Adaptations and Coping: Occupant Response to Discomfort in Energy Efficient Buildings

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This paper describes results of a post-occupancy evaluation of seven new energy efficient buildings in the Pacific Northwest. The research looked at how occupants coped with thermal, lighting, acoustical and air quality discomfort and whether these efforts were successful in reducing discomfort. Coping responses included environmental alterations (e.g., close the drapes, add a fan), changes in behavior (adjust clothes, go outdoors), and psychological processes (just put up with it, try to ignore the problem). The particular kind of coping process occupants engaged in was a function of: (1) the type of discomfort encountered (e.g., sun brightness versus office noise), (2) the type of workspace (e.g., private office versus partitioned cubicle), and (3) the controllability of the environment. The data analysis shows that changes in one's behavior and psychological coping processes were widespread, compared to adjusting the environment. However, behavioral and psychological coping were not very successful in alleviating discomforts and environmental problems. For instance, psychological coping predominated for noise, ventilation, and air quality problems. Yet, the coping success (e.g., the ability to successfully resolve the problem) was lowest for these discomforts. Coping success was highest for problems with sun warmth and brightness, both of which were resolved readily by closing drapes for a period of time. Coping success was high, in general, for occupants of private offices and others who had some degree of control over the ambient environment. Data analysis also shows that occupants frequently alter the original environment to make it more comfortable for their own needs. Alternations included the addition of fans, desk lamps, removing some of the ceiling lamps, and covering up or over-riding automatic daylighting control sensors -- all of which have energy implications. Over half of the 264 occupants in the study also added wall decor, plants, and personal artifacts to enhance the psychological comfort of their workspace. The high degree of occupant changes in their immediate environments suggest that building designers and engineers should provide greater opportunities for personal control over ambient conditions and/or more variability in interior conditions coupled with opportunities for self-selection of desired workspace location.

Introduction

Researchers have long known that building ambient environments are not always comfortable. Extensive studies have found that as many as half of building occupants are dissatisfied with thermal, acoustical, lighting, or air quality conditions in their buildings (Schiller and Arens 1988; Vischer 1989; Cowling, Coyne and Bradley 1990; Brill, Margulis, and Konar 1984,85; Marans 1987).

Despite the growing literature on ambient satisfaction and comfort, very little is known about how people cope with discomforts. How do they normally go about making themselves warmer or cooler? What do they do when there is too little ventilation or too little (or too much) light in their environments? Do their tactics and tinkerings work? Are they able to create more comfortable and satisfying conditions? What happens if their actions don't work?

These are some of the questions that were pursued in a post-occupancy evaluation of seven commercial office buildings in the Pacific Northwest (Heerwagen, Loveland, and Diamond 1991). The buildings were part of the Bonneville Power Administration's Energy Edge Program, a large scale research and demonstration project. BPA initiated the Energy Edge program to investigate whether commercial buildings could be designed and constructed to use 30% less energy than they would if they had been designed and constructed according to the Model Conservation Standards developed by the Northwest Power Planning Council (Diamond et al. 1990). The Energy Edge program involved researchers from numerous university and national laboratory settings, as well as engineers and others in private practice.

Coping: A Theoretical Perspective

Decades of research on stress and coping have focused primarily on the psychological and social issues (Lazarus and Folkman 1984) or on specific kinds of occupational and ambient stressors such as air pollution, airport noise and crowding (Evans, 1982; Campbell, 1983; Cohen, Evans, Stokols, and Crontz, 1986). Relatively little attention has been paid to the building environment, particularly to the ways in which people deal with the many environmental discomforts and irritations that may surface as they go about their work. The lack of research on environmental hassles and stressors at work is surprising, given the increased interest in occupational health issues (Karasek and Theorell 1990; Donatelle and Hawkins 1989; Beehr and Newman 1978).

Coping is defined as a response to a perceived stressor; a stressor can be of social, physiological or environmental origin and can range from a catastrophic event (death of a spouse) to small scale recurring events ("hassles"). The coping process is an important aspect of the person-environment interface. As such, it is likely to have an impact on people's work performance as well as their physical and mental well-being. Coping behaviors can be divided into three general classes: (1) behaviors aimed at changing the situation in some way (environmental coping); (2) changes in one's own behavior (behavioral coping); or (3) attempts to adjust to a situation by managing emotions or thoughts about the situation (emotional/psychological coping). The kinds of coping strategies used in a given situation are a function of individual differences in personality or experience as well as characteristics of the situation (Coelho, Hamburg, and Adams 1974; White 1974; Pearlin and Schooler 1978). Research on stress indicates that people tend to use a number of different coping approaches rather than just one (Lazarus, 1966; Baum, Singer, and Baum, 1983).

One of the major issues in environmental stress research is to identify the features of environments that tend to elicit different kinds of coping processes. It is generally considered "more adaptive" and "healthier" for people to exert control over the environment (that is, to engage in environmental coping) when the opportunity exists to do so (Cohen, Evans, Stokols, and Krontz 1986). Environmental conditions that are uncontrollable are likely to lead to more accommodation and emotion-focused coping processes (Lazarus and Cohen, 1977). Uncontrollable environmental demands are frequently associated with negative moods, performance decrements on complex tasks, negative social behavior, decreased motivation and a sense of hopelessness (Baum, Singer, and Baum 1982; Cohen 1980; Seligman 1975).

Negative effects may occur for low level, "mini-stressors" and daily hassles as well as for high intensity stressors (Evans and Cohen 1987). Many ambient conditions in buildings -- such as noise intrusions, lack of acoustical privacy, glare, uncomfortable temperatures -- fit the category of "daily hassles". As such, they are worthy of more attention from the building science research community. The research described in this paper looked at how occupants in seven Energy Edge buildings coped with ambient "hassle" they experienced in their work spaces.

Methods

The Survey Instrument

The primary study instrument was a 27-page Workspace Satisfaction Survey that assessed occupants' responses to the thermal, lighting, acoustical and air quality aspects of the environment. The survey gathered information on how frequently occupants perceived various problems (such as warm or cold discomfort, stuffy air, glare, reflections on the computer screen and so forth). We also assessed how bothersome the problems and discomforts were and how much they interfered with work. For each of the major problems encountered, occupants were asked to note how they coped with the problem and whether or not their coping efforts were successful.

The coping measure was a check list of items such as "I closed the drapes", "I drank something hot" and so forth. The items were selected to include three categories of response: (1) changes in the environment; (2) changes in one's behavior; and (3) changes in how one thinks or feels about the problem (e.g., "I tried to ignore it and concentrate harder on my work"). The occupants were asked to check all coping behaviors that they engaged in.

Subjects

A total of 268 subjects in seven buildings completed the survey. The sample included 122 males and 146 females whose jobs were broadly distributed across categories from "director" to "receptionist". Response rates ranged from 40% to 94%. The buildings with the highest response rates (88%, 94%, and 90%) were designed for specific clients in mind and had extensive occupant input into the design process. The buildings with the lowest response rates (40%, 43%, and 48%) housed professional groups such as lawyers, engineers, and an advertising firm. Even though the response rate was low in these buildings, the sample includes subjects from all job categories and from all locations within the building (e.g., private, corner offices as well as interior, partitioned spaces).

All surveys were delivered by the research team in person. The site visit was preceded by a letter sent to each building occupant explaining the purpose of the study and soliciting their involvement. Each survey was identified with a particular workstation so that we could locate each respondent on a floor plan (and thus facilitate analysis of the effect of workspace location).

Results

Our survey data show that the majority of occupants have modified their work environment: 65% of the occupants added personal artifacts, 56% decorated their walls, and almost half added plants. Furthermore, 21% added a desk lamp, 16% added a space heater, and 6% added fans. Field analyses also indicated that many occupants partially delamped their ceiling fixtures, and in all buildings with daylight controls, the control system was made inoperable. In open-ended comments, occupants said that they did not like the automatic daylight controls because they were distracting and because the light seemed too dim when the controls turned the electric lights off.

As can be seen in Table 1, the numbers of different coping behaviors used depended upon the particular discomfort encountered. Only 2% of the sample used three or more coping responses for sun brightness, in comparison to more than 50% who used three or more different responses to thermal discomforts. As will be shown later, the number of different coping behaviors one engages in seems to be related to the ease with which environmental changes can be made (e.g., closing the drapes when the sun is too bright).

Coping with Thermal Discomfort

The experience of cold discomfort varied across buildings, from a high of 88% in one building to a low of 36%. Warm discomfort varied from a low of 26% to a high of 67%. Almost 40% of the occupants who experienced thermal discomfort said it interfered with their work.

Tables 2 and 3 show how occupants responded to cold and warm discomfort. As can be seen, the highest percentage of occupants responded to thermal discomfort by adjusting their behavior in some way (e.g., adding or taking off clothing, drinking something hot or cold). Changes in the environment were less frequent. Interestingly, however, two environmental changes -- using fans and heaters -- are occupant-introduced solutions which have potential energy implications. It is also apparent that behaviors oriented toward the window are frequent ways to reduce thermal discomfort, such as opening a window when it is too warm or closing the drapes if heat is due to sun gain. In the one building that had numerous thermostats, occupants were far more likely to change the thermostat setting than they were to open windows or to change their own behaviors.

It is worth noting that 20 to 25% of the occupants responded to thermal discomfort by coping psychologically -- that is, by "just putting up with it" or

Table 1. Percent of Occupants Using Three or More Coping Behaviors for Different Problems

Cold discomfort	53%
Air quality problems	37%
Ventilation problems	25%
Sun warmth	30%
Sun brightness	2%
Noise	2%

Table 2. Coping with Cold Discomfort

	Percent Using
Changes in the Environment	
Use a space heater	26%
Adjusting thermostat	25%
Close the drapes	7%
Close door/window	5%
Change in Behavior	
Adjusting clothes	49%
Drink something	47%
Contact staff person	30%
Talk to co-workers problem	27%
Walk around to warm up	16%
Move to another space	10%
Emotional/Psychological Processes	
Just put up with it; there's nothing I can do	20%
Try to ignore the problem and concentrate harder on work	18%

Table 3. Coping with Warm Discomfort

	Percent Using
Changes in the Environment	
Close the drapes	35%
Open a door/window	17%
Adjust thermostat	25%
Add fan	20%
Change in Behavior	
Adjusting clothing	59%
Drink something cold	40%
Contact staff person	27%
Talk to co-workers	25%
Go outdoors for a while	20%
Move to another space	11%
Emotional/Psychological Processes	
Just put up with it; there's nothing I can do	23%
Try to ignore the problem and concentrate harder on work	19%

"trying to ignore it." This "solution" is the least likely to resolve the problem, and may contribute to employee dissatisfaction with work over the long term. We are not able to ascertain from our data whether people who engaged in psychological coping did so because other options weren't available or because their other attempts to cope didn't work.

Coping with Sun Warmth and Brightness

Slightly over 40% of the occupants said they experienced the sun as too bright at least sometimes, and 33% said the sun was too warm. Approximately 40% who experienced sun brightness said it interfered with their work, compared to 30% who experienced excessive solar warmth.

Almost 80% of the occupants who experienced discomfort from the sun responded by closing the window blinds. More than a third also "drank something cold" in response to sun warmth. In the one building that did not have operable window blinds, occupants tended to engage in more psychological coping or to move elsewhere when the sun was excessively bright or warm.

Coping with Video Display Terminal (VDT) Reflections

With the exception of one building, more than 60% of the occupants said they experienced VDT reflections from both windows and ceiling lights and 70% said that the reflections interfered with their work. Occupants coped with reflections in a variety of ways: 10% said they dimmed the lights, 47% closed drapes or blinds; 48% moved the computer screen; and 49% changed their position at the computer.

Coping with Acoustical Problems

Acoustical problems were experienced in all Energy Edge buildings. More than 40% of the occupants were dissatisfied with noise conditions, particularly those who were not in private offices where they could close the door to block out unwanted sounds, primarily from phones and conversations.

Across buildings, more than 70% of the occupants said they were bothered by coworkers' conversations and more than half said that telephones were bothersome. Almost 40% said that acoustical problems interfered with their work. Although this situation is not directly related to energy issues, acoustical problems in the Energy Edge buildings were related to daylight design strategies and passive solar building designs that require large open spaces to allow heat, air (and noise) to circulate freely. Also, the use of exposed hard surfaces for both thermal storage and daylight reflection exacerbated acoustic problems.

Compared to other ambient problems, there seemed to be little occupants could do about noise. Only 21% said they could close a door; 60% said they tried to ignore the problem, and 48% said they "just put up with it." Only 16% said they asked their coworkers to be quiet.

Coping with Air Quality Problems

Over 60% of the occupants across buildings said they were satisfied with air quality. The biggest problems were stuffy air (34% experienced), stale smelling air (22%), unpleasant smells (24%), and too little ventilation (33%). Only one building had problems with smoky air, and this was related to occupants' smoking outdoors near windows or open doors. All buildings had policies prohibiting smoking indoors. Although air quality problems were not frequently experienced, when they did occur, people

coped primarily by going outdoors for a while (13%), just putting up with it (10%) or opening a door or window (8%). Air quality problems existed more for occupants in partitioned workspaces: 40% of the occupants in these spaces said they experienced problems with air quality compared to 24% in both private offices and totally open workspaces.

The Costs of Coping

Although coping behaviors are generally expected to improve one's situation, there may be times when coping is ineffective or even detrimental to well-being. For instance, the response to VDT reflections may improve the visibility of the computer screen, but may also have side effects such as muscular strain, back aches, and negative mood (see the National Academy of Sciences, 1983). The coping item "I try to ignore the problem and concentrate harder on my work" suggests an effortful endeavor which may be both difficult and fruitless. That is, it is not likely to resolve the problem. Yet, this response was selected by almost a fifth of the occupants who experienced thermal discomfort and by 60% of the occupants who experienced bothersome noise, especially conversations. Preliminary analysis of health outcome data show that occupants who engaged in psychological/ emotional coping were more likely to experience headaches than were occupants who used other coping measures. The coping data also show that a number of occupants engage in avoidance or escape behaviors, such as going outdoors, working elsewhere, or walking around. Although these efforts may result in temporary respite, the problem will still exist.

Does Coping Work?

Occupants were asked how frequently their coping actions produced a more satisfactory condition. As can be seen in Table 4, responses varied across situations. Coping strategies were least successful for air quality, ventilation, and noise problems and most successful for sun problems. As was noted above, sun brightness and warmth were most readily resolved by environmental coping. Other problems, such as noise and air quality elicited more behavioral or psychological coping that does little to change environmental conditions.

Analysis of the relationship between coping and environmental satisfaction show significant relationships between warm coping success and overall thermal satisfaction ($r=.42$, $p=.001$) and between cold coping success and overall thermal satisfaction ($r=.28$, $p=.01$). There were no significant correlations between sun coping and lighting satisfaction or between air quality coping and air quality satisfaction.

Table 4. Ratings of Frequency of Coping Success

	Never/ Rarely	Usually/ Always
Warm discomfort	14%	57%
Cold discomfort	13%	56%
Too little ventilation	28%	49%
Air quality problems	43%	31%
Noise problems	32%	42%
Sun warmth	8%	79%
Sun brightness	6%	89%
Screen reflections on screen computer	8%	75%

Coping in Different Settings

Because occupants of private offices frequently can operate window blinds, open or close windows, operate lighting, and rearrange furniture, they should be more likely than occupants of other types of workspaces to engage in coping behaviors aimed at the environment and less likely to engage in psychological coping. To test this prediction, we recombined the coping behaviors into three categories -- environmental coping, behavioral coping, and psychological coping. Analysis of variance conducted on the mean number of coping behaviors used by occupants in the different workspace types shows that occupants in private offices used an average of 3.25 environmental coping actions, compared to a mean of 2.34 for occupants of partitioned workspaces and 1.9 for those in totally open spaces ($F=4.32$, $p=.01$). Analysis of psychological coping responses shows that occupants of partitioned workspaces engaged in the most psychological coping (ave. =3.28), compared to 1.9 for occupants in private offices and 2.13 for those in open workspaces ($F=6.82$, $p=.001$). There were no differences among the workspace groups in behavioral coping.

Discussion

To summarize what we have learned in this study:

(1) People tinker a lot with the ambient environment at their work stations;

(2) Many of the adjustments people make in ambient conditions are relatively simple (opening/closing blinds, turning lights on/off; adding lamps, fans or heaters);

(3) Most of these changes are likely to provide rapid and noticeable changes in the environmental conditions a person experiences at his/her work station (e.g., increase of decrease in light levels, air movement from the fan, heat from the heater);

(4) In addition to adjusting features of their environment, many occupants also added fans, heaters, and lamps to their work areas to enhance personal comfort;

(5) Coping behaviors such as drinking something hot/ cold, going outdoors, walking around, talking to coworkers about the problems are less likely to relieve the problem quickly or to create as noticeable a change as environmental manipulations; these behaviors are, however, widely used and may serve important functions other than comfort maintenance (e.g., muscle movement and relaxation, social interactions);

(6) Psychological coping (e.g., ignoring the problem or trying to concentrate harder on work) is unlikely to be effective because it doesn't address the problem, but rather tries to force an adaptation to existing problems. Psychological coping seems to occur more often when environmental manipulations are not possible, when other actions are not effective in reducing comfort, or when the "cost" of appropriate action is too high (such as when occupants refrain from asking coworkers to be quiet -- even in circumstances when conversations are very bothersome). Furthermore, there is some indication that psychological coping is associated with increased incidence of headache and other minor health complaints.

These data have important implications for energy conservation strategies in buildings. In the first place, the coping data suggest that comfort maintenance is a highly reflexive behavior rather than a cognitive, problem-solving process. People who are uncomfortable want quick and easy solutions to the discomfort, and do not want to spend a lot of time and effort. From an evolutionary point of view this makes perfect sense (Fagan 1990). The developing human species spent almost 3 million years in natural environments where comfort maintenance was a common and important part of every day life. When our hunting and gathering ancestors were too cold, they moved closer to the fire or added another layer of animal furs; when too warm, they sought the shade of a tree or the coolness of a rock outcropping. When the weather was foul they sought shelter in a cave or whatever makeshift place was available. Comfort maintenance was something they just *did* quickly and easily. This left their minds free to worry about things that really mattered -- like where the next meal was coming from or how to divide a mammoth carcass among members of the group or how to resolve a conflict with one's hunting partner.

We are not so very different today, even though we seek our needs in quite different settings. We still want rapid, easy solutions to discomfort problems. We don't like when discomfort interferes with matters that need our attention. And when the environment, as provided for us, does not allow comfort control, we often take matters into our own hands, by adding heaters, fans, or desk lamps. As was noted in the results section, many occupants also delamped the lighting fixtures in their office spaces and/or covered up the automatic daylighting controls because they didn't like the sudden and frequent change in lighting conditions that resulted when the overhead lights were turned off. Occupants' comments about the daylighting controls also suggests that people may prefer to change conditions themselves, rather than have the building "decide" what to do.

The results of interviews with occupants in one of the small Energy Edge buildings (a doctor's office), further support the suggesting that people want quick and easy solutions to discomfort. The building had a programmable thermostat that, theoretically, would allow fine control over thermal conditions. However, no one understood how to use the thermostat. Despite repeated help from the BPA Energy Edge team, thermal conditions in the building could not be adequately controlled.

Although the "take-home" message of this study and other research on environmental control seems to imply that more control will lead to greater satisfaction, this conclusion may not be warranted.

Control may actually be a negative experience if: (1) people need to make too many control decisions; (2) they need to make decisions too often, or (3) the controls are too complicated and/or require too many steps. We know very little at this point about what kind of control is most effective in solving discomfort, how to implement the control, and what effect control has on work performance, work satisfaction, or energy consumption in buildings.

Research by Paciuk (1990) also raises the important issue of "perceived" versus "actual" control over thermal conditions. She found that "perceived" control over the

thermal environment was associated with comfort and satisfaction. However, if occupants needed to actually exercise control in order to make themselves more comfortable, satisfaction and comfort ratings were lowered.

Given the current interest in workstations that allow a high degree of occupant control over lighting, temperature, air flow, and acoustics (through the use of white noise generators), it is worthwhile asking if this is the right direction to take. In addition to problems that could result from dissatisfaction with having to exercise too much control, another has to do with the impact of having control so close at hand. Will we be creating a new sociological phenomenon -- the "desk potato" -- who, like his better known cousin, the "couch potato", will spend his days flipping switches and working dials instead of getting up and moving around when he is too cold, or getting a cup of coffee or talking to coworkers? As was shown in our study, people engage in a number of such behaviors that do not directly solve comfort problems, but which nonetheless provide large muscle movement, relaxation, and social interaction that may not directly solve comfort problems, but which, nonetheless, may have important mental, muscular-skeletal, or social benefits. Researchers in occupational stress are concerned with the social isolation that already exists in work environments (Karasek and Theorell, 1990). Will this problem be exacerbated by creating opportunities for people to manipulate the ambient conditions at their workspace without leaving their chairs?

One question that remains unanswered is: What are people trying to accomplish when they manipulate the environment? Several studies suggest that occupants are not necessarily trying to maintain a desired level of comfort when they adjust their environment. For instance, research by Rubin, Collins, and Tibbott (1978) found that occupants in several buildings adjusted their window blinds in a certain way and left them in that position; thus, they did not seem to be making adjustments according to daily changes in sun or light. Hunt (1978) found similar results with electric light use. People in his office study tended to turn the lights on when they arrived at their offices and to keep them on all day, regardless of the amount of daylight entering the room.

We need to begin asking if there are other ways to enhance ambient comfort without providing such a high degree of control? One possible strategy that has not been exploited by building designers and managers is to provide comfort "zones" that differ in their lighting, thermal, and air movement characteristics. People could then work in the zones that appealed most to them at a particular time. This strategy may be particularly appealing if it were coupled with office designs that eliminate private workspaces and encourage occupants to work where they wish. With increasing numbers of people telecommuting, office designers are concerned with the economics of unused space that results when people work at home or are away from the office for long periods each day.

Another possible solution to comfort problems would be to assign people to work areas on the basis of their ambient preferences, rather than on seniority or status as is common practice now. Thus, people who prefer to have a warm environment or a brightly lighted space could be assigned to these spaces rather than to cool, dimly lighted spaces. Data from our Energy Edge study indicates that people do have preferred thermal and lighting conditions. A person-environment matching strategy would require much more knowledge about people's environmental preferences and desired levels of stimulation than now exists. Perhaps, though, we could all take a lesson from Goldilocks and begin to recognize the inherent differences that exist among people as well as among bears.

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Bibliography

Baum, A., J.E. Singer, and C. Baum. 1982. "Stress and the Environment." In G.W. Evans, ed., *Environmental Stress*. Cambridge University Press, New York.

Beehr, T.A. and J.E. Newman. 1978. "Job Stress, Employee Health and Organizational Effectiveness: A Facet Analysis, Model and Literature Review." *Personnel Psychology*, 31:665-699.

Brill, M., S. Margulis, and E. Konar. 1984. *Using Office Design to Increase Productivity*. Volume 1. Buffalo Organization for Social and Technological Innovation, Inc. Buffalo, NY.

Brill, M., S. Margulis, and E. Konar. 1985. *Using Office Design to Increase Productivity*. Volume 2. Buffalo Organization for Social and Technological Innovation, Inc. Buffalo, NY.

Campbell, J. 1983. "Ambient Stressors." *Environment and Behavior*, 15:355-380.

Coelho, G.V., D.A. Hamburg, and J.E. Adams, eds. 1974. *Adaptation and Coping*. Basic Books, New York.

Cohen, S. 1980. "After Effects of Stress on Human Performance and Social Behavior: A Review of Research and Theory." *Psychological Bulletin*. 88:82-108.

Cohen, S., G.W. Evans, D. Stokols, and D.S. Krontz. 1986. *Behavior, Health, and Environmental Stress*. Plenum, New York.

Cowling, I., S. Coyne, and G. Bradley. 1990. *Light in Brisbane Office Buildings -- A survey*. Research Report, Center for Medical and Health Physics, Queensland University of Technology, Brisbane, Australia.

Diamond, R.C., J.P. Harris, O. deBuen, B. Nordman, and B. Cody. 1990. "Evaluating Actual Performance of New Commercial Buildings: The Energy Edge Demonstration Program." *Proceedings from the ACEEE 1990 Summer Study on Energy Efficiency in Buildings*, vol 3. American Council for an Energy Efficient Economy, Washington D.C.

Donatelle, R.J., and M.J. Hawkins. 1989. "Employee Stress Claims: Increasing Implications for Health Promotion Programming." *Stress Management*. 3(3): 19-25.

Evans, G., ed. 1982. *Environmental Stress*. Cambridge University Press, New York.

Fagan, B. 1990. *The Journey from Eden: The Peopling of our World*. Thames and Hudson, London.

Heerwagen, J., J. Loveland, R.C. Diamond. 1991. *Energy Edge Post-Occupancy Evaluation Project: Final Report*. Bonneville Power Administration, Portland, Oregon.

Hunt, D.R.G. 1978. "The Use of Artificial Lighting in Relation to Daylight Levels and Occupancy." *Building and Environment*. Vol. 13: 21-33.

Karasek, R. and T. Theorell. 1990. *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life*. Basic Books, New York.

Lazarus, R.S. 1966. *Psychological Stress and the Coping Process*. McGraw-Hill, New York.

Lazarus, R.S. and S. Cohen. 1977. "Environmental Stress." In J. Wohwill and I. Altman, eds., *Human Behavior and the Environment*. Plenum, New York.

Lazarus, R.S. and S. Folkman. 1984. *Stress, Appraisal and Coping*. Springer, New York.

Marans, R.W. 1987. "Evaluating Office Lighting Environment." *Lighting Design & Application*, August: 32-36.

Paciuk, M. 1990. "The role of Personal Control of the Environment in Thermal Comfort and Satisfaction at the Workplace." In R.I. Selby, K.H. Anthony, J. Choi, and B. Orland, eds., *Coming of Age, EDRA 21*. Environmental Design Research Association, Washington D.C.

Pearlin L.I., and C. Schooler. 1978. "The Structure of Coping." *Journal of Health and Social Behavior*. 19:2-21.

Rubin, A.I., B.L. Collins and R.L. Tibbott. 1978. *Window Blinds as a Potential Energy Saver -- a Case Study*. BSS 112, U.S. Department of Commerce, NBS.

Schiller, G.E. and E.A. Arens. 1988. "Thermal Comfort in Office Buildings." *ASHRAE Journal*, October: 26-32.

Seligman, M.E.P. 1975. *Helplessness*. Freeman, San Francisco.

Sweitzer, G. 1990. *Daylighting Potentials for VDU Office Workplaces in Sweden: A Pilot Study*. The Royal Institute of Technology Report 890669-5. Stockholm, Sweden.

White, R.W. "Strategies of Adaptation: An Attempt at Systematic Description." In G.V. Coelho, D.A. Hamburg, and J.E. Adams, eds., *Adaptation and Coping*. Basic Books, New York.

Vischer, J. 1989. *Environmental Quality in Offices*. Van Nostrand Reinhold, New York.