Construction Engineering
Research Laboratory

US Army Corps
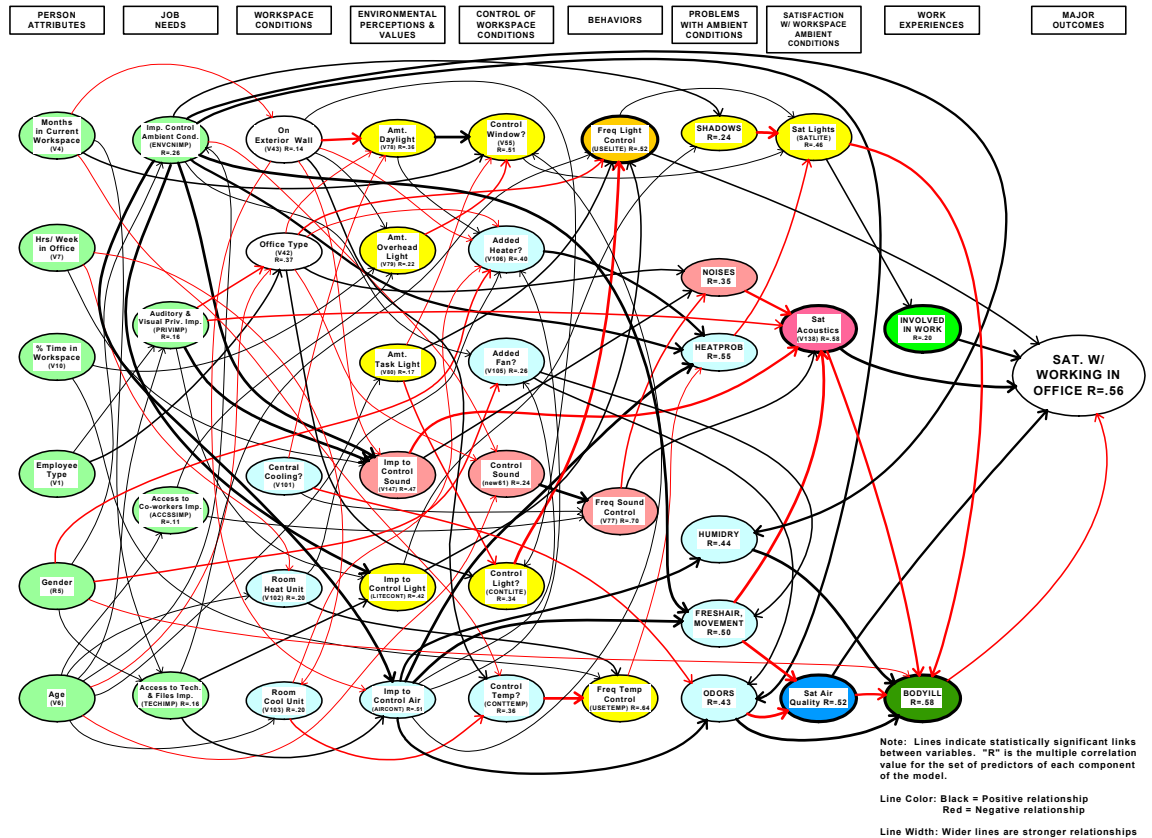of Engineers ®
Engineer Research and
Development Center

Assessing the Relationship Between Worker Productivity and the Indoor Environment

E. Susan Weidemann, Elisabeth M. Jenicek, Debra Brinegar Lister, and Christine Zimmer

March 2003

Note: Lines indicate statistically significant links between variables. "R" is the multiple correlation value for the set of predictors of each component of the model.

Line Color: Black = Positive relationship
Red = Negative relationship

Line Width: Wider lines are stronger relationships

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Final Report

ABSTRACT: In general, work environments (e.g., office buildings) are meant to support the work-related behaviors of employees who inhabit them so the parent organization may better reach its goals ("work outcomes"). Unfortunately, the construction planning process often disregards the effects that building components and utility systems have on building occupants. This study used an employee survey to study the effects of ambient conditions of lighting, temperature and air quality, and acoustics on work outcomes of performance, satisfaction with working in the office, and number of sick days. The evidence clearly showed that, through a path-to-outcomes analysis (path analysis), all these ambient conditions had significant impacts on performance, satisfaction with working in the office, and number of reported sick days.

Contents

List of Figures and Tables

Conversion Factors

Non-SI[*] units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
acres	4,046.873	square meters
cubic feet	0.02831685	cubic meters
cubic inches	0.00001638706	cubic meters
degrees (angle)	0.01745329	radians
degrees Fahrenheit	(5/9) x (°F − 32)	degrees Celsius
degrees Fahrenheit	(5/9) x (°F − 32) + 273.15.	kelvins
feet	0.3048	meters
gallons (U.S. liquid)	0.003785412	cubic meters
horsepower (550 ft-lb force per second)	745.6999	watts
inches	0.0254	meters
kips per square foot	47.88026	kilopascals
kips per square inch	6.894757	megapascals
miles (U.S. statute)	1.609347	kilometers
pounds (force)	4.448222	newtons
pounds (force) per square inch	0.006894757	megapascals
pounds (mass)	0.4535924	kilograms
square feet	0.09290304	square meters
square miles	2,589,998	square meters
tons (force)	8,896.443	newtons
tons (2,000 pounds, mass)	907.1847	kilograms
yards	0.9144	meters

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[*]*Système International d'Unités* ("International System of Measurement"), commonly known as the "metric system."

Preface

This study was conducted for the Directorate of Military Programs, Headquarters, U.S. Army Corps of Engineers (HQUSACE) under Project 4A162784AT45, "Energy Technologies Applied to Military Facilities"; Work Unit FLE-X78, "Energy Efficiency and Productivity." The HQUSACE technical monitor was Joe McCarty, CEMP-ET.

The work was performed by the Energy Branch of the Facilities Division (CF), Construction Engineering Research Laboratory (CERL). The Principal Investigator was Ms. Elisabeth M. Jenicek. Thomas Hartranft is Chief, CF-E; and L. Michael Golish is Chief, CF. The associated Technical Director is Mr. Gary W. Schanche. The technical editor was William J. Wolfe, Information Technology Laboratory-Champaign. The Director of CERL is Dr. Alan W. Moore.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL John Morris III, EN and the Director of ERDC is Dr. James R. Houston.

1 Introduction

Background

In general, work environments (e.g., office buildings) are meant to support the work-related behaviors of the employees who inhabit them so the parent organization may better reach its goals. The goals, or objectives, of an organization may be thought of as work "outcomes." Some typical types of work outcomes are job performance, employee retention, employee health, and employee satisfaction. Unfortunately, the construction planning process often disregards the effects that building components and utility systems have on building occupants, or the consequent impact on work outcomes. For example, past efforts to reduce building energy consumption have sacrificed worker comfort and productivity.

It is critical to any organization to determine the factors or conditions that will allow them to reach more positive levels of work outcomes. The U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC/CERL) was tasked to investigate and evaluate the impact of indoor environmental conditions (e.g., lighting and indoor air quality [IAQ]) on the productivity of office workers in Department of Defense (DOD) buildings. This work was undertaken to determine the office conditions that affect positive work outcomes, particularly in terms of ambient environmental conditions.

Objectives

The objectives of this phase of research were to:
1. Review and revise the survey developed in the pilot study to this work.
2. Use the revised survey to gather new data from a larger sample of employees in various offices at several DOD facilities.
3. Develop a conceptual path-to-outcomes model (defined in the following chapter) of the impact of ambient conditions on the productivity of office workers using previous research and information from the extensive literature review. This model contains a number of potential direct and indirect predictors of work outcomes.
4. Test the conceptual path-to-outcomes model, using the new data set.

Approach

1. Early efforts (during 1996 and 1997) concentrated primarily on gathering information on the impact of building systems on worker productivity from previous research. A literature search was conducted using the computerized index of the University of Illinois at Urbana-Champaign, the Internet, and recommendations from experts in the fields of lighting, thermal control, indoor air quality, and experimental design and analysis. An annotated bibliography was published (Lister, Jenicek, and Preissner, 1998), and served as input for this research.

2. In Phase 1 (the Pilot Research), the researchers developed and carried out a pilot study using previous research as a conceptual base, in which they:
   a. Reviewed research material provided by the government related to research about worker productivity, building systems involved, and sample surveys from the research.
   b. Developed a research strategy for evaluating office workers perceptions and attitudes toward their physical environment, and made recommendations for procedures, data collection, and analysis.
   c. Developed a survey to be administered to office workers.

3. From this information, the researchers developed a draft employee survey, which was distributed to other CERL personnel and additional interested parties. Results from responses to these surveys were analyzed quantitatively as part of the testing procedure (e.g., to examine variability in responses, etc.) Additionally, the respondents to that draft survey provided qualitative information, which was also useful for further modifications to the format, content, and length of the final survey. Based on this information, a revised pilot survey was developed and a research strategy for its deployment and analysis was prepared for Phase 2 of the research.

4. The stage of research and development described in this report involved the collection and analysis of new data from a larger sample of employees in numerous offices at several DOD facilities using the revised survey.

Mode of Technology Transfer

This report will be made accessible through the World Wide Web (WWW) at URL:

> http://www.cecer.army.mil

2 An Outcome Model for the Work Environment

The Path-to-Outcomes Model

A "path-to-outcomes model" is a graphic representation of a set of (hypothetical or data based) relationships, among a number of variables. The development and testing of a path-to-outcomes model can help to determine the relative importance of each variable condition. In this research, the variables are measures of specific physical characteristics of work settings and employee attributes, specific employee perceptions and behaviors associated with the workspace, and important work outcomes such as performance, satisfaction with working in the office, and number of sick days. The particular work environment conditions, employee attributes, perceptions and behaviors, and work outcomes can be thought of as components of the entire set of relationships to be considered.

The paths between the components can be shown either in a conceptual model that contains all the model components in their hypothesized relationships, or as an empirically determined model, based on results of analyses of real data. The empirically determined paths result from multivariate statistical analyses of the data, which have been gathered to measure each component.

Graphically, the potential relationships are shown with the primary outcomes, such as Performance, in the case of work environments, on the far right side of the diagram and with the most specific pre-existing components on the far left. These far left components may be, for example, existing characteristics of the environment (e.g., location of workspace on interior or exterior wall) or attributes of the employees (e.g., age and gender of the employee). Components in between those on the far left and those on the far right are hypothesized to be influenced by those to their left, and to be influences on those to their right. Figure 1 shows a simplified model.
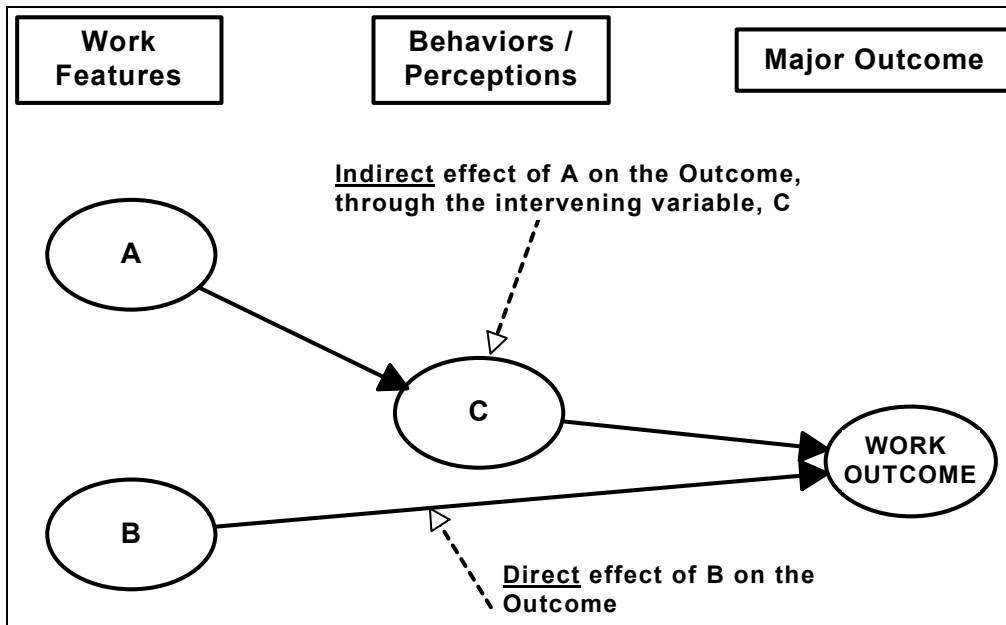
Figure 1. Example of direct and indirect effects on an outcome.

Figure 1 shows how work feature B has a direct impact on work outcome. In contrast, there is no direct linkage between work feature A and work outcome, a finding that could lead one to make the erroneous conclusion that A has no impact on the work outcome. In actuality, A does have an impact, but it is an indirect one, through the intervening condition, variable C. This figure illustrates the importance of measuring and thus being able to find important linkages between work environments and work outcomes.

Figure 1 provides the basis for the development of what can be referred to as a path-to-outcomes model of analysis. By collecting data about the work environment, people's behaviors and perceptions, and their evaluations of important work outcomes, then analyzing which features, behaviors, or perceptions have the most impact on the outcomes, it becomes possible to develop priorities for improvement.

The Value of a Path-to-Outcomes Model

The path-to-outcomes model have two major values: (1) the kind of information that can be learned, and (2) how that information can be used to develop priorities for decisions about the work environment.

Kinds of Information a Path-to-Outcomes Model Can Generate

A Path-to-Outcomes model can help clarify the following information about the components that have a direct impact on the outcome from the analyses used to statistically test the model:

- which conditions/behaviors/work experiences directly impact on the outcome
- whether those impacts are strong or weak
- whether those conditions, behaviors, or work experiences have a positive or negative impact on the outcome.

Appendix A presents additional discussion about this issue of direct impacts.

Following this, one must identify the predictors that have an indirect effect on the outcome, through an intermediate component. This information cannot be adequately determined by the use of simple bivariate correlations. This information is also often quite useful to those who design or maintain the physical environment of the work setting, in that it helps them better understand how facilities affect important work outcomes such as performance and satisfaction. Once the direct and indirect impacts are determined, more effective facilities decisions can be made to design and maintain facilities that improve work outcomes.

Specifically, it is fairly common to find that very specific features of the work environment (i.e., ambient characteristics) seldom have strong (or any), correlation with more general outcome measures. Still, if components (e.g., employee behaviors or perceptions) that are hypothesized to intervene *between* specific environmental features and general outcomes are measured, then it is likely the specific feature may be correlated with the intermediate component, which in turn may be correlated to the more general outcome.

Figure 1 shows a hypothetical example of both direct and indirect impacts on an outcome. This type of analysis, and the measurement of the intervening variable, prevents the incorrect conclusion that "A" has no impact on the outcome. Consequently, the value of using the path-to-outcomes model is that it can reveal the (indirect) impact of a particular environmental characteristic on an important work outcome, which would have otherwise been unknown without the measurement and testing of the relationship.

How Path-to-Outcomes Model Information Can Be Used

The path-to-outcomes model can show not only which of the many possible design components have an actual impact on important work outcomes like employee performance, but it can also indicate the strength and direction of that

impact. This information can be used to set priorities for modifications to existing facilities or make decisions about new ones. Resources to support facilities decisions are always limited. When those decisions can be made on the basis of substantiated fact, rather than on opinion, it is much more likely that the resultant design decisions will provide work environments that lead to positive work outcomes, like performance.

3 Research Process

This chapter describes the research process used to develop and test the path-to-outcomes model. The major phases of work in this project were:

1. Survey development
2. Survey distribution and collection
3. Survey data processing
4. Data analysis.

Survey Development

The Survey of Workplace Environmental Conditions was developed by modifying the survey developed during Phase 1 of this research. The original survey contained items from surveys used in previous research conducted by these authors and other researchers. Changes include wording revisions to some items, the deletion of some items, and the addition of new items felt to be measures of important concepts. The survey contained a total of 257 discrete questions about a variety of workplace conditions, employee characteristics and work behaviors, and important work outcomes. These pertained to:

- employee job information
- the amount of time spent in different work activities
- the importance of various work conditions, to do the job well
- descriptions of workspace and building system conditions
- control over and perceptions of different workspace environmental conditions (having to do primarily with lighting, temperature, air quality, and acoustics)
- work experiences, mostly dealing with physical and emotional experiences
- self-ratings of performance, in comparison to other people who do the same kind of work they do
- employee satisfaction ratings of various building and workspace ambient conditions as well as satisfaction with working in the office and job satisfaction.

Appendix B includes a copy of the final survey.

Survey Distribution and Collection

Over 1500 surveys were distributed by on-site personnel at the following three DOD installations: Fort Carson, CO (~650), Fort Huachuca, CA (~550), and Port Hueneme, CA (~300). The determination of what buildings would receive surveys for their employees was based on the following criteria:
1. The buildings were used for office spaces, rather than other types of work areas.
2. Office buildings were selected to reflect a variety of physical characteristics (e.g., year of construction, type of building material used, relative amounts of windows per building, central vs. window air conditioning units, etc.).
3. Office buildings were selected to reflect a variety of existing conditions.

The variety in physical characteristics and conditions was sought to increase the likelihood that employees would respond differently to different conditions. Variability in responses must occur to adequately test the hypothesized relationships in this research.

When data entry was completed, surveys were returned to CERL by mail.

Survey Data Processing

Once responses were obtained from the sample sites, they were entered into an SPSS data set, and data analysis was begun. Preliminary analyses were done to clean the data set. Cleaning included finding entered results which were incorrect and changing them by re-examination of the original surveys; finding respondents who had inadequately responded (e.g., had a lot of missing data or provided no variability in their responses) so that they could be omitted from the subsequent analyses, etc. Also some descriptive analyses (frequency distributions, cross tabulations, etc.) were done for other uses. This project achieved a survey return rate of 52 percent, quite acceptable for the analytic purposes of the research.

Analysis

Survey Respondents and Locations

The following tables provide information about the number, location, and type of employees whose survey responses were used in this analysis. Table 1 shows how many employees were in each of the three employee types at each of the three locations. (Note: There were 598 respondents overall. Table 1 shows only 577 respondents. Those missing from the count were those who did not identify "employee type.")

Note that information about the work setting was gathered from a number of different buildings at each location. Table 2 shows how many buildings were represented at each location. Overall, the survey respondents came from a total of 33 DOD buildings in three different locations.

Having respondents from 33 different buildings increases opportunities for variability in work environments, an important issue for the analyses done in this project. Both the number of respondents and the number of different buildings in which they were located are sufficient for the results of the model testing analyses discussed next.

Table 1. Number of responding employees, by type, for each location.

Employee Type	Site Location			Total
	Port Hueneme	Fort Huachuca	Fort Carson	
Supervisory	22	76	50	148
Professional/Technical	44	115	77	236
Administrative/Support	25	92	76	193
Total	91	283	203	577

Table 2. Number of buildings, by location.

	Site Location		
	Port Hueneme	Fort Huachuca	Fort Carson
Number of Buildings	6	15	12

Analytic Approach

The impact of the work environment (with a focus on ambient workplace conditions) was examined in terms of its impact on three major work outcomes:

1. "Performance" (of primary interest), which was a self-report measure of employee performance. It serves as a behavioral measure.
2. "Satisfaction with working in the office."
3. "Number of sick days in the last 2 months."

The latter two elements were considered because extensive prior theory and research have considered them to be important work outcomes. They represent the socio-psychological and physiological complements of the behavior-oriented performance.

Several stages and types of multivariate statistical analyses had to be completed sequentially to develop and empirically test a path-to-outcomes model, and to identify the direct and indirect predictors of the outcome measures. The following three sections summarize different analyses, procedures, and purposes.

1. Development of Indices for Increased Reliability of Measurement and Parsimonious Model Development

The survey instrument measured 257 variables. A number of questions were used to learn about each of the various environmental conditions and employees. For example, the survey included more than 35 lighting questions. To reduce the number of variables to a more useable set, a principal components analysis, using a Varimax rotation, was used to create a smaller set of factors, or groupings of variables, representing the different environmental conditions and employee perceptions and behaviors.

Once the factors were obtained, they were further examined for coherence, face validity, and (analytically) Alpha scale reliability. Those achieving adequate levels of reliability were then used to create a single measure, or index of that concept. For example, one set of variables was found by factor analysis to make up the performance measure. It consisted of a set of individual items asking the respondent to rank their own performance on nine dimensions (e.g., ability to meet deadlines, dependability, accuracy, amount of work accomplished, etc.). These were found to be highly intercorrelated and had an Alpha reliability level of 0.92 (where 1.00 would be perfect reliability), signifying that they could appropriately be used in the final stage of analyses (path analyses, to be discussed later). The full set of indices and individual variables that were selected for

model testing are referred to as components of the model from here on. Appendix C lists the 51 work outcome measures. Each measure identifies the specific survey variable(s) that make it up, the scale direction of the variable, and the Alpha reliabilities (for the indices).

2. Development of a Conceptual Path-to-Outcomes Model

The conceptual development of the Workplace Model was developed using the smaller set of variables and indices, referred to as components from now on, which were attained through factor analysis of the survey data. The intent of such a model is to create an explicit set of hypotheses about relationships among all the concepts that the empirically obtained components represent. These components and the hypothetical model are presented in Figure 2, a more complex version of Figure 1.

Using previous research and theory, the components were arranged, prior to analysis, in a way that could logically and temporally be possible.
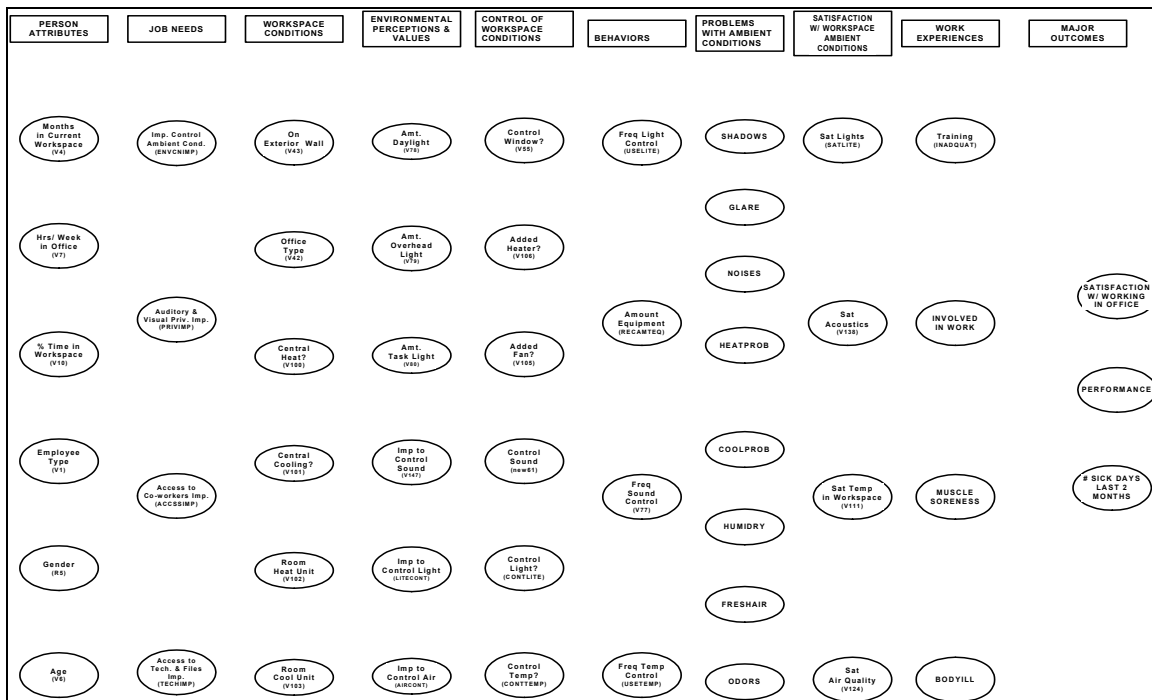
Figure 2. Hypothetical model.

3. Determination of Direct and Indirect Impacts on the Work Outcomes

The path-to-outcomes model was tested by a series of sequential stepwise regression analyses. The tables in Appendix D summarize specific results of each analytic step and provide technical statistical information (e.g., the beta weights, etc.). Each step represents a mini-portion of the model and contains a written summary of the relationships in that specific portion of the model.

Graphic Presentation of the Model Result

The results of step 3 above are shown as three empirical, data-determined models in Figures 3, 4, and 5, which is further explained in Chapter 4.
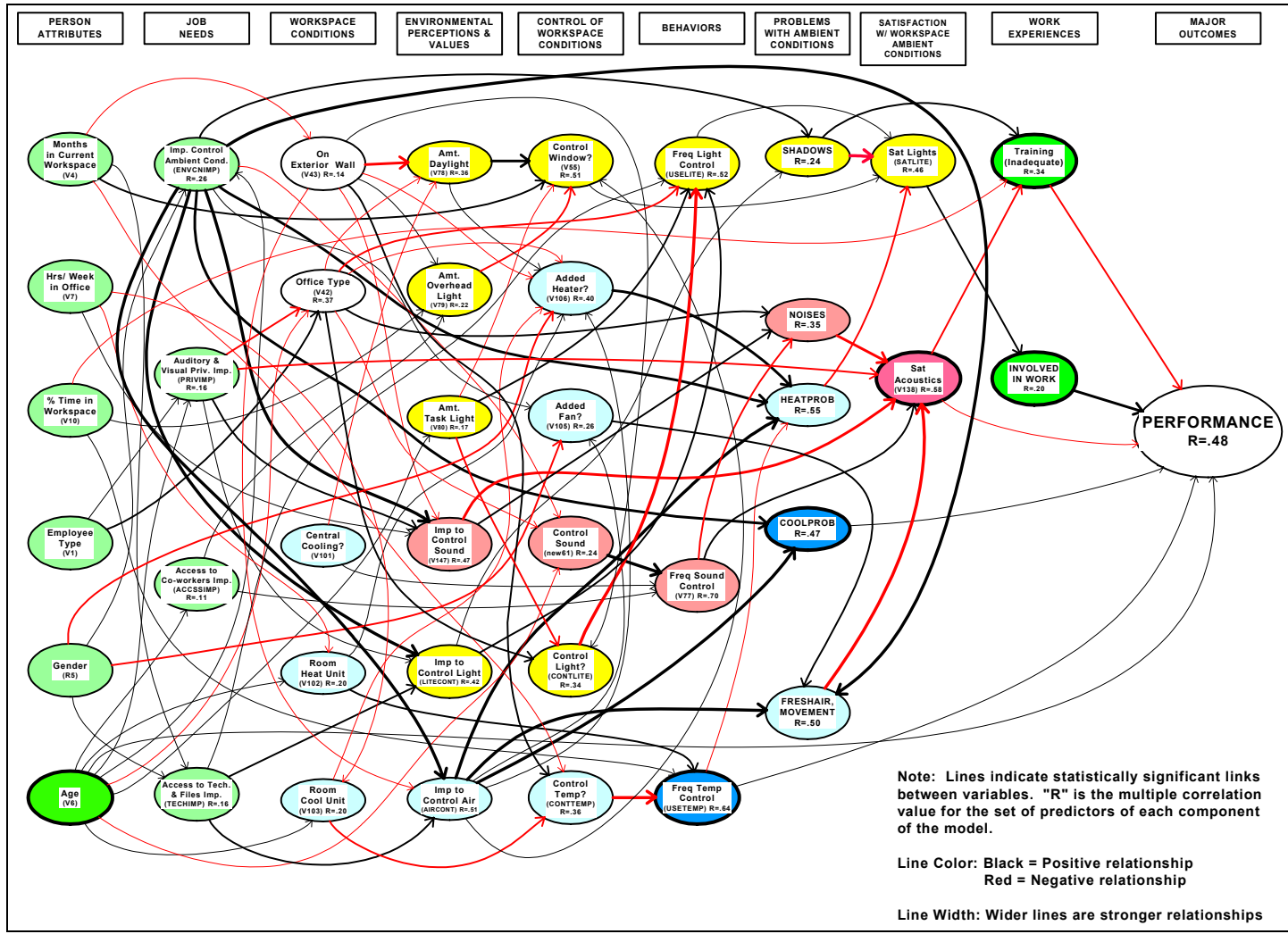
Figure 3. Performance.
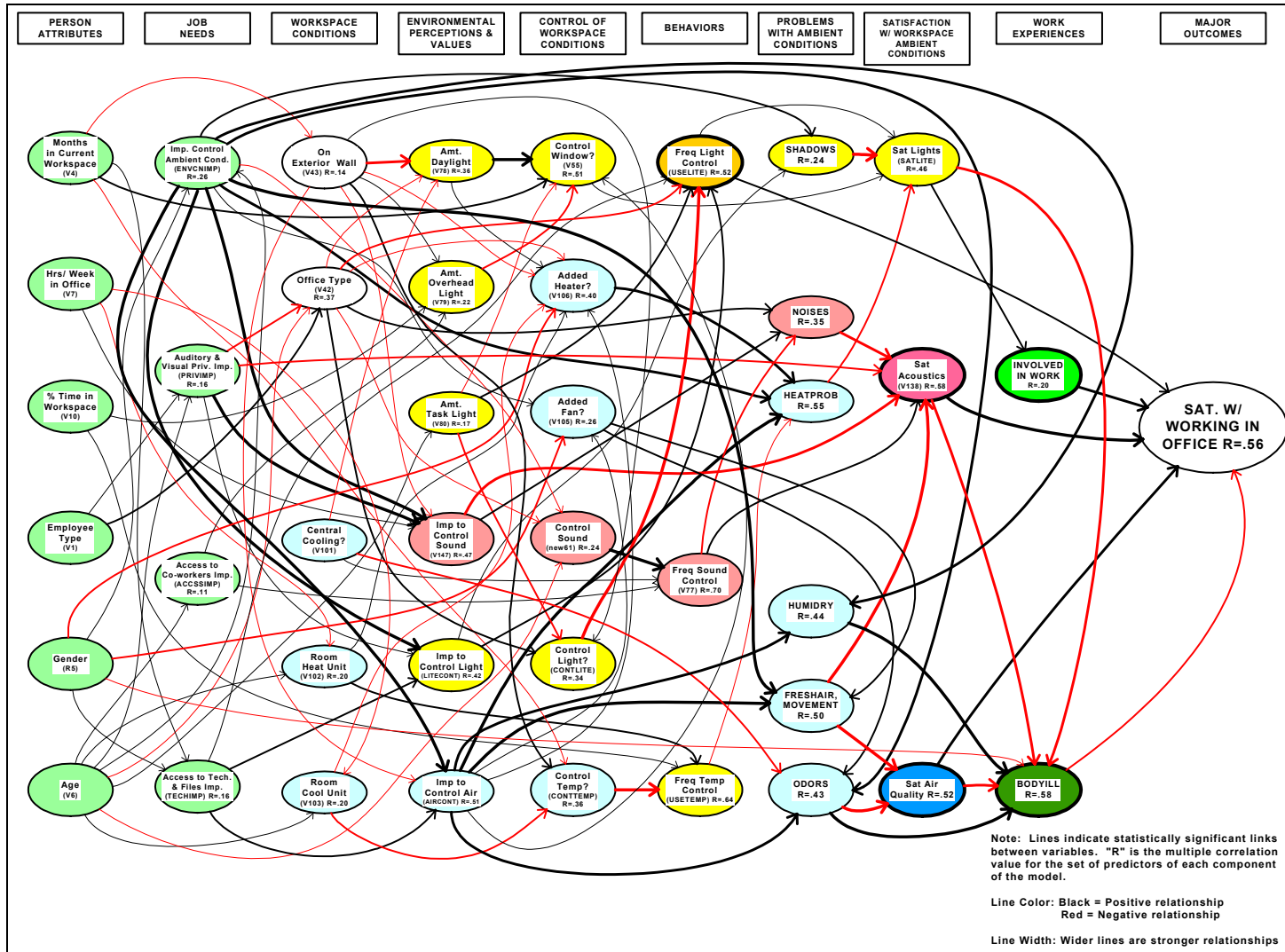
Figure 4. Satisfaction
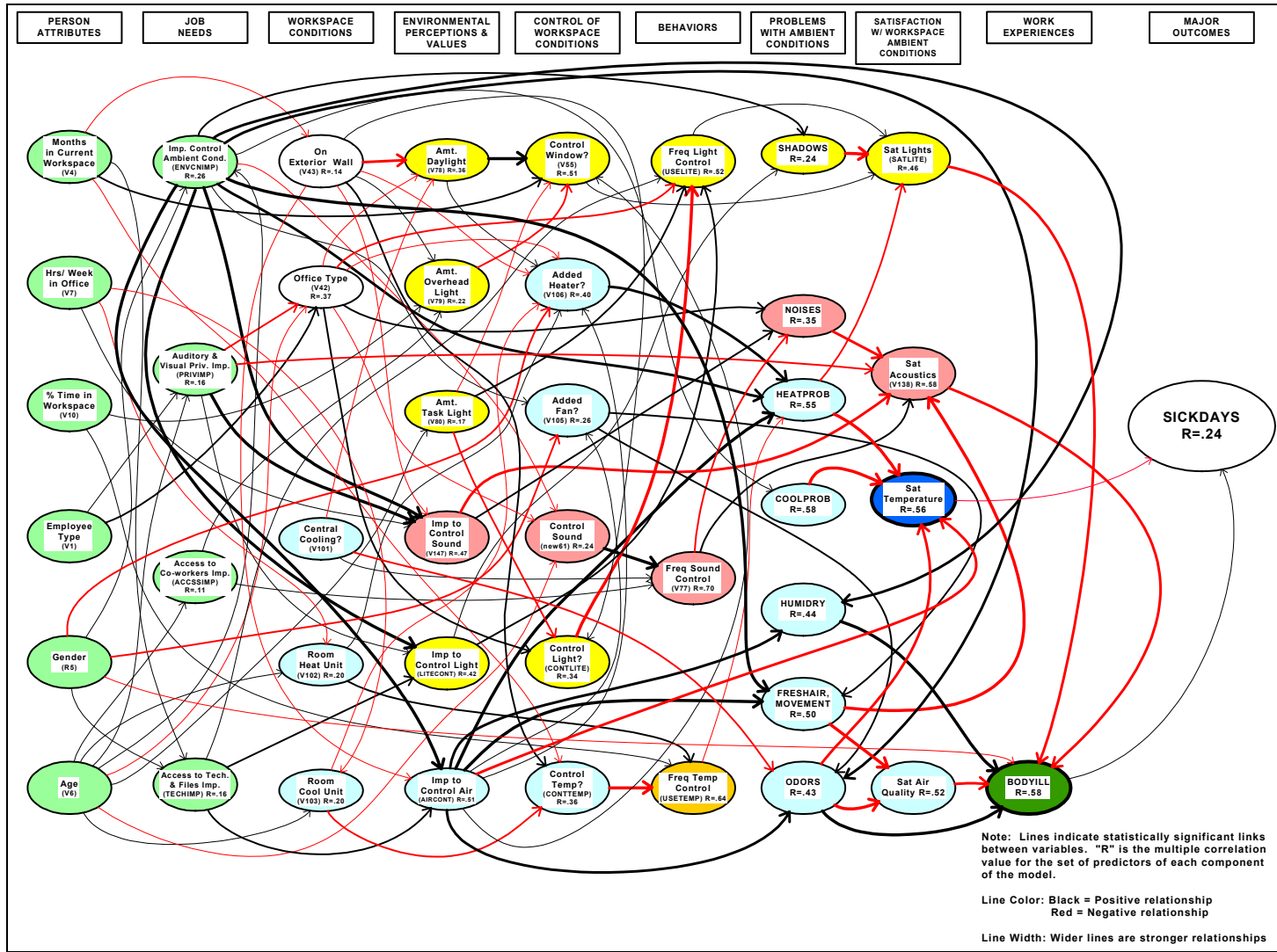
Figure 5. Sick days.

4 Results

This chapter describes the components and their arrangement in the conceptual model. Following that, the chapter shows and discusses the data-based model, and the direct and indirect impacts of ambient conditions and employee characteristics on employee ratings of performance, satisfaction, and health.

Components of the Hypothetical Workplace Model

A total of 51 indices—sets of highly correlated survey questions derived from the factor analysis—and single items were used as components in the development of the conceptual model, and subsequently, in the statistical analyses for the data based models. Figure 2 shows the conceptual arrangement of these 51 components (each one abbreviated, shown as an oval) into the sequence of hypothesized potential relationships. Appendix C contains a complete listing of all items and indices used in the models, the scales for each item, and the Alpha reliabilities for the indices.

The model is concerned primarily with determining the impact of various ambient conditions in the workplace (e.g., airflow, noise, lighting, air quality, control over these) on performance (shown on the right side in Figure 2) and the two other outcomes (satisfaction with working in the office and sick days). The model displays nine levels of components; eight of them could potentially have either direct or indirect impacts on the ninth (work outcomes). These levels move in a logical direction, from more specific to more general measures. That is, the model moves from given employee attributes and specific characteristics of the physical workplace and ambient conditions on the left, through a series of intervening variables such as perceptions and responses to the environment, towards the more general work outcome measures on the far right. The nine categories or levels of components in the conceptual model are:

1. *Person Attributes*, e.g., employee age, gender, hours/week spent in the office, etc.
2. *Job Needs*, e.g., how important auditory and visual privacy is for them to do their job well

3. *Workspace Conditions*, e.g., location of their workspace on an interior or exterior wall, type of workspace (open/closed), etc.
4. *Environmental Perceptions and Values*, e.g., perceptions of how much daylight or overhead or task lighting they have, and how important they feel it is to control ambient conditions in their workspace
5. *Control of Workspace Conditions*, e.g., how much actual control they have over ambient conditions, such as control over lighting, sound, and temperature in their workspace
6. *Behaviors*, such as how frequently they control lighting or sound conditions, etc.
7. *Problems with Workspace Ambient Conditions*, e.g., how often they experience shadows, noises, odors, etc. in their workspace
8. *Satisfaction with Workspace Ambient Conditions*, e.g., how satisfied or dissatisfied they are with their overall air quality, lighting conditions, acoustics, etc.
9. *Work Experiences*, such as how involved they feel with their work, how often they experience physical health symptoms, etc.

Major Work Outcomes consisted of three measures: (1) self-reported performance levels, (2) satisfaction with working in the office, and (3) number of sick days they had in the last 2 months.

In Figure 2, each oval represents an item or index measuring the component, some workplace feature or employee characteristic, perception, or behavior. The complete description of each component is contained in Appendix C.

This set of 51 components and its arrangement were tested to provide the empirical, research-based, results. Note that a different arrangement of components could lead to a slightly different set of specific results. This particular hypothetical model is based on previous work, literature reviews, expert consultations, etc., and is similar to other models of this type.

The next section presents the results of the statistical analyses, which answers the question: "What directly or indirectly impacts employee performance, satisfaction with working in the office, and number of sick days?"

What the Path-to-Outcome Models Demonstrate

The direct and indirect predictors of the outcomes are presented in the models shown in Figures 3, 4, and 5. They show how relatively important each ambient condition or employee attribute is to performance or to the other work outcomes.

Each model graphically shows the results. Sequential stepwise multiple regression analyses provided the information for these models. Only statistically significant relationships are shown. The models represent four kinds of information:

1. The degree of strength of the relationship between components is indicated by relative line widths. The darker/wider the line, the stronger the relationship. These represent the beta weights obtained in the analyses, which can be found in specific tables in Appendix D. Higher beta weights are indicators of stronger impacts.

2. The direction of the relationship, positive or negative, is indicated by line color. Red represents a negative or inverse relationship, and black represents a positive relationship. A negative relationship is one where, as one issue increases in level, the other issue decreases; there is an inverse relationship between the two items. For example, as distractions increase, performance would decrease. A positive relationship is one where, as one issue increases in level, the other issue also increases in level.

3. The combined strength of a set of components, in terms of their ability to predict an outcome, is shown by the multiple correlation (R) printed within each component. As with bivariate correlations, the closer the value is to 1.00, the stronger the impact of the components on the outcome. A multiple correlation above 0.70 is generally considered high, between 0.30 and 0.70 moderate, and less than 0.30 lower. However, the relative ranges can vary, depending on the nature of the variables involved in the research.

4. The type of work setting or employee characteristic is color-coded to allow an easier visual tracking of the conditions. Ambient conditions primarily related to lighting are yellow, those related to acoustics are red, and those related to HVAC are blue. Employee attributes are green. If they have a direct impact on the work outcome of performance, they are in a stronger, more intense color; if they have indirect impacts, they have a lighter value of the color.

Complexity of Indirect Linkages

The performance model obtained through this research is quite complex, with many linkages. Some of the linkages will not be individually discussed here because they are also present for the other work outcomes of satisfaction with working in the office and sick days. Appendix D contains tables that have a summary of direct predictors of each of the components in the model (Tables C4 through C37). For example, Table C4 includes information about the nature and strength of the relationship, Beta weights, and Pearson correlations, between inadequacy of training and the three components that are directly linked to it. The summary associated with Table C4 is as follows: those who feel they have

inadequate training also report more problems with shadows in their workspace, are less satisfied with acoustic privacy in their workspace, and spend less time in their workspace. The remaining tables in Appendix D provide similar types of information.

Predictors of Performance

Figure 3 shows which components of the work environment had a direct or indirect impact on employees' performance self-ratings. (Components not found in the conceptual model were not statistically significant.)

Direct Impacts on Performance

Six components had a direct impact on performance with a multiple correlation of R=0.48. The components included two in the category of employee work experiences, two related to ambient conditions of the workspace, one a behavior, and one an employee attribute. Those six components directly accounted for 23 percent of the variance in the performance ratings (R^2). For comparison sake, this is a moderately high percent, as opposed to other office environment research. (The unaccounted for variance would be explained by things not measured in this study, such as management issues, interpersonal issues, or other work environment issues such as adjacencies, types of group work space, equipment, and so forth.)

The work experiences had expected effects. That is, the more employees felt involved in their work, the higher the performance evaluation; correspondingly, their performance was less if they felt their training was inadequate (the negative link, shown by a red line, in Figure 3).

A finding not intuitively expected was the negative linkage between perceptions of the ambient characteristics and performance. That is, those who reported a higher frequency of problems with their workspace cooling (Coolprob), and those who were less satisfied with their workspace acoustics (Sat Acoustics) gave higher evaluations of their performance. At first glance, this would seem to be unreasonable. However, the finding is consistent with prior workplace research. Other complementary sources of evidence from those studies have offered an explanation that could also apply here. Previous research has found that high performers understand how important their work environment is to them to enable them to do their best work. If they are more motivated to perform (e.g., are

highly involved with their work) they are more likely to report workspace problems that can affect their performance.

The behavior that was directly linked to performance was frequency of use of temperature controls (Freq Temp Control). Those who were better able to control their workspace temperature by controlling heating, cooling, or ventilation had higher performance scores.

The final direct linkage to performance was age of employee. Older employees reported higher levels of performance than younger, possibly less experienced, employees.

Indirect Impacts on Performance

One of the most important findings is the existence of clear evidence for the effect of ambient conditions on performance. Most of that impact is indirect through other work experiences, i.e., involvement in work or adequacy of training, or more general evaluations of workplace ambient conditions, acoustics, and frequency of seasonal cooling problems. These impacts are through multiple ambient conditions, such as acoustics, lighting, workspace temperature, and air quality. All types have some indirect impact on performance, in contrast to the two direct linkages, acoustics and temperature issues. Satisfaction with workspace lighting (Sat Lights) has a direct positive impact on employees' feelings of being involved in their work. Satisfaction with workspace acoustics (Sat Acoustics) has a direct impact on feeling adequately trained (Training inadequate). It is not difficult to imagine that excessive or distracting noises in the workspace could negatively affect the ability to learn, or that lighting conditions have an impact on emotional well being, a fact well supported by recent lighting research on seasonal affective disorder.

Furthermore, some types of ambient condition problems affect other types of satisfaction with workspace ambient conditions. For example, the greater the number of seasonal problems with air movement and freshness (Freshair, Movement), the less satisfied people are with their workspace acoustics (Sat Acoustics). This suggests that there may be noise problems associated with ventilation processes, at least for some of the employees.

In general, the model provides substantial support for the importance of ambient conditions having either direct or indirect effects on employees' performance ratings. Indirect linkages are greater than direct links.

Predictors of Satisfaction with Working in the Office

Satisfaction is typically thought of as an affective response, an indication of how positive or negative one feels about some object or situation. For the work environment, an important outcome is how satisfied or dissatisfied people are with working in that setting. Workplace satisfaction has often been associated with the retention of valuable employees, an important concern of many large organizations today. Figure 4 illustrates which components of the work environment had a direct or indirect link to employee ratings of their satisfaction with working in the office.

Direct Impacts on Satisfaction with Working in the Office

Satisfaction with working in the office was directly influenced by five components. The multiple R-value of 0.55 indicates that this set of five accounted for 30 percent (R^2) of the variance in the outcome variable of satisfaction with working in the office. This indicates that the measures of the work environment in this study have a somewhat greater impact on satisfaction (30 percent) than they do on performance (23 percent), again, similar to other research in this area.

Two of those that had a direct link to satisfaction, were under the category of work experiences in the model. The more involved in and feeling excited about their work (Involved in work) the employees were, the higher their levels of satisfaction. Correspondingly, the more symptoms of ill health (Bodyill) they felt, the less satisfied they were.

In the category of satisfaction with workspace ambient conditions, both satisfaction with acoustics (Sat Acoustics) and satisfaction with air quality (Sat Air Quality) had direct positive impacts on their satisfaction with working in the office.

Those who were able to more frequently have control over their workspace lighting (Uselight) were also more satisfied.

Indirect Impacts on Satisfaction with Working in the Office

Simply looking at the colors on the model in Figure 4 shows the complexity, both in number and type of components, of the indirect linkages to satisfaction with working in the office. Lighting issues, through their link to feeling involved in and excited about their work, are present in terms of the amount and type of

lighting, the ability to control them, and the frequency with which they are con-trolled. Lighting problems, in terms of shadow problems in the workspace (Shadows), negatively affect people's satisfaction with their workspace lighting (Satlite).

Satisfaction with acoustics (Sat Acoustics) is influenced negatively by workspace noise problems (Noises), and positively by how often they are able to control sound levels (Freq Sound Control) and by how important they feel it is to control sound levels (Imp to Control Sound). Furthermore, if employees are not able to control the sound levels (Control Sound), there is a negative impact on their sat-isfaction with acoustics, in general. Previous research has shown that part of this noise problem in general often has to do with the openness or privacy of the workspace, and whether or not there are others in the workspace with them. This other research has also shown that noise problems have a deleterious effect on abilities to concentrate and get work done.

Finally, other air quality issues have indirect impacts on satisfaction with work-ing in the office. Problems in the workspace with odors (Odors), and with air movement and fresh air (Freshair, Movement), with humidity (Humidry), and with the frequency of heating problems (Heatprob) all indirectly and negatively impact on satisfaction with working in the office. The model results also show that employees have attempted to alleviate some of these problems, by adding a heater or a fan (Added heater, Added fan) to their workspace, or by otherwise exerting some control over their temperature (Control Temp). Finally, these is-sues are also shown to be influenced by the type of heating/cooling they have (Central cooling, Room cool unit, Room heat unit). Tables C4 through C37 in Appendix D describe all of these relationships in more detail.

In summary, the ambient conditions of the work environment have both direct and indirect impacts on satisfaction with working in the office. However, many of those effects are indirect, acting through other conditions or experiences. Without the use of a path-to-outcomes model, the importance of these would have been much less apparent.

Predictors of Health (Reported Sick Days)

Figure 5 shows the direct and indirect effects of the work environment on self-reports of number of reported sick days in the 2 months prior to the survey (SickDays). There are clear differences between Figures 3, 4, and 5 both in terms of the number of components that directly predict sick days, and in terms

of the strength of their impacts. First, there are only two direct predictors, with one having to do with workspace temperature conditions, and the other with symptoms of illness. Second, the level of impact is less. With a Multiple R-value of 0.24, only about 7 percent of the variance in sick days are directly affected by the conditions measured in this study. This is not surprising, since there are so many other factors, extraneous to the work setting, which might affect health.

Direct Impacts on Number of Reported Sick Days

Only two components in the model directly link to number of sick days (Sick-Days). Those who are more satisfied with their workspace temperature (Sat Temperature) report fewer sick days. Those who experience a greater frequency of ill health symptoms while at the office (Bodyill) report more sick days.

Indirect Impacts on Number of Reported Sick Days

Air quality issues are significant, in this model, by affecting both direct predictors of sick days. The more often employees experience problems with workspace heating (Heatprob), cooling (Coolprob), humidity or dryness (Humidry), and odors (Odors), the more likely they are to experience a greater frequency of ill health symptoms (Bodyill) or to be less satisfied with their workplace temperatures (Sat Temperature), both of which directly impact on number of reported sick days.

Lighting and acoustic issues also link directly to feelings of illness while at work, in that the more satisfied the employees are with acoustics (Sat Acoustics) and with lighting (Satlite), the less likely they are to feel symptoms of illness at work. The remaining linkages shown in Figure 5 are discussed in more detail in their relative tables in Appendix D.

In summary, the number of reported sick days are both directly and indirectly influenced primarily by air quality and temperature issues, although only to a relatively small extent.

5 Conclusions and Recommendations

Conclusions

This research has:
1. Reviewed and revised the survey developed in Phase 1 of this work.
2. Developed a conceptual path-to-outcomes model of the impact of ambient conditions on the productivity of office workers using previous research and information from the extensive literature review. This model contains a number of potential direct and indirect predictors of work outcomes.
3. Collected new data from a larger sample of employees using the revised survey in a number of offices at several DOD facilities.
4. Tested the conceptual path-to-outcomes model using the new data set.

This work used an employee survey to study the effects of ambient conditions of lighting, temperature and air quality, and acoustics on work outcomes of performance, satisfaction with working in the office, and number of sick days. These three outcomes are seen as being of complementary importance to effective organizations, in that they reflect a behavioral outcome (performance), an affective outcome (satisfaction), and a health outcome (number of sick days).

The evidence clearly showed that, through a path-to-outcomes analysis (path analysis), all these ambient conditions had significant impacts on performance, satisfaction with working in the office, and number of reported sick days. The greatest impact was on satisfaction with working in the office (30 percent of the variance accounted for by direct predictors). The study showed somewhat less on performance (with 23 percent of its variance accounted for directly). The least impact was on the work outcome of number of reported sick days (with only 7 percent of its variance accounted for directly). Note that most of the linkages to these work outcomes were indirect, which would explain why some previous research, looking primarily for direct linkages, has found relatively little effect of ambient conditions on work outcomes.

Because the models also show the strength of the linkages between ambient conditions and outcomes, it is possible to prioritize decisions about future work environments or modifications to existing ones. Priorities should generally be focused on those conditions that have the strongest impacts on the outcomes. If something has little or no effect on performance or other relevant outcomes, it should require less attention.

Finally, while ambient conditions did have a significant impact on the work outcomes, other potentially important work impacts (e.g., other work environment conditions, management strategies, organizational issues, etc.) were not within the scope of this research. Those issues have been addressed in other studies, and would be expected to increase the predictability of the work outcomes (the percentage of variance in each, which is accounted for by its predictors). However, they should be examined in congruence with these issues; otherwise it is not possible to determine how strong each is, in comparison to the others.

Recommendations

Methods of Gathering Information

This research used a single method of collecting information, a survey to employees about their office conditions. A survey is one of the most comprehensive methods of collecting information, in that it can get information about perceptions and evaluations of the work setting, frequency of various work related behaviors, work experiences, and work outcomes. In fact, it can obtain information that cannot be obtained any other way (e.g., information about how employees feel about their work environment and their evaluations of it, their work experiences, etc.).

However, the sole use of self-reported information (via surveys, interviews, etc.) does have some limitations, including the potential for inaccurate information (e.g., if the person does not have or is not able to provide accurate information, but still responds), and biased responses (e.g., from an employee who might wish to overestimate performance or underestimate the number of sick days).

Fortunately, previous research has indicated that most of the issues measured by this survey should not be too susceptible to these difficulties. The one issue that could appear to be most strongly threatened by response bias is that of performance. Future research should try to obtain performance measures independently of the respondents, to see if the same patterns of linkages hold be-

tween ambient conditions and these other measures of performance. Previous research has found congruence between supervisor and employee self-ratings of performance in other work settings. The use of multiple methods of gathering information is a scientifically sound approach to ensure valid and reliable research findings.

Even if there are some errors in levels of measurement (e.g., lower or higher than what is true) due to the above factors, it would not affect the results in terms of what issues impact on the work outcomes. That is because the statistical linkages tested in this research depend on finding systematic variation between model components. The actual level or value of a person's score is not critical for testing linkages in a path-to-outcomes model. It is only important that there be systematic differences between employees (variation) in terms of their responses, to test the models. There was sufficient variation provided by the employees in this study to do that. Variability alone is not a guarantee that a relationship will be found between the work environment and work outcomes. Systematic variability among the components is what empirically demonstrates the relationship, and is what was found in this research.

This study recommends using multiple methods of collecting information, especially with regard to issues where respondents may be uncertain or biased, even though as this study has demonstrated, useful results can be derived from a single data-collection instrument.

The Path-to-Outcomes Model

Another general issue to be considered in future work is the conceptual model that was tested in this work. This research developed and tested a particular conceptual model with newly collected data. That model was based on previous research and on the research team's prior research experience. Different information, or different expectations and hypotheses, could have developed a somewhat different conceptual model, i.e., one based on different concepts or different arrangements of those concepts. Any such change could produce a different set of results, in terms of which components impact on the work outcomes, and how strongly they affected them. Thus, it might be important to reconsider the model components and their arrangement, particularly if there were other types of work settings or other types of employees under consideration. However, the same general components of this model, used in future work to examine similar populations and settings, should produce results similar to those derived from this work.

Revising the Survey

This survey contained 257 discrete questions about the work environment, the employee, or employee experiences and outcomes. Part of the reason for the survey's length was to ensure that the concepts under study were measured reliably and validly. (Multiple items were used to measure many concepts.) It would be possible to further examine the data, to determine which items could be eliminated to yield a shorter survey that would be more efficient, both in terms of gathering information and analyzing it. Future assessments of the work environment could benefit from a shortening of this survey.

Practical Applications

While methodological or conceptual issues are important to consider in future research, the results of this phase of the research are strong enough to move to the next step, that is, considering practical uses of this information. One of the most important pragmatic questions is, "How can this information be used in helping the DOD enhance the quality, and therefore the effectiveness of their work environments?" It can be useful for both new and existing buildings.

The reported results can be used to illustrate the importance of carefully designing these systems in new buildings under design or development, and to more fully understand the complex ways in which building systems can either support or detract from employee performance, satisfaction, and health. New buildings could be designed to explicitly address specific environmental impacts shown in this research to affect work outcomes.

The DOD owns and occupies many existing office buildings; it is critical to maintain or retrofit them to best support employees and the work they need to do. To decide where to put limited resources intended for improvements, it is first necessary to identify where problems currently exist. Indoor environmental conditions and problems can certainly be measured by instruments and experts sent to each office location. However, both instrumentation and personnel costs are very expensive methods of identifying problem buildings. Surveys that measure environmental conditions and problems based on the experiences of those who occupy each office (the employees themselves) could be cost-effective tools for identifying problems in currently occupied workplaces. Once problem buildings are identified, more extensive testing (if needed), by instrumentation and indoor environmental specialists, could be done on problem locations alone. In other words, the survey could serve as a diagnostic tool.

Abbreviations and Acronyms

BOSTI   Assistant Chief of Staff for Installation Management

CERL   Construction Engineering Research Laboratory

CONUS   Continental United States

DOD   Department of Defense

DOE   U.S. Department of Energy

ERDC   Engineer Research and Development Center

FY   fiscal year

HVAC   heating, ventilating, and air-conditioning

IAQ   indoor air quality

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Appendix A: Correlates of Work Outcomes

Table A1. Performance: significantly correlated items and indices.

Item/Index Name	Description	Correlation
Other Outcomes		
V256	Satisfaction with your job, in general	0.18
V255	Satisfaction with working in the office	0.12
Work Experiences		
INADQUAT	Feeling inadequately trained, over worked, out of control of work pace	-0.22
INVOLVED	Feeling energetic, excited about, involved with work	0.31
Satisfaction with Workspace Ambient Conditions		
V138	Satisfied with acoustic quality of my workspace	-0.09
V111	Satisfied with temperature at my workspace	-0.10
V124	Satisfied with the air quality at my workspace	-0.08
Problems with Workspace Ambient Conditions		
NOISES	Frequency of hearing noises in your workspace	0.12
HEATPROB	Frequency of seasonal heating problems in your workspace	0.12
COOLPROB	Frequency of seasonal cooling problems in your workspace	0.13
HUMIDRY	Seasonal problems with workspace humidity and dryness	0.12
ODORS	Frequency of odor problems in your workspace	0.12
Behaviors		
USELITE	Frequency of controlling room and task lighting	0.12
USETEMP	Frequency of controlling ventilation and heating	0.14
Environmental Perception and Values in Workspace		
LITECONT	Importance of controlling room/task lighting	0.16
AIRCONT	Importance of controlling air and temperature in workspace	0.15
V147	Importance of controlling sound in workspace	0.09
Job Needs		
ENVCNIMP	Control of workspace ambient conditions important to do job	0.13
TECHIMP	Access to technology and files important to do job well	0.17
Person Attributes		
V4	Months in current workspace	0.10
GENDER5	Gender	-0.12
V6	Age of employee	0.18
V10	Percent of time spent in workspace	0.10

Table A2. Satisfaction with working in the office: significantly correlated items and indices.

Item/Index Name	Description	Correlation
Other Outcomes		
PERFRMNC	Performance rating	0.12
V256	Satisfaction with your job, in general	0.61
V225	Number of sick days in last 2 months	-0.12
Work Experiences		
INADQUAT	Feeling inadequately trained, over worked, out of control of work pace	-0.22
INVOLVED	Feeling energetic, excited about, involved with work	-0.35
SORENESS	Experience muscle soreness while at work	-0.24
BODYILL	Feeling ill at work	-0.29
Satisfaction with Workspace Ambient Conditions		
SATLITE	Satisfied with lights in your workspace	0.28
V138	Satisfied with acoustic quality of your workspace	0.40
V111	Satisfied with temperature at your workspace	0.22
V124	Satisfied with the air quality at your workspace	0.35
Problems with Workspace Ambient Conditions		
SHADOWS	Seasonal shadow problems in your workspace	-0.28
GLARE	Seasonal glare from fixtures & sun in your workspace	-0.21
NOISES	Frequency of hearing noises in your workspace	-0.17
HEATPROB	Frequency of seasonal heating problems in your workspace	-0.18
COOLPROB	Frequency of seasonal cooling problems in your workspace	-0.25
HUMIDRY	Seasonal problems with workspace humidity and dryness	-0.28
FRESHAIR	Seasonal problems with air movement & freshness in workspace	-0.30
ODORS	Frequency of odor problems in your workspace	-0.35
Behaviors		
USELITE	Frequency of controlling room and task lighting	0.25
V77	Frequency of sound control in your workspace	0.21
Control of Workspace Conditions		
V105	Fan added to your workspace	-0.09
NEW61	Control sound levels in your workspace	0.18
CONTLITE	Control light in your workspace	-0.13
Environmental Perception and Values in Workspace		
AIRCONT	Importance of controlling air and temperature in workspace	-0.17
V147	Importance of controlling sound in workspace	-0.14
Workspace Conditions		
V42	Your office type	-0.16
V102	Room heat unit in your workspace	0.10
Job Needs		
ENVCNIMP	Control of environment important: to do your job well	-0.10
PRIVIMP	Auditory and visual privacy important: to do job well	-0.11
Person Attributes		
V6	Your age	0.11

Table A3. Number of sick days in the last 2 months.

Item/Index Name	Description	Correlation
Other Outcomes		
V255	Satisfaction with working in the office	-0.12
Work Experiences		
SORENESS	Experience muscle soreness while at work	0.15
BODYILL	Feeling ill at work	0.19
Satisfaction with Workspace Ambient Conditions		
SATLITE	Satisfied with lights in your workspace	-0.13
V138	Satisfied with acoustic quality of your workspace	-0.15
V111	Satisfied with temperature at your workspace	-0.19
V124	Satisfied with the air quality at your workspace	-0.15
Problems with Workspace Ambient Conditions		
HEATPROB	Frequency of seasonal heating problems in your workspace	0.11
COOLPROB	Frequency of seasonal cooling problems in your workspace	0.09
FRESHAIR	Seasonal problems with air movement & freshness in workspace	0.09
ODORS	Frequency of odor problems in your workspace	0.11
Environmental Perception and Values in Workspace		
LITECONT	Importance of controlling room/task lighting	0.08
AIRCONT	Importance of controlling air and temperature in workspace	0.12
V80	Amount of task light in your workspace	0.11
Workspace Conditions		
V101	Is your workspace centrally cooled	-0.13
Person Attributes		
V4	Number of months in your workspace	0.12
V1	Employee type	0.13

Appendix B: The Survey of Workplace Environmental Conditions

NAVY ENERGY SHOWCASE PROJECT:

SURVEY OF WORKPLACE ENVIRONMENTAL CONDITIONS

NCBC Port Hueneme Public Works and the U.S. Army Construction Engineering Research Laboratories (USACERL) are conducting a survey of building occupants in order to better understand the impact of indoor environmental conditions on the occupants' ability to do their work. Findings from this study will be used to make recommendations on the design, construction, retrofit, and operation and maintenance of office buildings and indoor environments - here - or at other DOD installations.

This survey is intended to find out how you feel about the thermal, lighting, air quality, and noise conditions in your workspace, both now and in different seasons, and how they might affect your ability to do work. It also asks about the layout of your workspace (e.g., furniture, equipment, location, etc.), what types of work you do, and what is important to help you do your job well.

This survey is confidential. No one but the research team working with USACERL will see the information you give us; and no information about an individual's responses will be given to anyone. Findings will be reported only in grouped categories, like job types or building locations.

Please fill out the survey today. When completed, please seal and return in the attached, pre-addressed and postage-paid envelope.

Questions? If you have any questions about this survey, or how the information from it will be used, please contact Deb Lister, at 1-800-USA-CERL, x6338 or via E-mail (d-lister@cecer.army.mil).

THANKS VERY MUCH FOR YOUR HELP

SURVEY OF WORKPLACE
ENVIRONMENTAL CONDITIONS

April 1997

PURPOSE

This survey is intended to find out how you feel about various environmental conditions in your workplace, both now and in different seasons, and how well you feel the environment supports your work. It asks about what types of work you do, what is important to help you do your job well, and, more specifically, how you feel about the office environment.

INSTRUCTIONS

▪ Please read **all** the instructions carefully. The way you are asked to answer the questions changes from time to time.

▪ Please describe your office environment as it is <u>now</u> (except when you are asked about other times of the year).

▪ If a particular question does not apply to your work or office environment, please write "n/a" (for not applicable) in the right-hand margin, next to the question.

> Definition: We have found that terms like "office," "workstation," and "cubicle" do not apply to everyone's situation. Instead, we refer to all of these as "work-spaces." Your workspace is the assigned space or the part of a room where you usually work. It includes your furniture and the floor area around it, but does not include any part of the room that is used by others or that could be considered someone else's workspace.

FEEL FREE TO WRITE ADDITIONAL CLARIFYING INFORMATION AT ANY TIME.

YOU AND YOUR JOB

The following information will help us to understand how different types of people experience their work environment. Remember, all information in this survey is **CONFIDENTIAL**.

1. What is your employee type? (check one)

    Supervisor   Professional/ Technical   Administrative/ Support

2. What is your job title/series and rank (if applicable)?

3. How long have you been working in this building?

4. How long have you been working in your current workspace location?

5. What is your gender?   Female   Male

6. What is your age? _____ years

TIME SPENT WORKING

1. In the average week, how much time do you spend **in** the office?

    No. of hours _____ per week

A. How much of this, if any, is on the weekends?   No. of hours _____ on weekend

B. How much of this, if any, is at night?   No. of hours _____ at night

WORKSPACE ACTIVITIES

1. Please estimate for each of the following:

A. How much of your workday is usually spent in the following locations (*should total 100%*):

Your workspace	_____	%
Other peoples' workspaces	_____	%
Conference/ meeting rooms	_____	%
Other (please describe)	_____	%
Total	**100**	**%**

B.   How much of your day <u>in your workspace</u> is usually spent doing the following activities (*should total 100%*):

Using a computer	_____	%
Reading papers or documents	_____	%
Writing	_____	%
Filing	_____	%
Drawing, illustrating or laying out materials	_____	%
In work-related, face-to-face conversations	_____	%
In work-related telephone conversations	_____	%
Other (please describe)	_____	%
Total	**100**	**%**

DOING YOUR JOB

To do your job well, how important or unimportant are each of the following?

To do your job well, how important is...	Not Important				Very Important
Visual access to co-workers.					
The ability to talk with co-workers easily.					
Visual privacy from co-workers.					
Acoustic privacy from co-workers.					
Controlling your light levels.					
Controlling your ventilation.					
Controlling your temperature.					
Controlling your humidity.					
Controlling your sound level.					
Having access to an operable window in your workspace.					
Controlling who enters your workstation.					

To do your job well, how important is...	Not Important				Very Important
Controlling the arrangement of your workspace and equipment.					
Working in a room with others.					
Working in a room by yourself.					
Having the appropriate technology.					
Having access to needed files/ information.					
Other (please describe)					

BUILDING SYSTEMS

1. Is the building's <u>heating</u> system adjusted differently for weekends/ after hours than for regular work hours?   Yes   No   Don't know

2. Is the building's <u>cooling</u> system adjusted differently for weekends/ after hours than for regular work hours?   Yes   No   Don't know

3. Is the building's <u>lighting</u> adjusted differently for weekends/ after hours than for regular work hours?   Yes   No   Don't know

YOUR WORKSPACE

Your **WORKSPACE** refers to the assemblage of furniture, shelving, cabinets, and other equipment (and the space around them), arranged for **YOUR USE**. Your workspace may be in a room by itself, or in a room with other individual workspaces. The following questions ask about **YOUR WORKSPACE**.

1. Workspace type

How would you describe your <u>office type</u>?

> Individual private workspace   Shared private workspace

> Open workspace (cubicle <u>with</u> partition)   Open workspace (cubicle with <u>no</u> partition)

> Other (please describe)

2. Workspace location

> Are any of the walls of your workspace along an exterior wall?:   Yes   No

If **yes**, which side of the building is it on?

North   Northeast   East   Southeast   South

Southwest   West   Northwest

3. Do you have a window in or near your workspace?   Yes   No

If **yes**,   a.   How far away from your desk is it?   _____   # of feet

b.   Can it be opened?   Yes   No   Not Sure

4. How many of each of the following kinds of equipment do you have in **your** workspace?

PC _____   Monitor _____   Printer _____   Server _____   Fax

Other Peripherals (e.g., scanner, etc.,)

ENVIRONMENTAL CONDITIONS IN YOUR WORKSPACE

1.   Control of conditions

A.   Do you have control of the following environmental conditions in your workspace? If yes, please go on to questions B. and C.

	Yes	No		Yes	No
Ventilation air			Humidity		
Fresh air from windows			Room lighting		
Heating			Task (or desk) lighting		
Cooling			Sound level		

B.   If you **do** have control of any of these

C.   How frequently do you control these conditions?

How sufficient is it?

Not at all sufficient	Highly sufficient		Never	Rarely	Some times	Often	Very Often
		Ventilation air					
		Fresh air from windows					
		Heating					
		Cooling					
		Humidity					
		Room lighting					
		Task (or desk) lighting					
		Level of sound					

2. Lighting

A. How much lighting do the following sources provide <u>in your workspace</u>?

	None	Little	Some	Most	All	Don't have it
Daylight						
Overhead lights						
Task or desk light(s)						
Other						

B. Have you provided any additional lighting to your workspace?   Yes   No

If **yes**, what kind was it? (Please describe)

_____

_____

_____

_____

C. How much do you agree or disagree with each of the following?

	Strongly Disagree	Neutral	Strongly Agree	Does not apply
I often have glare on my computer screen.				
Artificial lighting gives objects an unnatural color.				
I prefer to work with fluorescent lights.				
I prefer to work with incandescent lights.				
I am aware of working in my shadow.				
I prefer to work by a window.				
The position of light fixtures in my workspace seems to be wrong.				
I am satisfied with the task lighting at my workspace.				
I am satisfied with the overhead lighting.				

.   How would you describe the light level in your workspace for each of the following?

	Too Dim		Just Right		Too Bright	Does Not Apply
Reading documents						
Reading a computer screen						
Writing on the desktop						
Conversing with others						
Overhead light						
Task lighting						
Room lighting, in general						

E. What are the <u>good</u> things about the lighting in your workspace?

_____

_____

F. What are the <u>bad</u> things about the lighting in your workspace?

_____

_____

3. Temperature

A. How is <u>your workspace</u> heated or cooled? Check all that apply:

Central heat   Central cooling   Don't know

Room heating unit   Room cooling unit

B. Have any of the following been added to your workspace? Please check all that apply:

Fan   Space heater   Air conditioner   Other

C. Please estimate how frequently these occur at your workspace:

	Always	Sometimes	Never	Does not apply
The sun makes my workspace too hot.				
The temperature in my workspace is stable during the day.				
I am satisfied with the temperature at my workspace.				

D. Describe your <u>general</u> perception of the <u>temperature</u> while at your workspace, for these times.

(* It is realized that at any time the temperature of a space may have large swings in either direction, please mark the response that best describes it generally.)

	Too Hot	Just Right	Too Cold
Summer			
Winter			
Fall/ Spring			

E. What are the good things about the temperature conditions at your workspace?

_____

F. What are the bad things about the temperature conditions at your workspace?

_____

4. Air Quality

    A. Have you added any of the following devices to your workspace? Please check all that apply:

        Humidifier   Dehumidifier   Deodorizer   Smoke filtering device

        Other

B. Please estimate how frequently each of the following occur at your workspace:

	Always	Sometimes	Never
Awareness of unpleasant odors while at my workspace.			
Please describe odor: _____			
Awareness of chemical odors			
Awareness of musty or moldy odors			
Awareness of dust in the air.			
I am satisfied with the air quality at my workspace.			

    C. Please describe your seasonal perception of the quality of the air at your workspace:

During the Summer

Just Right

Too Dry   **Too Humid**

Too Drafty   **Too Stuffy**

During the Winter

	Just Right	
Too Dry		Too Humid
Too Drafty		Too Stuffy

During the Spring/ Fall

	Just Right	
Too Dry		Too Humid
Too Drafty		Too Stuffy

D. What are the good things about the quality of air at your workspace?

_____

_____

E. What are the bad things about the quality of air at your workspace?

_____

_____

5. **Sound/ Noise**

A. Please estimate how frequently each of the following occur, while you are in your workspace:

	Always	Sometimes	Never	Does not apply
I hear air blowing through the ducts.				
I overhear others talking.				
I hear hum from the light fixtures.				
I hear noise from the office copiers.				
I hear noise from keyboards and printers.				
I hear noise from the mechanical equipment.				
I am able to carry on a conversation without raising my voice.				
I am satisfied with the acoustic quality of my workspace.				

B. Indicate your general perception of the level of noise at your workspace.

Just Right

Too Noisy   **Too Quiet**

C. What are the <u>good</u> things about the acoustics of your workspace?

_____

_____

D. What are the <u>bad</u> things about the acoustics of your workspace?

_____

_____

Control of conditions - How important is it for you to be able to control the following environmental conditions <u>in your workspace</u>?

	Not at all Important				Very Important
Ventilation air					
Fresh air from windows					
Heating					
Cooling					
Humidity					
Room lighting					
Task (or desk) lighting					
Sound level					

8. **Seasonal Problems with Environmental Conditions**

How often are you affected by **problems or inadequacies** of the following aspects of your workspace during different times of the year? **Please use the scale indicated for your answers.**

1 Never   2 Rarely   3 Sometimes   4 Frequently   5 Always

	Summer	Winter	Spring/Fall
Air Movement			
Air Freshness			
Odors			
Heating			
Humidity			
Cooling			
Dryness			
Lighting			
Shadows			
Glare (daylight)			
Glare (light fixtures)			

9. **What Else?**

   A. If there are any good aspects of your environmental work conditions which have not been previously addressed in this evaluation, please describe them here.

In your workspace?

_____

_____

In your building?

_____

_____

B. If there are any <u>problems</u> with your environmental work conditions which have not been <u>previously</u> addressed in this evaluation, please describe them here.

In your workspace?_____

In your building?_____

10. Changes

Are there any <u>changes</u> that could be made to the lighting, heating, air conditioning or ventilation which would make your workspace a more comfortable place to do work?

_____

_____

_____

WORK EXPERIENCES

1. A.   How often do you experience the following <u>while at work</u>?

Work-Related Experience	Frequency of each experience				
	Always	**Often**	**Sometimes**	**Rarely**	**Never**
Feeling excited about my work.					
Feeling inadequately trained for the work that I do.					
Feeling in control of the pace of my work.					
Feeling overworked.					
Feeling strongly involved in my work.					
Poor concentration.					
Headaches.					
Feeling energetic.					
Nausea.					
Respiratory problems.					
Dizziness.					

	Frequency of each experience				
Work-Related Experience	**Always**	**Often**	**Sometimes**	**Rarely**	**Never**
Eye irritation.					
Eye strain.					
Nasal congestion.					
Throat irritation.					
Feeling sleepy.					
Soreness in arms, wrists or hands.					
Soreness in lower back.					
Soreness in neck and shoulders.					
Fatigue					
Ear infections					
Other (please describe)					

1. B.   Look at the above list and **circle** any of those experiences which you feel are affected by **working in this building.**

2.   How many days have you been <u>out sick</u> during the last <u>2 months</u>?

(Don't count sick days used for other purposes)

HOW WELL DO YOU DO YOUR WORK?

1. Rate how well you do your work, in comparison to other people who do the same kind of work you do, for each of the following:

	Below average	Average	Slightly Better Than Average	Good	Very Good	One of the best	The Best
Meeting deadlines							
Taking responsibility							
Dependability							
Accuracy							
Creativity							
Efficiency							
Amount of work Accomplished							
Quality of work accomplished							
Your overall performance							

2. How would you rate the existing **office environmental factors**, in terms of helping or hindering your ability to do your work well?

	Hinders a lot	Hinders some	Neither helps nor hinders	Helps some	Helps a lot	Don't know
Air Movement						
Air Freshness						
Temperature (with heat on)						
Temperature (with AC on)						
Humidity						
Dryness						
Lighting						

	Hinders a lot	Hinders some	Neither helps nor hinders	Helps some	Helps a lot	Don't know
Background Sound Level						
Other (please describe)						

SATISFACTION

How satisfied or dissatisfied are you with each of the following?

	Very Dissatisfied	Somewhat Dissatisfied	Neither	Somewhat Satisfied	Very Satisfied
Provisions for you to control ventilation in your workspace.					
Provisions for you to control the temperature in your workspace.					
Provisions for you to control the light levels in your workspace.					
Air quality in your workspace, in general.					
Air quality in the building, in general.					
The temperature of your workspace, in general.					
The temperature of the building, in general.					
The lighting in your workspace, in general.					
The lighting in the building, in general.					
Sound levels in your workspace, in general.					
Sound levels in the building, in general.					
Working in the office.					
Your job, in general.					

Do you have any other comments about the lighting, temperature, and air quality conditions in your <u>building</u>? In your <u>workspace</u>?

What is today's date?

What is the approximate outdoor temperature today? _____ °F

WE THANK YOU VERY MUCH FOR GIVING US YOUR TIME AND INFORMATION. Please seal this questionnaire in the attached, postage-paid envelope and return as soon as possible.

Remember, your responses will be seen <u>only</u> by the research team.

Again, thank you very much for your time and cooperation.

Appendix C: Table of Model Components (Items and Indices Used in the Model)

Table C1. Work outcome model components (items & indices used in the model).

Component	Description	Alpha Reliability	Scale
V004	Months in Current Workspace	N/A	# months
V007	Hours/Week in Office	N/A	# hours
V010	% of Daily Time Spent in Workspace	N/A	% time
V001	Employee Type	N/A	1 Supervisor 2 Prof/Technical 3 Admin/Support
Gender 5	Employee Gender	N/A	0 Female 1 Male
V006	Employee Age	N/A	Age in years
ENVCINIMP V26 V27 V28 V29 V30 V31	Importance, To Do Job Well, of Controlling Workspace Environment Controlling your light levels Controlling your ventilation Controlling your temperature Controlling your humidity Controlling your sound level Having access to an operable window in your workspace	0.88	1 Not Important 5 Very Important
PRIVIMP V24 V25	To Do Job Well, Privacy from Co-Workers Important Visual privacy from co-workers Acoustic privacy from co-workers	0.81	1 Not Important 5 Very Important
ACCSSIMP V22 V23	To Do Job Well, Important to have Access to Co-workers Visual access to co-workers Ability to talk with co-workers easily	0.70	1 Not Important 5 Very Important
TECHIMP V36 V37	To Do Job Well, Important to have Access to Technology/Info Having the appropriate technology Having access to needed files/info	0.78	1 Not Important 5 Very Important
V043	Workspace Along What Wall?	N/A	1 Exterior Wall 2 Interior Wall

Component	Description	Alpha Reliability	Scale
V042	Openness of Workspace Type	N/A	1 Indiv. & Closed 2 Shared & Closed 3 Open w/partition 4 Open, no part.
V100	Workspace is Centrally Heated	N/A	0 No 1 Yes
V101	Workspace is Centrally Cooled	N/A	0 No 1 Yes
V102	Workspace Heated by a Room Unit	N/A	0 No 1 Yes
V103	Workspace Cooled by a Room Unit	N/A	0 No 1 Yes
V078	Amount of Daylight in Workspace	N/A	1 None 5 All
V079	Amount of Overhead Light in Workspace	N/A	1 None 5 All
V080	Amount of Task/Desk Lighting in Workspace	N/A	1 None 5 All
V147	Importance of Controlling Workspace Sound Levels	N/A	1 Not Important 5 Very Important
LITECONT V145 V146	Importance of Controlling Workspace Lighting Room lighting Task/desk lighting	0.74	1 Not Important 5 Very Important
AIRCONT V140 V141 V142 V143 V144	Importance of Controlling Air & Temperature in Work-space Ventilation air Fresh air from windows Heating Cooling Humidity	0.90	1 Not Important 5 Very Important
NEW55	Control of Fresh Air form Window in Workspace	N/A	0 No 1 Yes
V106	Heater Added to Workspace	N/A	0 No 1 Yes
V105	Fan Added to Workspace	N/A	0 No 1 Yes
NEW61	Have Control of Sound Levels in Workspace	N/A	0 No 1 Yes
CONLITE V59 V60	Have Control of Workspace Lighting Room lighting Task/desk lighting	0.35	1 Yes 2 No

Component	Description	Alpha Reliability	Scale
CONTTEMP	Have Control of Workspace Temp	0.80	1 Yes
V54	Ventilation air		2 No
V56	Heating		
V57	Cooling		
USELITE	Frequency of Control of Workspace Lighting	0.64	1 Never
V75	Room lighting		5 Very Often
V76	Task/desk lighting		
RECAMTEQ	# of Pieces of Equipment in Workspace	N/A	# pieces
V77	Frequency of Controlling Workspace Sound Levels	N/A	1 Never
			5 Very Often
USETEMP	Frequency of Workspace Temperature Control	0.88	1 Never
V70	Control of ventilation air		5 Very Often
V72	Control of heating		
V73	Control of cooling		
SHADOWS	Frequency of Shadow Problems in Workspace	0.99	1 Never a problem
V172	Shadows in the summer		5 Always a prob-
V173	Shadows in the winter		lem
V174	Shadows in the spring/fall		
GLARE	Problems with Glare in Your Workspace	0.95	1 Never a problem
V175	Glare (daylight) in summer		5 Always a prob-
V176	Glare (daylight) in winter		lem
V177	Glare (daylight) in spring/fall		
V178	Glare (light fixtures) in summer		
V179	Glare (light fixtures) in winter		
V180	Glare (light fixtures) in spring/fall		
NOISES	Frequency of Workspace Acoustic Problems	0.72	1 Never
V132	I overhear others talking		5 Always
V134	I hear noise from the office copiers		
V135	I hear noise from keyboards/printers		
V136	I hear noise from the mechanical equip		
HEATPROB	Frequency of Workspace Heating Problems	0.84	1 Never
V158	Winter heating problems		5 Always
V159	Spring/fall cooling problems		
COOLPROB	Frequency of Workspace Cooling Problems	0.86	1 Never
V163	Summer cooling problems		5 Always
V164	Winter cooling problems		
V165	Spring/fall cooling problems		
HUMIDRY	Frequency of Workspace Humidity/Dryness Problems	0.92	1 Never
	Summer humidity problems		5 Always
V161	Winter humidity problems		
V162	Summer dryness problems		
V166	Winter dryness problems		
V167	Spring/fall dryness problems		
V160			

Component	Description	Alpha Reliability	Scale
FRESHAIR	Frequency of Workspace Air Movement & Freshness Problems	0.94	1 Never 5 Always
V148	Summer air movement problems		
V149	Winter air movement problems		
V150	Spring/fall air movement problems		
V151	Summer air freshness problems		
V152	Winter air freshness problems		
V153	Spring/fall air freshness problems		
ODORS	Aware of Odor/Dust Problems in Workspace	0.91	1 Never 5 Always
V120	Awareness of unpleasant odors		
V121	Awareness of chemical odors		
V122	Awareness of musty or moldy odors		
V123	Awareness of dust in the air		
V154	Summer odor problems		
V155	Winter odor problems		
V156	Spring/fall odor problems		
SATLITE	Satisfied with the Lighting in My Workspace	0.88	1 Dissatisfied 5 Satisfied
V91	Task		
V92	Overhead		
V138	Satisfied with the Acoustic Quality of My Workspace	N/A	1 Never 5 Always
V111	Satisfied with My Workspace Temperature	N/A	1 Never 5 Always
V124	Satisfied with the Air Quality of My Workspace	N/A	1 Never 5 Always
INADQUAT	Inadequacy of Training; Not in Control of Work Pace	0.51	1 Never 5 Always
V182	Feeling inadequately trained		
V184	Feeling overworked		
V183	Feeling in control of the pace of your Work		
INVOLVED	Feel Involved in My Work	0.76	1 Never 5 Always
V181	Feeling excited		
V185	Feeling strongly involved		
V188	Feeling energetic		
SORENESS	Frequency of Muscle Soreness While at Work	0.80	1 Never 5 Always
V197	In arms, wrists or hands		
V198	In lower back		
V199	In neck and shoulders		

Component	Description	Alpha Reliability	Scale
BODYILL	Frequency of Ill Health Symptoms While at Work	0.89	1 Dissatisfied
V187	Headaches		5 Satisfied
V189	Nausea		
V190	Respiratory problems		
V191	Dizziness		
V192	Eye irritation		
V193	Eye strain		
V194	Nasal congestion		
V195	Throat irritation		
V201	Ear infections		
WORK OUTCOME MEASURES			
V225	Number of Sick Days in Last 2 Months	N/A	# reported
V255	Satisfaction with Working in the Office	N/A	1 Dissatisfied
			5 Satisfied
PERFRMNC	Performance Evaluation of Employee (Self-rated)	0.92	1 Below Average
V226	Meeting deadlines		7 Best in Peer Grp
V227	Taking responsibility		
V228	Dependability		
V229	Accuracy		
V230	Creativity		
V231	Efficiency		
V232	Amount of work accomplished		
V233	Quality of work accomplished		
V234	Your overall performance		

Appendix D: Tables of Direct Predictors of Model Components

Table D1. Performance.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.48
	FEELING INVOLVED IN MY WORK	INVOLVED	0.28	0.31
V181	Often feel excited about my work			
V185	Often feel strongly involved in my work			
V188	Often feel energetic			
	INADEQUACY OF TRAINING, CONTROL OF WORKSPACE	INADQUAT	-0.26	-0.22
V182	Feel inadequately trained			
V184	Feel overworked			
V183	Don't feel in control of pace of my work			
	FREQUENCY OF TEMPERATURE CONTROL	USETEMP	0.17	0.14
V70	Control ventilation air			
V72	Control heating			
V73	Control cooling			
	FREQUENCY OF WORKSPACE COOLING PROBLEMS	COOLPROB	0.15	0.13
V163	Often affected in summer			
V164	Often affected in winter			
V165	Often affected in spring/ fall			
V138	SATISFIED W/ ACOUSTIC QUALITY OF MY WORKSPACE	V138	-0.14	-0.09
V6	AGE OF EMPLOYEE	V6	0.14	0.18

SUMMARY: People who rank themselves higher on performance tend to feel more strongly involved in their work and feel they are adequately trained and in control of the pace of their work. However, they report a higher frequency of being affected by cooling problems, more frequently try to control their temperature, and report they are less satisfied with acoustics in their workspace. They also tend to be older.

Table D2. Satisfaction with working in the office.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.56
	FEELING INVOLVED IN MY WORK	INVOLVED	0.25	0.35
V181	Often feel excited about my work			
V185	Often feel strongly involved in my work			
V188	Often feel energetic			
V138	SATISFIED W/ ACOUSTIC QUALITY OF MY WORKSPACE	V138	0.24	0.40
	FREQUENCY OF CONTROL OF WORKSPACE LIGHT	USELITE	0.18	0.25
V75	Often control room lighting			
V76	Often control task lighting			
V124	SATISFIED WITH AIR QUALITY OF MY WORKSPACE	V124	0.17	0.35
	FREQUENCY OF ILL HEALTH SYMPTOMS WHILE AT WORK	BODYILL	-0.08	-0.29
V187	Headaches			
V189	Nausea			
V190	Respiratory problems			
V191	Dizziness			
V192	Eye Irritation			
V193	Eye Strain			
V194	Nasal Congestion			
V195	Throat Irritation			
V201	Ear Infections			
SUMMARY: Those people who are satisfied with working in the office are also satisfied with the acoustic quality and air quality of their workspace and more often control their workspace lighting. They also report fewer health problems while at work.				

Table D3. Number of sick days in last 2 months.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.24
V111	SATISFIED WITH WORKSPACE TEMPERATURE	V111	-0.15	-0.19
	FREQUENCY OF ILL HEALTH SYMPTOMS WHILE AT WORK	BODYILL	0.14	0.19
V187	Headaches			
V189	Nausea			
V190	Respiratory problems			
V191	Dizziness			
V192	Eye Irritation			
V193	Eye Strain			
V194	Nasal Congestion			
V195	Throat Irritation			
V201	Ear Infections			
SUMMARY: People reporting a higher number of sick days in the last 2 months are less satisfied with their workspace temperature and report experiencing a higher number of health symptoms, while at work.				

Table D4. Inadequacy of training.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.34
V172	Always have shadows in workspace in summer			
V173	Always have shadows in workspace in winter			
V174	Always have shadows in workspace in spring/ fall			
V138	SATISFIED WITH ACOUSTIC PRIVACY IN MY WORKSPACE	V138	-0.16	-0.22
V10	PERCENT OF DAILY TIME SPENT IN MY WORKSPACE	V10	-0.15	-0.14
SUMMARY: Those who feel they have inadequate training, also report more problems with shadows in their workspace, are less satisfied with acoustic privacy in their workspace and spend less time in their workspace.				

Table D5. Feeling involved in work.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.20
	SATISFIED WITH LIGHTING IN WORK SPACE	SATLITE	0.20	0.20
V91	Satisfied with the task lighting			
V92	Satisfied with the overhead lighting			
SUMMARY: Those who report higher feelings of being involved with and excited about their work report higher satisfaction with task and overhead lighting in their workspace.				

Table D6. Muscle soreness.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.48
	PROBLEMS WITH GLARE IN WORK SPACE	GLARE	0.26	0.41
V175	Have summer daylight glare			
V176	Have winter daylight glare			
V177	Have fall/ spring daylight glare			
V178	Have summer light fixture glare			
V179	Have winter light fixture glare			
V180	Have fall/ spring light fixture glare			
	AWARE OF ODORS/ DUST IN WORKSPACE	ODORS	0.18	0.39
V120	Aware of unpleasant odors			
V121	Aware of chemical odors			
V122	Aware of musty or moldy odors			
V123	Aware of dust in the air			
V154	Have summer odor problems in work space			
V155	Have winter odor problems in work space			
V156	Have fall/ spring odor problems in work space			
V138	SATISFIED WITH ACOUSTIC QUALITY OF MY WORKSPACE	V138	-0.11	-0.30
V111	SATISFIED W/TEMPERATURE AT WORKSPACE	V111	-0.09	-0.26
SUMMARY: Those who report more body muscle soreness tend to report higher levels of problems with glare in their workspace, and more awareness of odors, dust, etc., in their workspace. They are also less satisfied with their workspace's acoustic quality and temperature.				

Table D7. Frequency of ill health symptoms while at work (Bodyill).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.58
	AWARE OF ODORS/ DUST IN WORKSPACE	ODORS	0.27	0.49
V120	Aware of unpleasant odors			
V121	Aware of chemical odors			
V122	Aware of musty or moldy odors			
V123	Aware of dust in the air			
V154	Have summer odor problems in work space			
V155	Have winter odor problems in work space			
V156	Have fall/ spring odor problems in work space			
V183	Feel in control of pace of my work (1)			
	FREQUENCY OF WORKSPACE HUMIDITY/DRYNESS PROBLEMS	HUMIDRY	0.16	0.40
V161	Summer humidity problems			
V162	Winter humidity problems			
V166	Summer dryness problems			
V167	Winter dryness problems			
V168	Spring/ Fall dryness problems			
V138	SATISFIED WITH ACOUSTIC QUALITY OF MY WORKSPACE	V138	-0.12	-0.38
	SATISFIED WITH LIGHTING IN WORK SPACE	SATLITE	-0.13	-0.32
V91	Satisfied with the task lighting			
V92	Satisfied with the overhead lighting			
	EMPLOYEE GENDER	GENDER5	-0.13	-0.19
V124	SATISFIED W/AIR QUALITY OF MY WORKSPACE	V124	-0.06	-0.34
SUMMARY: People experiencing a higher frequency of health symptoms while at work also report more problems with odors and dust and with humidity and dryness in their workspace. They are less satisfied with acoustics and air quality in their workspaces. They are also somewhat likely to be women.				

Table D8. Satisfaction with lighting in workspace (Satlite).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple 5=0.46
	FREQUENCY OF SHADOW PROBLEMS IN WORK SPACE	SHADOWS	-0.35	-0.42
V172	Always have shadows in workspace in summer			
V173	Always have shadows in workspace in winter			
V174	Always have shadows in workspace in spring/ fall			
	FREQUENCY OF WORKSPACE HEATING PROBLEMS	HEATPROB	-0.16	-0.26
V158	Winter heating problems			
V159	Spring/ Fall heating problems			
	FREQUENCY OF CONTROL OF WORKSPACE LIGHT	USELITE	0.12	0.14
V75	Often control room lighting			
V76	Often control task lighting			
NEW55	CONTROL OF WINDOW FRESHAIR IN WORKSPACE	NEW55	0.10	0.07
SUMMARY: People who are more satisfied with the lighting in their workspace seldom have problems with shadows and with heating problems as well. They are often in control of that lighting, as well as in control of the windows (if they have them).				

Table D9. Satisfaction with workspace acoustics.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.58
	FREQUENCY OF WORKSPACE AIR MOVEMENT AND FRESHNESS PROBLEMS	FRESHAIR	-0.28	-0.45
V148	Summer air movement problems			
V149	Winter air movement problems			
V150	Spring/ Fall air movement problems			
V151	Summer air freshness problems			
V152	Winter air freshness problems			
V153	Spring/ Fall air freshness problems			
	FREQUENCY OF WORKSPACE ACOUSTIC PROBLEMS	NOISES	-0.24	-0.38
V132	I overhear others talking			
V134	I hear noise from office copiers			
V135	I hear noises from keyboards/ printers			
V136	I hear noises from mechanical equipment			
V147	IMPORTANCE OF CONTROLLING SOUND LEVELS IN MY WORKSPACE	V147	-0.14	-0.33
V77	FREQUENCY OF CONTROLLING WORKSPACE SOUND LEVELS	V77	0.13	0.24
	TO DO JOB WELL, PRIVACY FROM CO-WORKERS IS IMPORTANT	PRIVIMP	-0.13	-0.23
V24	Visual privacy from co-workers is important			
V25	Acoustic privacy from co-workers is important			
SUMMARY: Those who are more satisfied with their workspace acoustics experience fewer problems with air movement, and overhead fewer noises in their workspace. They do exert control over sound levels in their workspace and feel it is important to do so. However, they tend to feel that visual and acoustic privacy from their co-workers is not important.				

Table D10. Satisfaction with workspace temperature.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.56
	FREQUENCY OF WORKSPACE HEATING PROBLEMS	HEATPROB	-0.25	-0.49
V158	Winter heating problems			
V159	Spring/ Fall heating problems			
	FREQUENCY OF WORKSPACE COOLING PROBLEMS	COOLPROB	-0.16	-0.46
V163	Often affected in summer			
V164	Often affected in winter			
V165	Often affected in spring/ fall			
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	-0.16	-0.39
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
	AWARE OF ODORS/ DUST IN WORKSPACE	ODORS	-0.14	-0.36
V120	Aware of unpleasant odors			
V121	Aware of chemical odors			
V122	Aware of musty or moldy odors			
V123	Aware of dust in the air			
V154	Have summer odor problems in work space			
V155	Have winter odor problems in work space			
V156	Have fall/ spring odor problems in work space			
SUMMARY: People who are satisfied with the temperature of their workspace are those who experience fewer heating and cooling problems throughout the year. They also feel that it is less important to control air conditions and report fewer dust and odor problems in their workspace.				

Table D11. Satisfaction with workspace air quality.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.52
	AWARE OF ODORS/ DUST IN WORKSPACE	ODORS	-0.40	-0.51
V120	Aware of unpleasant odors			
V121	Aware of chemical odors			
V122	Aware of musty or moldy odors			
V123	Aware of dust in the air			
V154	Have summer odor problems in work space			
V155	Have winter odor problems in work space			
V156	Have fall/ spring odor problems in work space			
V156	Have fall/ spring odor problems in work space			
	FREQUENCY OF WORKSPACE AIR MOVEMENT & FRESHNESS PROBLEMS	FRESHAIR	-0.17	-0.42
V148	Summer air movement problems			
V149	Winter air movement problems			
V150	Spring/ Fall air movement problems			
V151	Summer air freshness problems			
V152	Winter air freshness problems			
V153	Spring/ Fall air freshness problems			
SUMMARY: People who are satisfied with their workspace air quality report fewer odor and dust problems in their workspace and fewer problems with air movement and freshness.				

Table D12. Workspace shadow problems (Shadows).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.24
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.19	0.23
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your workspace			
	IMPORTANCE OF CONTROLLING WORKSPACE LIGHTING	LITECONT	0.10	0.17
V145	Important to control room lighting in workspace			
V146	Important to control task/ desk lighting in work-space			
SUMMARY: The more problems that people have with workspace shadow problems, the more important they feel it is to be able to control environmental conditions and lighting in their workspace.				

Table D13. Frequency of workspace acoustic problems (Noises).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.35
V147	IMPORTANCE OF CONTROLLING SOUND LEVELS IN MY WORKSPACE	V147	0.23	0.23
V42	OPENNESS OF OFFICE TYPE	V42	0.19	0.22
V77	FREQUENCY OF CONTROLLING WORKSPACE SOUND LEVELS	V77	-0.15	-0.20
SUMMARY: The frequency of workspace acoustic problems increases with the openness (lack of enclosure, like walls or doors) of the workspace. With more open offices, people are less able to control the sound around them, and feel that it is more important to be able to do so.				

Table D14. Frequency of workspace heating problems (Heatprob).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.55
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.36	0.44
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
V106	HAVE ADDED A HEATER TO WORKSPACE	V106	0.24	0.31
	FREQUENCY OF TEMPERATURE CONTROL	USETEMP	-0.18	-0.14
V70	Frequently control ventilation air			
V72	Frequently control heating			
V73	Frequently control cooling			
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.14	0.35
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your work-space			
SUMMARY: Those who experience more heating problems within their workspace are more likely to have added a heater to their workspace, but are otherwise less likely to control their temperature in other ways. They are also more likely to feel that it is important to control the air and temperature conditions in their workspace, as well as other workspace environmental conditions.				

Table D15. Frequency of workspace cooling problems (Coolprob).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.47
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.33	0.44
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.21	0.37
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your workspace			
SUMMARY: Those who have more workspace cooling problems also feel it is more important to be able to control the air and temperature in their workspace, as well as other workspace environmental conditions.				

Table D16. Frequency of workspace dryness problems (Humidry).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.44
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.27	0.38
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your work-space			
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.24	0.37
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
SUMMARY: Those who have more workspace cooling problems also feel it is more important to be able to control the air and temperature in their workspace, as well as other workspace environmental conditions.				

Table D17. Problems with workspace air movement and freshness (Freshair).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.50
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.27	0.42
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your work-space			
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.26	0.41
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
V105	HAVE ADDED A FAN TO WORKSPACE	V105	0.14	0.22
SUMMARY: People who experience more workspace air movement and freshness problems are more likely to have added a fan to their workspace. They also feel that it is important to be able to control the air and temperature in their workspace, as well as other environmental conditions there.				

Table D18. Aware of odors/dust in workspace (Odors).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.43
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.22	0.34
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.19	0.33
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your workspace			
V101	WORKSPACE IS CENTRALLY COOLED	V101	-0.18	-0.22
V105	HAVE ADDED A FAN TO WORKSPACE	V105	0.14	0.22
SUMMARY: People who experience odors or dust in their workspace are less likely to have central cooling and are somewhat more likely to have added a fan to their workspace. They also feel it is important to have control over air and temperature conditions as well as other environmental conditions in their workspace.				

Table D19. Frequency of control of workspace lights (Uselite).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.52
	HAVE CONTROL OF WORKSPACE LIGHTING	CONTLITE	-0.37	-0.42
V59	Room Lighting			
	Task/ desk lighting			
V42	OPENNESS OF OFFICE TYPE	V42	-0.18	-0.23
V80	AMOUNT OT TASK/ DESK LIGHT IN WORKSPACE	V80	0.14	0.23
	IMPORTANCE OF CONTROLLING LIGHT	LITECONT	0.12	0.20
V145	Room lighting			
V146	Task/ desk lighting			
	TO DO JOB WELL, IMPORTANT TO HAVE ACCESS TO TECHNOLOGY AND INFORMATION	TECHIMP	0.11	0.12
V36	Have the appropriate technology			
V37	Have access to needed files and/ or information			
	TO DO JOB WELL, PRIVACY FROM CO-WORKERS IS IMPORTANT	PRIVIMP	-0.11	.02 *
V24	Visual privacy from co-workers is important			
V25	Acoustic privacy from co-workers is important			
	HAVE CONTROL OF WORKSPACE TEMPERATURE	CONTTEMP	0.09	-.01 *
V54	Control of ventilation air			
V56	Control of heating			
V57	Control of cooling			

SUMMARY: People who most often control their workspace lighting are (obviously) those who have control of them (negative correlation is due to scale reversals) and are more likely to be in less open offices, thereby using more task/ desk lighting. They also feel it is important to be able to control their lighting. Those who feel that it is important to have access to technology and files tend to more frequently control their workspace lights (perhaps due to computer use).

(Note: "PRIVIMP" and "CONTTEMP" have no direct (Pearson) correlation with the frequency of workspace light control. Their role, in this result, is to act as a "suppressor" (see Cohen & Cohen, 1975, for an extensive discussion of suppressor variables).)

Table D20. Frequency of controlling workspace sound levels.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.70
NEW61	DO YOU HAVE CONTROL OF SOUND LEVELS IN YOUR WORKSPACE?	NEW61	0.66	0.67
	TO DO JOB WELL, IMPORTANT TO HAVE ACCESS TO CO-WORKERS	ACCSSIMP	0.18	0.18
V22	Visual access to co-workers important			
V23	Ability to talk with co-workers important			
V101	WORKSPACE IS CENTRALLY COOLED	V101	0.11	0.12
SUMMARY: How frequently people act to control their workspace sound levels is primarily dependent on whether or not they feel they have the ability to control them. It is also slightly affected by the workspace being centrally cooled (sounds from air vents?). Also, those who control their workspace sound levels feel that it is somewhat more important to have visual and verbal access to their co-workers, to do their job well. (Note: Supervisory personnel are more likely to have individual closed workspaces, which would allow greater sound control.)				

Table D21. Frequency of temperature control (Usetemp).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.64
	HAVE CONTROL OF WORKSPACE TEMPERATURE	CONTTEMP	-0.58	-0.62
V54	Control of ventilation air			
V56	Control of heating			
V57	Control of cooling			
V102	WORKSPACE HEATED BY ROOM UNIT	V102	0.14	0.25
V10	PERCENT OF DAILY TIME SPENT IN WORKSPACE	V10	0.11	0.13
SUMMARY: Those who frequently control the ventilation air, heating, or cooling in their workstation are those who have such control, those who have workspaces heated by room units, and who spend more time in their workspaces.				

Table D22. Control of window fresh air in workspace.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.51
V78	AMOUNT OF DAYLIGHT IN WORKSPACE	V78	0.37	0.43
V4	MONTHS IN CURRENT WORKSPACE	V4	0.18	0.23
V79	AMOUNT OF OVERHEAD LIGHT IN WORKSPACE	V79	-0.14	-0.22
V80	AMOUNT OF TASK/ DESK LIGHT IN WORKSPACE	V80	-0.14	-0.09
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.09	0.15
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
SUMMARY: Those who have greater control over window fresh air in their workspace tend to be those who have been in their current workspace longer. They also need/ use less overhead and task/ desk lighting, and feel it is important to control their air and temperature conditions.				

Table D23. Have added a heater to my workspace.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.40
V102	WORKSPACE HEATED BY ROOM UNIT	V102	0.21	0.16
V103	WORKSPACE COOLED BY ROOM UNIT	V103	-0.20	-0.07
	EMPLOYEE GENDER	GENDER5	-0.21	-0.24
V42	OPENNESS OF OFFICE TYPE	V42	-0.14	-0.17
V43	WORKSPACE ALONG WHAT WALL?	V43	-0.11	-0.17
V78	AMOUNT OF DAYLIGHT IN WORKSPACE	V78	0.08	0.16
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.06	0.13
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
SUMMARY: Relatively few people had added a heater to their workspace (19%), but of those who did, they were more likely to be women, slightly more likely to have a room heating unit, and very slightly less likely to have a room cooling unit. If their office was more enclosed or on an exterior wall and thus had more daylight from a window, they were somewhat more likely to have added a heater to their workspace. They also felt it was more important to control the air and temperature conditions in their workspace.				

Table D24. Have added a fan to my workspace.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.26
	EMPLOYEE GENDER	GENDER5	-0.17	-0.21
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.11	0.18
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your workspace			
	IMPORTANCE OF CONTROLLING AIR & TEMPERATURE CONDITIONS	AIRCONT	0.07	0.15
V140	Ventilation air			
V141	Fresh air from windows			
V142	Heating			
V143	Cooling			
V144	Humidity			
SUMMARY: Almost thirty (29%) of the respondents reported adding a fan to their workspace; of those, 57% were women. Those who had added a fan also felt it was important to have control over workspace air and temperature conditions, as well as other environmental conditions.				

Table D25. Have control of sound levels in workspace.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.24
V42	OPENNESS OF OFFICE TYPE	V42	-0.21	-0.19
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	-0.10	-0.11
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your work-space			
V6	AGE OF EMPLOYEE	V6	-0.11	-0.09
SUMMARY: Having control of sound levels in the office is more likely with less open (more enclosed) office spaces. Those who do have control are likely to be older (more senior?) employees, who feel that it is important to have control of workspace ambient conditions.				

Table D26. Have control of workspace lighting (Contlite).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.34
V80	AMOUNT OF TASK LIGHT IN WORKSPACE	V80	-0.25	-0.23
V42	OPENNESS OF OFFICE TYPE	V42	0.22	0.23
V43	WORKSPACE ALONG WHAT WALL?	V43	0.11	0.11
SUMMARY: Those who have control of their workspace lighting tend to be in workspaces on the exterior wall, have more enclosed workspaces and have more task lighting in their workspaces.				

Table D27. Have control of workspace temperature.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.36
V103	WORKSPACE COOLED BY ROOM UNIT	V103	-0.25	-0.27
V43	WORKSPACE ON WHAT WALL?	V43	0.16	0.20
V4	MONTHS IN CURRENT WORKSPACE	V4	-0.15	-0.19
SUMMARY: Relatively few employees have control of heating (19%) or ventilation (16%) in their workspaces. However, if they do, they are more likely to have room-cooling units, and be on exterior walls. The longer they have been in their current workspace, the more likely they are to have control of their workspace temperature.				

Table D28. Amount of daylight in workspace.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.36
V43	WORKSPACE ALONG WHAT WALL	V43	-0.30	-0.32
V101	WORKSPACE CENTRALLY COOLED	V101	-0.15	-0.15
V42	OPENNESS OF OFFICE TYPE	V42	-0.10	-0.11
SUMMARY: Those who are on exterior walls have more daylight in their workspaces. They are somewhat less likely to have centrally cooled workspaces (although many (61%) of the respondents did have central cooling), and are less likely to have open offices.				

Table D29. Amount of overhead light in workspace.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.22
V43	WORKSPACE ALONG WHAT WALL?	V43	0.18	0.18
	TO DO JOB WELL, IMPORTANT TO HAVE ACCESS TO CO-WORKERS	ACCSSIMP	0.10	0.11
V22	Visual access to co-workers important			
V23	Ability to talk with co-workers important			
V10	PERCENT TIME IN WORKSPACE	V10	0.09	0.08
SUMMARY: Those who have more use of overhead light in their workspace are more likely to be in workspaces on interior walls, spend slightly more time in their workspaces, and feel that access to others is important, in order to do their job well.				

Table D30. Amount of task lighting.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.17
	AGE OF EMPLOYEE	V6	0.14	0.15
SUMMARY: The older the employee the more likely they are to use more task lighting.				

Table D31. Importance of controlling sound levels in my workspace.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.47
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.36	0.42
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your workspace			
	IMPORTANCE OF AUDITORY/ VISUAL PRIVACY, TO DO JOB WELL	PRIVIMP	0.18	0.28
V24	Visual privacy from co-workers			
V25	Acoustic privacy from co-workers			
V7	HOURS/ WEEK IN OFFICE	V7	0.11	0.13
V43	WORKSPACE ALONG WHAT WALL?	V43	-0.06	-0.09
SUMMARY: Those who feel it is important to control the sound levels in their workspace also feel it important to control other workspace ambient conditions, and to have privacy from co-workers in order for them to do their job well. They also spend more hours a week in the office and tend to have a workspace along an exterior wall.				

Table D32. Importance of controlling workspace lighting (Litecont).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.42
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.33	0.40
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your work-space			
	TO DO JOB WELL, IMPORTANT TO HAVE ACCESS TO TECHNOLOGY & INFORMATION	TECHIMP	0.12	0.23
V36	Have the appropriate technology			
V37	Have access to needed files and/ or information			
	IMPORTANCE OF AUDITORY/ VISUAL PRIVACY, TO DO JOB WELL	PRIVIMP	0.10	0.19
V24	Visual privacy from co-workers			
V25	Acoustic privacy from co-workers			
SUMMARY: Those who feel it is important to control their workspace lighting also feel that control of other ambient conditions in their workspace is important, in order to do their job well. They also feel that it is important to have access to needed information and technology and to have privacy for their co-workers, in order to do their job well.				

Table D33. Importance of controlling workspace air and temperature conditions (Aircont).

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.51
	IMPORTANCE, TO DO A JOB WELL, OF CONTROLLING WORKSPACE ENVIRONMENTAL CONDITIONS	ENVCNIMP	0.45	0.49
V26	Controlling your light levels			
V27	Controlling your ventilation			
V28	Controlling your temperature			
V29	Controlling your humidity			
V30	Controlling your sound level			
V31	Having access to an operable window in your work-space			
V43	WORKSPACE ALONG WHAT WALL?	V43	-0.10	-0.13
	TO DO JOB WELL, IMPORTANT TO HAVE ACCESS TO TECHNOLOGY & INFORMATION	TECHIMP	0.09	0.24
V36	Have the appropriate technology			
V37	Have access to needed files and/ or information			
SUMMARY: Those who feel it is important to control their workspace air and temperature conditions also feel that, in order to do their job well it is important to control other workspace ambient conditions and to have access to technology and needed files. They are also somewhat more likely to have workspaces along exterior walls.				

Table D34. On exterior wall.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.14
V4	MONTHS IN CURRENT WORKSPACE	V4	-0.14	-0.14
SUMMARY: Those who have workspaces on exterior walls have been in their workspaces longer (average = 31 months) than those with interior workspaces (average = 21 months).				

Table D35. Openness of office type.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.37
	IMPORTANCE OF AUDITORY/ VISUAL PRIVACY, TO DO JOB WELL	PRIVIMP	-0.22	-0.26
V24	Visual privacy from co-workers			
V25	Acoustic privacy from co-workers			
V1	EMPLOYEE TYPE	V1	0.21	0.26
V6	EMPLOYEE AGE	V6	-0.12	-0.18
SUMMARY: People who are in more enclosed offices are more likely to be supervisors and be older employees. They are also more likely to feel that privacy from co-workers is important, in order to do their job well.				

Table D36. Have room heating unit.

Component	Predictor	Index/ Variable #	Beta	Pearson Correlation Multiple R=0.20
V6	EMPLOYEE AGE	V6	0.15	0.17
V7	HOURS/ WEEK SPENT IN OFFICE	V7	-0.11	-0.13
SUMMARY: Although relatively few employees (12%) have room heating units, those who do tend to be somewhat older and to spend somewhat fewer hours/ weeks in the office.				

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14. ABSTRACT

In general, work environments (e.g., office buildings) are meant to support the work-related behaviors of employees who inhabit them so the parent organization may better reach its goals ("work outcomes"). Unfortunately, the construction planning process often disregards the effects that building components and utility systems have on building occupants. This study used an employee survey to study the effects of ambient conditions of lighting, temperature and air quality, and acoustics on work outcomes of performance, satisfaction with working in the office, and number of sick days. The evidence clearly showed that, through a path-to-outcomes analysis (path analysis), all these ambient conditions had significant impacts on performance, satisfaction with working in the office, and number of reported sick days.

15. SUBJECT TERMS

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