes & Kaplan, 1972), whereas other studies have reported negative findings such as decreased performance (Becker, Gield, Gaylin, & Sayer, 1983; Oldham & Brass, 1979), lower judgments of functional efficiency (Brookes & Kaplan, 1972), lower levels of psychological privacy (Brookes & Kaplan, 1972; Hedge, 1982; Sundstrom, Town, Brown, Forman, & McGee, 1982; Sundstrom et al., 1980), environmental dissatisfaction (Marans & Yan, 1989; Oldham & Brass, 1979; Spreckelmeyer, 1993), fewer friendship opportunities (Oldham & Brass, 1979), supervisor feedback (Oldham & Brass, 1979), privacy (Brookes & Kaplan, 1972; Hundert & Greenfield, 1969), increased noise (Brookes & Kaplan, 1972; Sundstrom, et al., 1980), increased disturbances and distractions (Brookes & Kaplan, 1972; Hedge, 1982; Hundert & Greenfield, 1969; Ives & Ferdinands, 1974; Mercer, 1979; Nemecek & Grandjean, 1973; Oldham & Brass, 1979; Sundstrom, et al., 1980), and increased feelings of crowding (Sundstrom, et al., 1980).

In a study by Zalesny and Farace (1987), employees relocated from traditional to open offices. Managers reported that their new work areas were less adequate than before the office change, that they had less privacy, and that they were less satisfied with the physical environment. Given these reported increases in disturbances and distractions, one would expect productivity to be negatively affected, especially in light of the findings from the Steelcase (Louis Harris & Associates, Inc., 1978) study in which 41% of a sample of office workers indicated that the most important office characteristic in getting their work done well was the ability to concentrate without noise or other distractions. However, these respondents rated the level of noise and other distractions in their work environments as the third worst characteristic of their workplace. In a follow-up study 2 years later, more than half of another sample of office workers reported that quiet was important to completing their work, yet only 48% reported that they actually experienced quiet offices.

Recent statistics suggest that disturbances from office noise has reached epidemic proportions, with 54% of a sample of more than 2,000 U.S. and Canadian office workers in various office plans from 58 different sites

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reporting that they are bothered often by one or more sources of noise, such as telephones, people talking, ventilation systems, piped-in music, and office equipment (Sundstrom, Town, Rice, Osborn, & Brill, 1994). Furthermore, reported disturbances from combined sources of noise were found to be negatively related to environmental satisfaction and job satisfaction. Contrary to expectations, however, Sundstrom et al. (1994) found no relationship between disturbances and self or supervisor ratings of performance.

Many companies continue to adopt open office designs primarily because of the reduced costs in construction and maintenance. However, another reason why open plan offices are so popular is the belief that they facilitate greater communication, which in turn, facilitates greater productivity (Boje, 1971; Pile, 1978). This belief is based on the social facilitation hypothesis, which states that performance of routine tasks will improve in nonprivate areas (Geen & Gange, 1977). The theory suggests that employees who find their jobs boring may find that contact with other people provides a source of stimulation. However, Sundstrom (1978) found that social contact can exceed an optimum level, causing a worker to feel crowded, especially in areas with minimal privacy. As a result of crowding, discomfort may occur, which then causes decreased job performance. Research findings have shown a high correlation between architectural privacy (the visual and acoustic isolation supplied by an environment) and psychological privacy (a sense of control over access to oneself or one's group), even among people with the least complex jobs (Sundstrom et al., 1980). Furthermore, no relationship has been found between architectural accessibility and social contact among coworkers. These findings directly contradict the claims of open office designers regarding increases in communication. Moreover, whereas one of the proposed advantages of the open office design was increased communication, they have actually been found to prohibit confidential conversations (Sundstrom, 1986). In short, empirical findings suggest that employees prefer privacy over accessibility because of the increases in noise and distractions experienced in nonprivate workspaces (Sundstrom et al., 1980).

McCarrey, Peterson, Edwards, and Von Kulmiz (1974) suggested that the findings of lower satisfaction in open offices are due to employees' perceived lack of control over input to and from the environment. This occurs through lack of auditory privacy, lack of personal privacy, and lack of confidentiality of communications. This is supported by the concept of overload (Cohen, 1978), which posits that workers prefer quiet workplaces where neighboring coworkers are relatively few and far apart because exposure to sources of overload can then be controlled. Empirical research on open offices has supported the theory of overload, finding that employees tend to prefer lower

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levels of spatial density in their work areas and a greater number of partitions (Oldham, 1988; Oldham & Rotchford, 1983).

Not all research findings have shown that open offices cause employees to suffer from their working conditions. Even among those who do report complaints, they often are not directed at the same problems, and different individuals do not report suffering with the same severity (Wineman, 1986). Overall, however, research shows that employees experience increases in physiological and psychological stress after moving from conventional offices to open offices (Brookes & Kaplan, 1972; Wineman, 1986). In addition, higher levels of satisfaction have been found among those in conventional private offices compared with those in open plan offices (Sundstrom et al., 1980).

The majority of complaints associated with open offices appear to focus on the immediate increase in distractions and disturbances (Hedge, 1982). It may be that at first, the increase in noise negatively affects worker productivity. However, there may be a habituation process to these disturbances and distractions, which would cause productivity to return to original levels following an adjustment period. Many of the findings in this field are confounded with the element of change, as the studies cited investigated employees' reactions to the immediate changes in office design. Often, researchers examine employee reactions following organizational moves from conventional private offices to open plan offices without any follow-up measures. An example of the potential problem this can pose is illustrated in a study by Sundstrom et al. (1980) in which employees who had worked in their offices for at least 6 months reported no relationship between their office design and amount of social contact with their coworkers. The authors noted that these findings are inconsistent with previous research and speculated that moving into an open office may create increased interaction only for a short period, after which people revert back to their earlier habits and develop ways of regulating their social contact. Similarly, it is possible that many of the complaints associated with open offices are simply due to the stress associated with the changes. Perhaps once employees have had time to adapt to their new environment, negative attitudes lessen or disappear altogether.

To date, only one study by Stokols, Churchman, Scharf, and Wright (1990) has investigated office workers' reactions to environmental changes in their offices over time. The researchers assessed employees' change desirability, exploratory style, job satisfaction, and perceptions of the quality of the social environment and the overall quality of work activities either prior to or following office renovation or relocation. The participants experienced either (a) no relocation or renovation, (b) on-site renovation only, (c) short-

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distance relocation to a building across the street, or (d) long-distance relocation to a building 10 miles away. Contrary to expectations, the level of environmental change was not found to be related to employees' perceptions of the disruption of the move or renovation. Positive correlations were found between the degree of environmental change and positive feelings about the physical environment. Those employees who welcomed the change prior to the move or renovation subsequently rated the quality of the social environment at work more positively than those who were initially less optimistic about the change. However, the authors did not report any changes in the workers' satisfaction with the physical environment over time, and they did not assess office design or how changes in office design were related to employees' satisfaction with the physical environment.

This study used a longitudinal research design consisting of three measurement periods to assess employees' satisfaction with the physical environment and their perceived job performance after relocating from traditional to open offices as well as to determine if these measures changed over time. Data were collected prior to the relocation, shortly following the move, and 6 months after the move. Employees were surveyed using the following four outcome variables: (a) satisfaction with the physical environment, (b) perceptions of the physical stress of the office environment, (c) satisfaction with team member relations, and (d) perceived job performance.

Satisfaction with the physical environment measured the employees' satisfaction with their office environment with regard to issues such as whether the employees feel they have adequate work and storage space and whether the personnel traffic corridors are well defined for traffic flow. Employees' satisfaction with their workspace or overall environmental satisfaction have been frequently studied in the literature (e.g., Brill, Margulis, Konar, & Bosti, 1984; Marans & Spreckelmeyer, 1981; Marans & Yan, 1989; Sundstrom et al., 1982; Sundstrom, 1986) and have been found to be related to job satisfaction and performance (Sundstrom et al., 1980; Wineman, 1986).

Perceived physical stressors assessed employees' satisfaction with the physical comfort of the environment, such as whether the lighting, temperature, and ventilation systems are adequate and whether the noise from telephones and coworkers talking is bothersome. Perceptions of spatial characteristics, ambient conditions, and psychosocial characteristics of the office (i.e., lighting, temperature, environmental control, privacy) have been found to be related to environmental satisfaction (Marans & Yan, 1989; Spreckelmeyer, 1993) and job satisfaction (Carlopio, 1996; Sundstrom et al., 1994) and indirectly related to organizational commitment and turnover (Carlopio, 1996).

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Team member relations referred to the extent to which employees feel they are "part of a team" and their level of satisfaction with the relationships between themselves and other team members or team leaders. Some researchers (e.g., Boje, 1971; Pile, 1978) have posited that open offices facilitate social interaction, which subsequently increases productivity.

Last, perceived job performance assessed employees' satisfaction with their productivity levels and whether the office environment affects their ability to work. Questions addressed whether the employees feel they are able to complete their assigned tasks and meet deadlines, whether they have adequate access to necessary resources, whether they are able to stay focused and "on task," and whether the office design facilitates privacy and confidentiality.

This study investigated whether the aforementioned variables were related to the relocation from traditional to open offices both initially and over an extended period of time. It was expected that employees' levels of satisfaction with the physical environment, physical stress, and performance would decrease initially and that their satisfaction with team member relations would increase immediately after the move to the open offices. However, it was also expected that the employees would adjust to their new environment and that their reported levels of satisfaction with the physical environment, physical stress, team member relations, and perceived job performance would all return to their base rates (prior to the move) after the employees had worked in their offices for 6 months.

The use of office protocols was also measured to determine whether any guidelines had been established to assist employees in adapting to an open office design and to determine the extent to which these protocols were followed. The protocols were measured on the second and third time intervals only, as they were designed to assess the practices followed in the open offices design. Examples of protocols included respecting the privacy of others and telephone conversation noise. Research suggests that the use of open office protocols may help reduce the number of distractions that frequently arise from the behavior of colleagues (Hedge, 1982).

The implications of this study include both employees' reactions to the initial change and the long-term reactions to the new office design. Through the use of a longitudinal research design, the effects due to change may be disentangled from the effects of variations in office design. This investigation also assessed if reported levels of productivity varied following the relocation and if they returned to initial levels following a period of adjustment.

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METHOD

The organization studied was a large oil and gas company located in western Canada. The company had contracted the researchers to assess the effects of a pilot study to determine whether the company should implement the new office design organization-wide.

Interviews and focus groups were conducted by all three researchers in June 1997 with organizational employees (clerical, secretarial, and technical). These were conducted to determine how productivity would be measured within this organization. During the interview or focus group, the participants were asked to provide a brief job description and to describe the tasks they carry out in performing their jobs, how they measure their own productivity, and any concerns they might have about the open office design.

Using the information obtained from employees and the existing literature, a questionnaire was developed. Specifically, factors that affected productivity as well as employees' concerns regarding the new office design were identified. The surveys were administered at the following three separate time intervals: (a) just prior to the relocation, (b) 1 month following the relocation, and (c) 6 months after the relocation. The surveys were administered in August 1997, September 1997, and March 1998, respectively. The manager in charge of the location distributed the surveys. Employees returned the completed questionnaires directly to the researchers in sealed envelopes to maintain confidentiality. Anonymity could not be provided, as the surveys from the three measurement times were matched according to name. However, once the surveys were matched, the participants were numerically coded for data entry. The original surveys were then destroyed.

PARTICIPANTS

A total of 20 employees participated in the interviews or focus groups. The focus groups ranged in size from 2 to 6 employees. In general, the groups were homogeneous in composition, with employees from similar areas and positions interviewed together.

At each measurement period, 80 surveys were distributed, with a total of 21 participants returning all the questionnaires at all three time intervals (26% response rate). The surveys were distributed by the manager directly to all employees to complete at their workstations at their convenience. Participants then mailed all completed questionnaires directly to the researchers. The questionnaire took approximately 30 minutes to complete. Although there was a greater response rate at Time 1 and Time 2, a case was only included in the analyses if all three measurement times were completed.

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There were no differences found between the type of office assignment for those employees who had completed all three surveys in comparison with those who had only completed one or two surveys.

The employees (all office staff) reported that they spent, on average, 36% of their time in the office on the computer, 19% in meetings, 20% performing desk work, 20% on the telephone, and 7% performing other tasks. Repeated measures analyses indicated that the amount of time employees spent in meetings changed from Time 1, with employees spending less time in meetings in the new office design, $F(2, 36) = 4.06$, $p < .03$. Follow-up analyses indicated that the amount of time employees spent in meetings decreased significantly from Time 1 to Time 3 only, $t(19) = 3.85$, $p = .001$. Thus, the tasks that the employees engaged in, their team members, and their reporting relationships all remained constant over the time intervals.

LOCATION DESCRIPTIONS

The offices that workers occupied before the move were located in a high-rise building in the downtown core of a metropolitan city. These employees relocated to a building in an industrial park in the same city. In addition to the building shift, most employees moved from traditional to open offices. Prior to the move, 76% of the respondents reported they worked in "traditional" private offices (12' × 12', with one worker, one desk, and a door that closed the room off from the corridor), 16% shared an office with one other worker (20' × 20', with two workers, two separate desks, no partitions between them, and a door), and 8% shared an area with two to four other workers where there were 65-inch partitions between them (see Figure 1).

Following the relocation, 81% of respondents shared space with two to four other workers in a 14' × 15' area with 65-inch partitions between them (as in Figure 1), whereas 5% worked in a bull pen (30' × 15', sharing space with up to nine workers with 65-inch partitions between them; see Figure 2). The individual workspace dimensions in these two types of workspace were 70" × 100". In addition, 14% shared a traditional office (20' × 20', two workers, two separate desks, and a door).

MEASURES

To measure any fluctuations in organizational productivity, a context-specific instrument was designed. The survey items were created from the information obtained in the interviews and focus groups and from the existing literature (e.g., Carlopio, 1996; Donald, 1994; Stokols & Scharf, 1990; Sundstrom et al., 1994; Zalesny & Farace, 1987). The participants were

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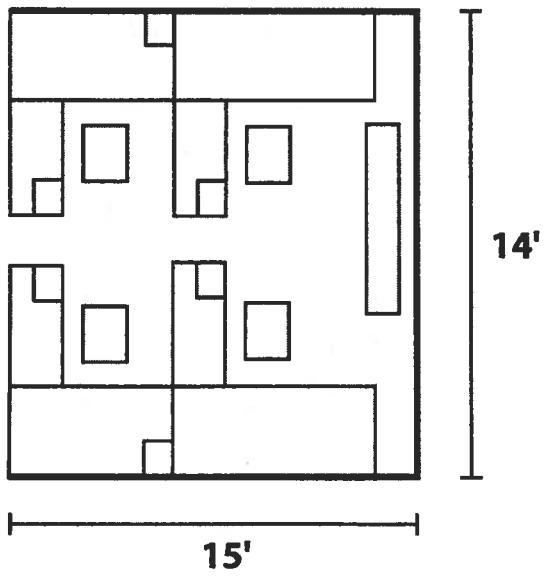

Figure 1: Floor Plans of the Shared Office

instructed to indicate the extent to which they agreed with each of the statements in the survey.

Physical Environment. The Physical Environment subscale consisted of six survey questions related to the functionality and design of the office space. Examples of survey items were as follows: "I have enough storage space at my workspace" and "I have enough work surface area at my workspace." Respondents were asked to indicate on a 5-point Likert-type scale, ranging from 1 (*strongly agree*) to 5 (*strongly disagree*), their agreement with each statement. In other words, higher scores indicated less agreement or satisfaction, with a response of 3 (*neither agree nor disagree*) considered neutral. The average Cronbach's alpha for this measure was .76 over the three administrations.

Physical Stressors. Physical Stressors was a 5-item subscale consisting of questions such as "The lighting is appropriate" and "Noises (e.g., phones, other people talking, ambient background) are not bothersome." Physical stress was measured on a 5-point Likert-type scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). The 5-item measure produced a Cronbach's alpha coefficient of .67.

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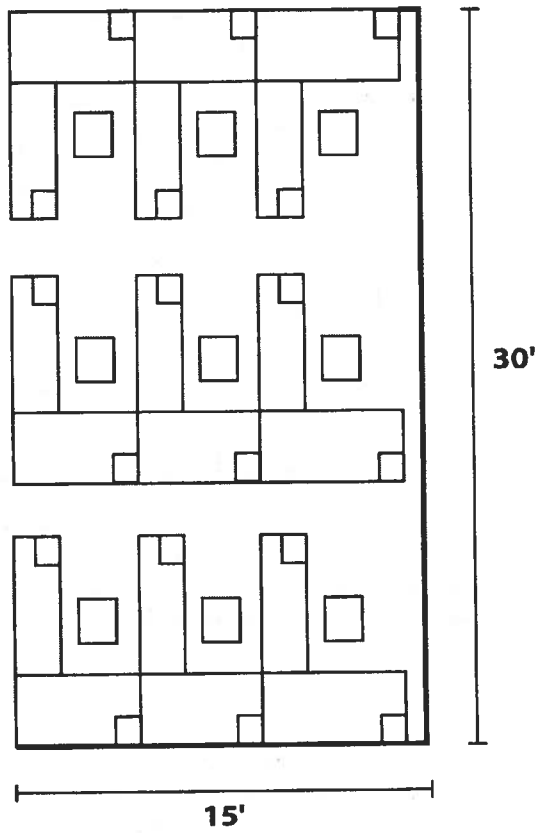

Figure 2: Floor Plans of the Bullpen

Team Member Relations. Team Member Relations consisted of 5 items related to an employee's relationship with other members of the team. This scale included statements such as "I really feel I am part of my team" and "My team members approach me when needed." This variable was also measured on a 5-point Likert-type scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). The average internal consistency of this scale for the three administrations was .71.

Performance. Perceived performance was assessed through a 20-item subscale consisting of items such as "I am able to stay focused and 'on task' at work" and "I am able to complete my planned tasks for the day." Responses

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ranged from 1 (*strongly agree*) to 5 (*strongly disagree*). An average Cronbach's alpha of .89 was obtained for the 20-item Performance scale for all three administrations.

Protocols. The use of office protocols was assessed through 11 survey items. Respondents were first asked if a particular protocol had been established in their work area and, second, to what extent they would agree that the protocol was followed. If a respondent indicated that a particular protocol had not been established, the item was coded as zero. Responses to established protocols ranged from 1 (*strongly agree*) to 5 (*strongly disagree*). Examples of protocols include "telephone conversation noise" and "use of breakout rooms (private meeting rooms used for meetings or private telephone conversations)."

Items from the Physical Environment, Physical Stress, Team Member Relations, and Performance subscales were presented in a random order on the survey. The 11 protocols were grouped together at the end of the questionnaire. See the appendix for survey questions.

RESULTS

The means, standard deviations, and correlations of all measures for all three measurement times are presented in Table 1. Graphical representation of the mean differences for all the measures over time are presented in Figure 3. Four separate within-subject, repeated measure analyses were carried out using the MANOVA program of SPSS to analyze whether employees' satisfaction with the physical environment, physical stress, team member relations, or performance had changed over time.

The main effect of time was significant for the Physical Environment subscale, $F(2, 40) = 33.44, p < 0.01, \eta^2 = 63$. Follow-up paired comparisons, using a Bonferroni alpha correction of 0.02, showed a significant difference in respondent scores from Time 1 to Time 2, $t(21) = -7.06, p < 0.01$, and from Time 1 to Time 3, $t(21) = -5.47, p < 0.01$ (Dunn, 1961). These results indicate that the employees were significantly less satisfied with the physical environment of the open office design. Furthermore, this dissatisfaction remained constant from Time 2 to Time 3, indicating that the employees had not adapted to the change.

For the Physical Stressors subscale, the main effect of time was found to be significant, $F(2, 40) = 25.06, p < 0.01, \eta^2 = .56$, for the three time periods. Follow-up paired comparisons, using a Bonferroni alpha correction of 0.02,

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TABLE 1
Means, Standard Deviations, Alphas, and Correlations for the Dependent Measures

Variable	M	SD	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1. Physical environment 1	1.73	.79	(.80)													
2. Physical environment 2	2.66	.66	.23	(.45)												
3. Physical environment 3	2.67	.67	.21	.71**	(.59)											
4. Physical stressors 1	2.01	.74	.79**	.17	.08	(.63)										
5. Physical stressors 2	3.03	.67	-.08	.44**	.27	.12	(.45)									
6. Physical stressors 3	3.00	.68	-.06	.31	.42**	.03	.56**	(.46)								
7. Team member relations 1	1.68	.52	.30	.20	.09	.45**	.30	.30	(.66)							
8. Team member relations 2	2.07	.55	.18	.30*	.30	.15	.57**	.40*	.49*	(.64)						
9. Team member relations 3	2.30	.62	.19	.45*	.31*	.18	.56**	.43**	.39	.65**	(.71)					
10. Performance 1	1.90	.52	.81**	.30	.19	.75**	.19	.06	.48**	.38	.47*	(.88)				
11. Performance 2	2.59	.47	.05	.53**	.28	.07	.65**	.39*	.41*	.67**	.51**	.36	(.84)			
12. Performance 3	2.55	.54	.12	.56**	.54**	.01	.56**	.61**	.29	.70**	.66**	.40	.67**	(.87)		
13. Protocols 2	0.43	.83	–.32	–.07	–.26	–.09	.07	–.11	.07	.23	–.10	–.25	.27	–.09	(.79)	
14. Protocols 3	0.73	.93	–.20	–.06	.30	–.28	–.17	–.15	–.11	–.08	–.10	–.24	.01	.03	.56**	(.92)

NOTE: Alpha coefficients are reported in parentheses in the diagonal.
*$p < .05$. **$p < .01$.

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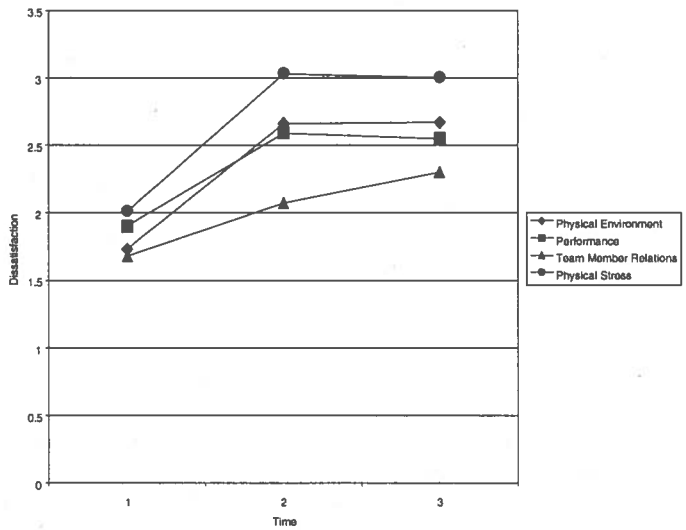

Figure 3: Employees' Mean Levels of Satisfaction With the Physical Environment, Physical Stress, Team Member Relations, and Performance Over Time

showed a significant difference in respondent scores from Time 1 to Time 2, $t(25) = -5.63$, $p < 0.01$, and from Time 1 to Time 3, $t(22) = -5.09$, $p < 0.01$. These results indicate that the employees were significantly less satisfied with the physical stress of the open office design. Once again, this dissatisfaction did not abate from Time 2 to Time 3, suggesting that "adaptation" had not occurred.

The main effect of time was significant for the Team Member Relations subscale, $F(2, 40) = 11.74$, $p < 0.01$, $\eta^2 = .37$. Follow-up paired comparisons, using a Bonferroni alpha correction of 0.02, showed a significant difference in respondent scores from Time 1 to Time 2, $t(21) = -3.58$, $p = 0.001$, and from Time 1 to Time 3, $t(21) = -3.85$, $p = 0.001$. The results indicate that employees were significantly less satisfied with team member relations in the open office design. Furthermore, employees' dissatisfaction with team member relations in the open offices did not lessen after the participants had been in their new offices for 6 months.

The main effect of time was significant for the Performance subscale, $F(2, 40) = 36.22$, $p < 0.01$, $\eta^2 = .64$, for the three time periods. Follow-up paired comparisons, using a Bonferroni alpha correction of 0.02, showed a signifi-

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cant difference in respondent scores from Time 1 to Time 2, $t(25) = -6.16, p < 0.01$, and from Time 1 to Time 3, $t(21) = -5.64, p < 0.01$. These results indicate that the employees were significantly less satisfied with their perceived job performance in the open office design. Once again, this dissatisfaction did not lessen over the course of this investigation.

A paired t test was conducted to analyze whether the establishment and use of protocols had changed after employees had been in the new offices for 6 months. The main effect of time was not significant for protocol use, $t(25) = -1.62, p = .12$, from Time 2 to Time 3. The response frequencies for Time 3 reveal that the majority of the employees reported no protocols existed.

DISCUSSION

The data show that in all categories and for most questions, employees appear to be negatively affected by the relocation to open offices, reporting decreases in their satisfaction with the physical environment, increases in physical stress, decreased team member relations, and lower perceived job performance. These results clearly indicate that not only was there an initial decrease on these dimensions but also that this dissatisfaction did not abate over time. In fact, satisfaction with team member relations was lowest after the employees had been in the new location for 6 months. This indicates that the employees did not adapt to the new office environment but rather continued to find the increase in the number of disturbances and distractions counterproductive.

The results are consistent with those from case studies by Hedge (1982) and Sundstrom et al. (1980), in which increased environmental openness and accessibility were related to increased disturbances and decreased privacy. Sundstrom et al. found that employees with the most demanding jobs were most negatively affected by the conditions of the open office, as they were most likely to require privacy and quiet to perform their jobs; however, the researchers also found that for all types of jobs studied, participants generally preferred privacy over accessibility. Sundstrom et al. also found a positive correlation between privacy and performance, even among those employees with the least complex jobs.

The findings of this study should be interpreted in light of recent research by Marans and Yan (1989), Sundstrom et al. (1994), and Spreckelmeyer (1993), which suggest that small-scale attributes such as lighting at the workstation, size of individual work surfaces, office privacy, and noise account for incremental variance in employees' satisfaction with their work environment

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above and beyond office design alone. Marans and Yan concluded that office design does not contribute to our understanding of why some workers in open offices are satisfied with their workspaces whereas others are not and suggest that the degree to which open offices are successful will depend largely on specific space considerations, including adequate storage and work surface areas. However, in this study, analyses of individual items assessing noise, lighting, adequacy of work surface area, and adequacy of storage area indicate no significant differences in employees' satisfaction with these office characteristics following the relocation to open offices.

Previous research indicates that the most frequently reported disturbances in open offices are from the behavior of coworkers rather than from office machinery (Hedge, 1982). This would suggest that open office protocols may be helpful in controlling the behavior of coworkers and decreasing the number of disturbances. Hedge recommended "educating the users of open-plan offices on how to behave in, work in, and generally use it to maximum benefit" (p. 539). The data from the present study also emphasize the lack of established protocols in the new open offices, with the majority of employees reporting that no protocols had been established. Furthermore, the results show that this has remained constant over the course of the study, with no protocols having been established even after 6 months in the open offices. An interesting follow-up to this study would be to train the employees in the use of open office protocols to assess if their subsequent levels of environmental satisfaction improve.

The findings are particularly interesting in light of the fact that advocates of open offices contend that they facilitate communication, particularly among team members located in proximity to one another (Allen & Gerstberger, 1973; Hundert & Greenfield, 1969; Ives & Ferdinands, 1974; Zahn, 1991). However, the results of this study are consistent with those of Sundstrom et al. (1980), Cohen (1978), and Sundstrom (1986) and suggest that open offices do not facilitate communication among coworkers. In fact, employees often feel that open office designs decrease communication because they prohibit confidential conversations.

The primary complaints listed by employees were lack of privacy and confidentiality and increased noise. Therefore, we recommended to the organization that additional break out rooms for private conversations, meetings, and phone calls be provided. Second, we recommended that open office protocols be established and their practice be encouraged to assist employees in adapting to the new office design. Last, we recommended that additional

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space be provided to those employees who had reported their work and storage areas were inadequate. Research by Spreckelmeyer (1993) and Marans and Yan (1989) suggested that the amount of working surface, storage areas and space, and ambient office space are predictive of employee satisfaction with the office environment. Moreover, the perceived adequacy of office space was found to be more important than the actual amount of space provided to employees.

Several limitations of this study must be mentioned. The first is the small sample size and the attrition of participants throughout the investigation. Although there were no apparent differences between those employees who returned all three surveys and those who returned only one or two, this possibility cannot be ruled out. Had a larger sample size been obtained, the results may have been different. At minimum, the power of the analyses was limited due to the restricted sample size. The effect sizes indicate, nonetheless, that the statistically significant results have practical utility, with the variance accounted for in the dependent measures ranging from 37% to 64%.

A second limitation of the study was the lack of objective measures. All the data gathered were strictly based on self-reports of employee perceptions of performance and satisfaction. It would, of course, be preferable to have been able to compare employees' perceptions to hard data such as performance appraisals by supervisors or sales figures. Unfortunately, these data were not available due to organizational constraints. Without this information, it is impossible to assess if employees' dissatisfaction with the new environment is directly affecting their productivity.

One final limitation of this study is the lack of a control group. As this investigation was a field study, there are many possible intervening variables that may have been in operation. Once again, it unfortunately was not possible to obtain these data. Therefore, it cannot be stated for certain if the changes observed in satisfaction were solely due to the new open office environment or if other organizational events may have also influenced the findings. Despite these limitations, this study is important for two reasons. First, as a field study, the individuals surveyed were those working in real jobs in actual offices. Second, the longitudinal research design assessed both the immediate and the long-term consequences of moving from private offices to open offices. This allows for the impact of the immediate change to be disentangled from the long-term impact of the open office design on employee satisfaction with the physical environment and their perceived job performance.

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APPENDIX
Survey

Indicate the extent to which you agree with each of the following statements:

Performance

1. The general office layout facilitates team work.
2. I am able to stay focused and "on task" at work.
3. Formal client (including internal employee) feedback about my work is positive.
4. There are places for me to go to have privacy.
5. I have easy access to information that I need to do my work.
6. I am able to be productive in my present workspace.
7. I am easily distracted by others' conversations (reverse coded).
8. I am able to meet my personal performance goals and objectives.
9. Peer feedback about my work is positive.
10. I am able to maintain my knowledge about new technology.
11. I can easily accommodate a drop-in visitor at my workspace.
12. I am able to deal effectively with unanticipated problems.
13. Informal client (including internal employee) feedback about my work is positive.
14. I am able to complete my planned tasks for the day.
15. I have easy access to equipment that I need to do my work.
16. It is easy to have a one-on-one conversation at my workspace.
17. I am located close to people I need to talk with in my job.
18. I am able to meet deadlines.
19. Leader and/or supervisor feedback about my work is positive.
20. My group/team works cohesively.

Team member relations

1. I really feel I am part of my team.
2. It is easy to ask advice from anyone here.
3. I look forward to seeing the people at work each day.
4. I like having the team leaders located with the rest of the team.
5. My team members approach me when needed.

Physical environment

1. I feel personally safe coming to and going from work.
2. I have enough storage space at my workspace.
3. Personnel traffic corridors are well defined.
4. I have enough work surface area at my workspace.
5. I am able to take a break away from the office (e.g., at lunch).
6. Confidential and/or sensitive information is handled well in the present office layout.

Physical stressors

1. The lighting is appropriate.
2. Noise (e.g., phones, other people talking, ambient background) is not bothersome.

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3. The air quality (ventilation) is adequate.
4. The air temperature is appropriate.
5. There is enough natural light at my workspace.

Looking at the following protocols regarding working in an open-air environment indicate

1. whether the protocols have been established in your work area, and
2. if they have, to what extent you would agree that they are always followed.

Protocols

1. face to face conversational noise
2. telephone conversational noise
3. meeting noise
4. use of "breakout rooms"
5. use of social spaces and/or common areas
6. odors (e.g., food, cologne, perfume)
7. appropriate traffic flow for workers and/or visitors
8. respecting the privacy of others
9. use of radios
10. personal space "markers" (e.g., plants, photos, posters)
11. borrowing materials (e.g., manuals)

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