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I am submitting herewith a thesis written by Amy E. Crumpton entitled "Facility Planning for Group Work: A Case Study." I have examined the final copy of this thesis for format and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Interior Design.

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FACILITY PLANNING FOR GROUP WORK: A CASE STUDY

A Thesis Presented for the

Master of Science Degree

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Amy E. Crumpton

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ABSTRACT

As many types of organizations widen their focus from individual productivity to group productivity, it is necessary to explore physical environments that meet the needs of work groups. The purpose of this case study was to answer four research questions about group work and environmental preferences. Six work groups from a government contract organization were studied in this context.

The research questions addressed in the research were: (1) what are the group work patterns for these groups in this organization; (2) what is current satisfaction with group space; (3) what physical environment choices do respondents make in support of group work in a planning exercise; and (4) are respondents willing to trade personal space for group space. Each of 50 subjects completed a questionnaire to assess group work patterns and current workplace effectiveness. They also participated in an office planning exercise under budget and non-budget constraints to solicit environmental preferences. Data were analyzed by work group as well as by the individual variables of job level (manager, professional/technical, clerical) and personality trait (introvert, extrovert).

Questionnaire results indicated more than half of the participants spent at least half their time each day in group work. 50% of respondents felt their current environment did not support their group work adequately. Planning exercise results indicated when faced with a budget situation, 41% of respondents were willing to give up some individual space for group space. Data analysis revealed significant differences in response rates for job level and work group. Analysis by the personality trait of introversion/extroversion revealed no differences in response rates. Overall results indicated group work was prevalent among respondents and employees recognized the need for group space to support that work

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1

INTRODUCTION

The operating environment of organizations is changing rapidly. Because of a sharp increase in global competition, organizations are having to produce higher quality goods and services with a smaller work force ("Future Work", 1991). To remain viable in the changing global market, organizations, among other things, are turning to the idea of working in groups or teams instead of the individual work orientations of the past (Moleski and Lang, 1982; McCue and Zutz 1992; Whitaker, 1992).

With the structure of organizations changing rapidly to this group-work based approach, it is imperative that interior designers and facility managers understand the implications of the new issues that are inherent in working in groups. The purpose of this study was to explore the pertinent issues in the design of group spaces and begin to develop a method for integrating these issues into the design process. A first step in this process was a case study of one organization to determine perceptions of group work patterns and current workplace effectiveness as well as a trade-off office planning exercise to assess environmental preferences.

Related Research and Theory

As a result of a fundamental shift over the past 30 years in the nature of work from a focus on the production of goods and products to the provision of services and knowledge-based activities, today over 80 percent of the work force in developed countries is employed in knowledge and service industries (McCue and Zutz, 1992). Baloga and Cornell (1992) of Steelcase have coined the term "knowledge worker", a person who "in the performance of their daily job has as their primary function to analyze, decide, collaborate, and act on information as their fundamental raw material." In knowledge work industries, tasks have become more technical, complicated, unstructured, and require more collaboration and group problem solving (Moleski and Lang, 1982).

The design of office environments has not kept up with the rapid changes in organizational structure. The impact of Frederick Taylor's (1911) scientific management theory describing people as units of production still pervades the field of office design. Work spaces are arranged according to hierarchical space standards which do not consider the specific processes of work, but instead hinge on the idea that all employees at one hierarchical level have the same environmental needs. Overall, the focus of design and research has been to focus on the individual tasks and characteristics in order to provide effective design. One of the most comprehensive studies (N = 6,000+) of the individual work environment was conducted by the Buffalo Organization for Sociological and Technological Innovation (BOSTI) (Brill, Margulis, Konar, and BOSTI, 1984). This research attempted to address the "complex issues of the impact of the office environment on office work performance and worker satisfaction." The researchers examined eighteen specific facets of the work environment in relation to four bottom line measures: job performance, job satisfaction, satisfaction with work environments, and ease of communication.

However, as interest in organizational effectiveness in terms of work groups increases, research must begin to focus on the needs of work groups. McCue and Zutz (1992) noted that in response to group formation and increasing economic pressures, the facility manager needs to understand teams and their functions to provide space that is most effective for both the team and the organization.

The conceptual framework for this study (see Figure 1-1) includes three categories of variables thought to be associated with group environments 1) individual variables; 2) group variables; and 3) environmental satisfaction/workplace effectiveness. The model incorporates the individual variables of personality type, and job level, and the group variables of group task, group work patterns, group boundary issues, and work products to attempt to describe current work patterns and workplace effectiveness. It is proposed that current workplace effectiveness as well as user defined environmental needs will be related the environmental choices made in the office planning exercise. Research and theory on each of these categories will be reviewed in the following sections.

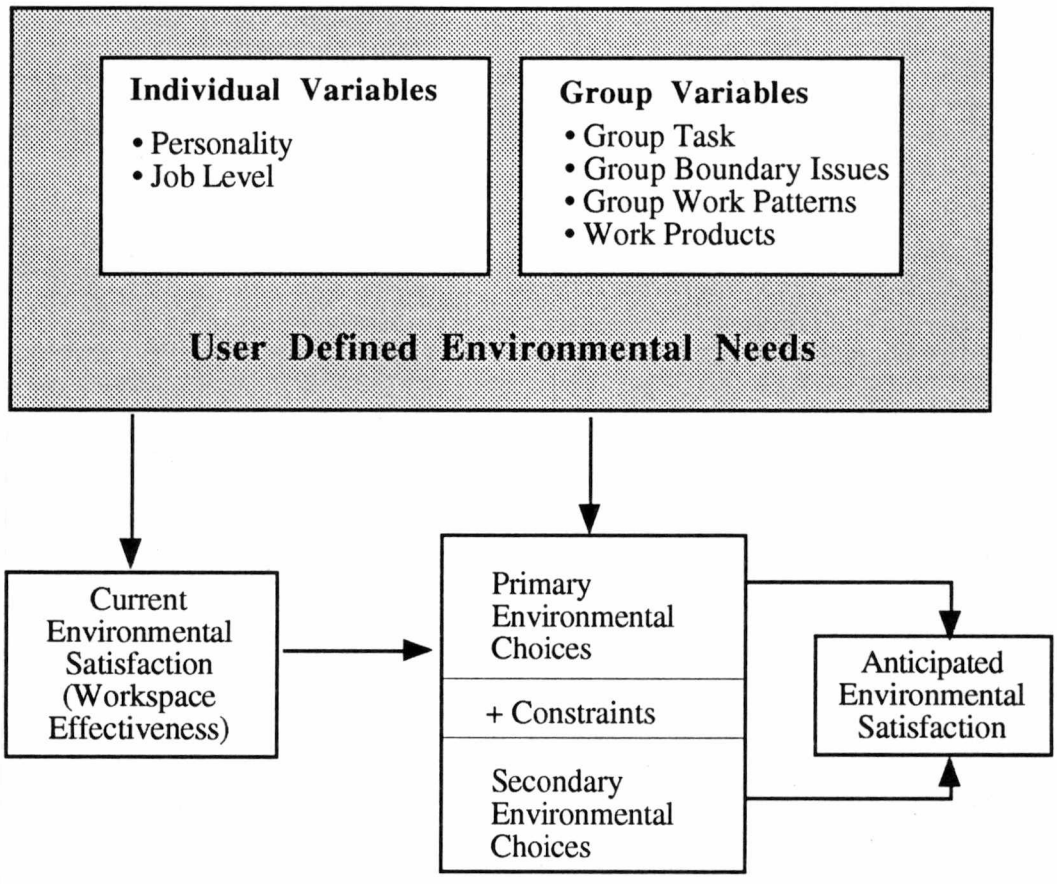


Figure 1-1. Conceptual Model for Current Study of Group Work Environments

Individual Variables

The individual demographic variables that have been included in this research include job level and the personality trait of introversion/extroversion. In the past, research and theory has reflected that both job level (Brill et al., 1984; Ferguson and Weisman, 1984) and personality traits (Kleiner, 1983; Hellriegel and Slocum, 1980; Kiersey and Bates, 1984) can affect organization work patterns and preferences.

Introversion/Extroversion. The Jungian personality trait of introversion/extroversion deals with the way in which the individual confronts the environment. Extroverts tend to get their energy from people and their surroundings, while introverts prefer solitude to recover energy (Kiersey and Bates, 1984). The extrovert's interest flows mainly to the outer world of actions, objects and persons, while the introvert's interest flows mainly to the inner world of concepts and ideas. While this variable has been linked to work preferences in terms of dealing with people and tasks, the concepts of introversion/extroversion have not been used to test differences in environmental preferences. In order to control for any differences that might occur by personality types this aspect of the individual was included. It was hypothesized that extroverts might want or choose to work in groups and prefer group work spaces while introverts might not choose these spaces.

Job Level. Job level was included primarily because by definition—at least according to the past individual oriented work environment research—managers did more group work than employees at other job levels. The BOSTI study (Brill et al., 1984) demonstrated that the activities differentiating managers from professional/technical workers and clerical/secretarial workers was their increased participation in scheduled and unscheduled meetings. This study suggested that the differences between managers and clerical workers are more pronounced than the differences between managers and professional.technical workers and clerical workers.

Both of these individual variables were included in the current study to see if the theories would be substantiated, as well to control for these factors in the analysis.

Group Variables

The group variables included group task, group boundary issues, work products, and group work patterns. Group task is defined as the purpose of the work group and the specific duties involved in carrying out the work group responsibilities. Boundary issues represent concerns that groups have about the interactions they have with other groups or individuals in the organization. The work products variable is a check to see if the products/output of the groups is perceived to be a collective work product or is made up of individually produced work products. A third group variable is group work patterns. This variable includes measures of time spent in group work, group activities, and group places.

Group Task. Several types of groups have been identified by researchers in their studies of groups (Brill et al, 1984; Herman Miller, 1990; Sundstrom and Altman, 1984; Drucker, 1992; Sundstrom, DeMeuse and Futrell, 1990). Most of these types hinge on the task that the group must perform. Two studies will be included for review, since they represent research and theory from two different areas—individual focused work environment research (Brill et al., 1984) and work team effectiveness research (Sundstrom and Altman, 1989).

Although the focus of the BOSTI study was the productivity and satisfaction of the individual worker, some design interpretations were proposed resulting from the research. Work group types were differentiated by the task interdependence of the group. The researchers selected three different types of work flows central to the work environment needs of the groups: independent work flow, sequential work flow, and team work flow. Independent work flow indicates that people in a single job category, each fully capable of performing the task, are organized for parallel task accomplishment. In sequential work flow people in several different job categories are organized so that each performs a component of a larger task. The components are in a predetermined sequence. In team work flow people in several different job categories are focused on one large task, generally working simultaneously on it. Extensive interaction is necessary, both in designing the task and devising methods to accomplish it. According to Brill et al. (1984), the design recommendations focused on different physical environment supports for effective work groups in terms of group identity, clarity, and function.

Sundstrom and Altman (1989) defined four types of work groups in terms of their integration and differentiation from the organization. Differentiation is the "division of labor and the development of specialized, independent subsystems," while integration is the "communication, coordination and centralized control required for the subsystems to operate in concert." By using these factors in a two dimensional matrix, Sundstrom and Altman (1989) distinguish necessary environmental supports in terms of a two dimensional matrix of integration and differentiation of the work group with the organization.

This analysis provided a framework for the role of the physical environment in relation to work group type. At the low end of the spectrum where there was little integration and low differentiation, the category, Advice and Involvement Groups, represented the minimal work group, a "collection of individuals who work together on a restricted project for a restricted amount of time." At the high end of the spectrum, where there was high integration and high differentiation, were the Action Negotiation teams, which "perhaps provide the best illustration of the dynamic changing quality of group-organization boundaries." Each of these group differed in the type of environment they needed ranging from an emphasis on the interface function to the barrier function that the environment should provide to promote group effectiveness.

Group Boundary Issues. The issues central to this research about group boundaries include visual differentiation of the work group, physical separation of the work group, and boundary regulation, or control of group area entrance. Central to these issues is the concept of territoriality (Hall, 1959; Somer, 1969; Lyman and Scott, 1967). It is widely recognized that individuals tend to appropriate space and assume proprietary rights (Becker, 1973; Whyte, 1943; Shaw, 1981; Richards and Dobins, 1957).

As a part of our fundamental nature, territoriality becomes a serious issue to investigate in the formation of work groups, not only for group territories but for individual territories within the group territory. Group territories help to differentiate the work group and give them a specific identity (Shaw, 1981). Individual territories do the same for the individual. Both of these needs may conflict with others in the organization, other work groups, and other individuals within the work group.

Group Work Patterns. As the focus on the productivity of work groups increases, it

follows that there will be an increase in the importance (and environmental support) of group work i.e. conferences, meetings, exchanging information etc. One focus of this study was to see what the perceptions of current patterns of group work were in this particular organization. As BOSTI (Brill et al., 1984) measured activities and places in which work took place, their focus was on the individual and on the work that employees did as individuals. In contrast to the BOSTI Study, in the current study the measure of work patterns is primarily the amount of time spent in group activities during an average day.

Work Products. A classification of work products was included to ascertain whether employees felt that the work they produced was a collective product or a group of individual work products. Katzenbach and Smith (1993) noted that the major difference between a collection of individuals who work in the same unit and an interdependent team is the production of collective work products.

Environmental Satisfaction and Workspace Effectiveness

Environmental satisfaction is a measure that has often been used to link the physical work environment to worker productivity, performance, and job satisfaction (Brill et al., 1984; Szilagyi and Holland, 1980; Oldham and Brass, 1979; Sundstrom, Burt, and Kamp, 1980). One component of environmental satisfaction—and the focus of this study—is workspace effectiveness, defined as the extent to which the physical environment meets the needs of the worker.

As noted earlier, the BOSTI research (Brill et al., 1984) addressed eighteen specific facets of the work environment in relation to four bottom line measures—job performance, job satisfaction, satisfaction with work environments, and ease of communication. Of these eighteen, most of the facets contributed to environmental satisfaction, half of them contributed to job satisfaction and ease of communication, and two of them to job performance. This study showed a clear link between the physical work environment and the satisfaction and performance of office workers.

Because environmental satisfaction has been linked to increased productivity for individuals, it also follows that environmental satisfaction with group work environments

would be linked to increased group productivity. For example, providing dedicated group meeting areas sends a message to employees that the organization realizes the importance of group work and is willing to promote it through providing environmental supports .

Purpose of the Current Study

The purpose of this research was to measure individual characteristics (personality trait and job level), group work characteristics (work patterns, group task, group boundary preferences, work products), and current workplace effectiveness in relation to environmental preferences.

Research Questions

The following questions were posed in this research. Each question was assessed in terms of overall frequency, and by the variables of work group, job level and personality trait.

1. What are the group work patterns observed in this organization?
2 How do respondents feel that their current environment supports their work in groups?
3. What physical environment choices do respondents make in the office planning exercise to support their work in groups?
4. Are the respondents willing to give up personal space for group space?

2

METHOD

Project Background and Research Approach

Oak Ridge Associated Universities (ORAU) is a government contract organization providing services for such customers as the Department of Energy and the National Science Foundation as well as member universities from across the nation. ORAU administers training programs, distributes fellowships, and helps research scientists in member universities obtain research positions in government and non-government organizations.

ORAU was chosen for the research study primarily because the organization is actively pursuing a continuous improvement program, involving such concepts as empowerment and team building. The organization is energetically exploring the team concept and is encouraging the use of teams and teamwork throughout the organization. The site also represented a convenience sample since the researcher had access to the organization through part-time employment. A third reason for choosing the site was that the organization was in the planning stages for a new building (not involving these particular work groups) and the design and development process was unearthing interesting questions about the amount of group space versus individual space that should be designated for the facility. It is hoped that this initial survey will answer some general questions about group work patterns at ORAU while initiating others for more detailed study.

The case study approach was chosen to study work groups at ORAU. Cornell and Brenner (1993) noted that the best way to study work groups is "in situ", in the context in which they exist and function. Touliatos and Compton (1988) also noted that "field research is the preferred strategy when it is difficult or undesirable to study phenomena out of their natural context."

Field studies are non-experimental investigations that examine existing relationships

and situations of people in their everyday lives and do not attempt to manipulate or influence subjects being studied (Touliatos and Compton, 1988). A case study is a specific type of field study offering an in-depth analysis of an individual, a family, a culture, an organization, program or an event. Yin (1993) contends that a case study is an "approach that is especially well suited to answer "how" and "why" questions about complex, real-life events over which the researcher has little or no control." Although the case study has been criticized for its inability to rule out the influence of extraneous factors, it is strong in realism, significance, strength of variables, theory orientation, and heuristic quality (Kerlinger, 1986)

The focus of the current study was to discover group work patterns and group work space preferences for this organization and see if different work groups had different group space needs. The data is preliminary to a comprehensive study across organizations, and/or across different types of work groups.

Participants and Setting

The participants for this research on group facilities consisted of six work groups of two divisions at Oak Ridge Associated Universities. Participation in the research was voluntary. The researcher asked division directors if they would like to participate and the director sent out a memo asking for volunteers. These program managers then contacted the researcher directly to indicate their desire to participate. Those programs who did not choose to participate may have had different attitudes about group space or little interest in the group space concept.

The structure of the organization is such that areas of concentrations (divisions) are divided up into programs which handle tasks for the Department of Energy and outside clients like the National Science Foundation. The unit for much of the analysis was the group or program level, with participation ranging in number from six to eleven people per group.

Primarily the groups were production/service groups (Sundstrom and Altman, 1989). That is, the groups performed a service (e.g., information services for the division, business office for division) or produced a product (e.g., provide research opportunities

for scientists, training programs, fellowship appointments, evaluation of educational programs).

Work Group Descriptions

Computer Group. The purpose of the computer group was to "monitor all divisional computer and networks," "maintain systems and train users on as needed," and "support the division in all computer, software, hardware, technical and training needs." Six people in this group participated in the study. The specific responsibilities of this group consist of:

- "Minimize computer down time"
- "Meet with users daily to prevent/maintain problems"
- "Computer programming"
- "Technical support"
- "Design and implement new systems and maintain existing systems"

Training Group. The purpose of the training group is to "analyze, design, develop, implement, evaluate, and manage training programs in environmental safety and health," as well as "provide training and improve participants skills in communicating risk information to the public and media." Eleven people in this group participated in the study. The specific responsibilities of this group consist of:

- "training document production"
- "analyzing, design, developing and implementing training programs"
- "client interface, and program evaluation"
- "research planning and database searches"

Research Opportunities Group. The purpose of this group is to "develop, implement and manage programs that provide hands-on research opportunities for members of the academic community in federal research facilities," to develop "knowledge that can be taken back to college classrooms." Eleven people in this group participated in the study. The specific responsibilities of this group consist of:

- "coordinating with external organizations"
- "reviewing applications, decide eligibility, prepare contracts, write proposals, and manage appointments"
- "school visits, literature design and distribution"

- "recruitment, facilitate selection process, manage budgets"

Fellowship Group. The purpose of this group is to "administer fellowship appointment for different offices within the Department of Energy," as well as "to promote education and supply a need of scientists for DOE research" Six people in this group participated in the study. The specific responsibilities of this group consist of:

- "Interacting with program sponsors"
- "talk with participants and universities on the phone"
- "forecast budgets"
- "distribute and receive applications"

Business Office Group. The purpose of this group is to "provide administrative support to division program areas," as well as "provide financial and administrative management including budgets, payroll, travel and purchasing." Eight people in this group participated in the study. The specific responsibilities of this group consist of:

- "financial and administrative management"
- "Meet with program managers"
- "preparation of proposals, presentations and budget documents"
- "work orders, payroll and personnel records"

Program Evaluation Group. The purpose of this group is to "evaluate educational programs administered for DOE and other federal agencies to determine if they meet their goals and objectives," as well as "collect and analyze survey forms and report results in published papers." Eight people in this group participated in the study.The specific responsibilities for this group consist of:

- "data collection, management, analysis, report preparation"
- "find sponsors for work"
- "develop proposals for new and continued work"
- "survey design, statistical analysis, desk-top publishing"

Demographics

Work group demographics are shown in Table 2-1. The sample is representative of the of the organization in several respects. According to documentation from ORAU

Table 2-1. Demographics

	Training Group n	Computer Group n	Research Group n	Fellowship Group n	Business Group n	Evaluation Group n	TOTALS n (%)
Respondents	11	6	11	6	8	8	50
Sex (n=50)							
Male	3	3	2	2	1	2	13 (26%)
Female	8	3	9	4	7	6	37 (74%)
Age (n=49)							
18-24	0	0	2	0	1	2	5 (10%)
25-35	3	2	2	2	2	3	14 (29%)
36-45	7	3	2	1	2	1	17 (33%)
46-55	1	0	3	2	3	2	11 (22%)
55+	0	1	2	0	0	0	3 (6%)
Years with Organization (n=50)							
0-2	1	3	3	2	3	2	14 (28%)
3-5	2	2	2	2	2	2	12 (24%)
6-8	4	0	2	1	1	1	9 (18%)
9-11	3	0	1	0	1	2	7 (14%)
12-15	1	1	2	0	0	1	5 (10%)
16-18	0	0	0	0	0	0	0 (0%)
19-20	0	0	0	0	1	0	1 (2%)
20+	0	0	1	1	0	0	2 (4%)
Years with Work Group (n=50)							
0-2	3	4	7	3	3	3	23 (46%)
3-5	6	1	2	3	3	5	20 (40%)
6-8	2	0	0	0	1	0	3 (6%)
9-11	0	0	1	0	1	0	2 (4%)
12-15	0	1	1	0	0	0	2 (4%)
Job Level (n=49)							
Manager	5	3	6	3	2	1	20 (41%)
Prof/Tech	4	2	2	0	0	4	12 (25%)
Cler/Sec	2	1	2	3	6	3	17 (35%)
Personality Type (n=50)							
Introvert	1	4	3	0	2	2	12 (24%)
Unclassified	2	0	0	0	0	2	4 (8%)
Extrovert	8	2	8	6	6	4	34 (68%)

(1992), the organization is composed of 40% managers, 23% professional/technical and 37% clerical/secretarial employees. This corresponds closely to the sample data of 41% managers, 25% professional/technical and 37% clerical/secretarial. The gender mix however, is not as representative. Frequencies in the organization are 37% men and 63% women. However in the study the sample is composed of only 26% men and 74% women. This may be because the study included only one division manager level or higher and this sample did not include the most technical and scientific programs in the organization.

Procedures

Pretest

The pretest sample consisted of ten subjects from two programs in a separate division of ORAU (not part of the final survey). Based on this pretest, small changes were made in the wording of questions to enhance understanding. In addition, the budget for the second part of the planning exercise was increased to give a richer choice for group spaces. All other facets of the pretest were considered satisfactory.

Data Collection

Data were collected from August 1-15, 1994 with eight questionnaires arriving later than the one week deadline. The packet distributed to the subjects consisted of three parts:

1. A form indicating consent to participate in the study.
2. Part One of the survey—an 8 1/2x11 inch booklet of questions about how subjects do individual and group work.
3. Part Two of the survey instrument, the office planning exercise, with three cards to help graphically explain the choices available in the exercise. For this portion of the exercise subjects were asked to make environmental choices from several options in three basic categories: layout, shared spaces, and personal spaces.

The total time requirement for the completion of the survey was approximately 30 minutes (reports from subjects) with some participants going as long as 45 minutes because of interruptions in the process or individual differences.

Measures

A questionnaire and an office planning exercise were developed to answer the four research questions (See Appendix). Many items on the questionnaire were items from the BOSTI study (Brill et al., 1984) for comparison purposes. The questionnaire was designed to provide responses about demographic information, work patterns, and current workspace effectiveness.

The office planning exercise was developed to see what group spaces each subject felt would be beneficial to accomplish the work they do in their program. They were also asked to choose between several individual environments. In the first scenario, subjects were asked to make unconstrained choices to determine what combination of group and individual spaces would be requested. The second scenario introduced a budget constraint and asked the subjects to make the best choices they could from within the budget. The purpose of this exercise was to determine what trade-offs would be made between group and individual spaces given a budget constraint.

The variables measured in the questionnaire included job level, the personality trait of introversion/extroversion, work group, amount of time spent in group work, amount of time spent in group activities, amount of time spent in group places, work products, current group environment effectiveness, and current individual environment effectiveness. The office planning exercise measured the variables of total cost, shared space and individual space costs for budget and non-budget situations. The planning exercise also indicated a measure of willingness to give up individual space for group space. Each of the variables is discussed in terms of its corresponding research question.

Control Variables

Job level. Three job levels were used: manager, professional/technical and clerical/secretarial.

Personality trait of introversion/extroversion. This variable was computed from the individual answers to questions #8-17, taken from the Kiersey-Bates (1984) survey. If the sum of all responses was greater than five the subject was coded as an extrovert. If the sum of all responses was equal to five the subject was unclassified. If the sum was five or fewer, the subject was coded as an introvert.

Work group. The work group was described by the participants in item number #60 of the questionnaire. Each respondent was asked to give the overall purpose of their group as well as their specific duties within the group to gain a richer understanding of group task.

Research Question 1: Group Work Patterns

Amount of time spent in group work. This was item number 30 in the questionnaire. The responses ranged from 1 (almost all my time spent in group work) to 5 (almost all of my time spent working alone). If the response to this question was 1, 2, or 3, the subject was coded as 1 (spending at least 50% of time in group work). If the response was 4 or 5, the subject was coded as 0 (spending less than 50% of time in group work).

Amount of time spent in group activities. The responses to this question come from questionnaire items 18 and 19. Responses were classified into two groups for each question, those reporting at least 1 hour, and those who reported 1/2 hour or less.

Amount of time spent in group places. The responses to this question came from items 34, 35 and 39. Responses were again classified into two groups for each question, those reporting at least 1 hour, and those who reported 1/2 hour or less.

Work Products. The response to this question is from item #59. Responses were classified into two groups, those reporting collective work products and those reporting individual work products.

Research Question 2: Workspace Effectiveness

Current environmental support of group activities. This was item #48, a question directly assessing the current environmental support for group activities. The responses ranged from strongly disagree(1) to strongly agree(4). The statement that the participants were to evaluate was: "My current workspace (including group spaces) is very effective in supporting the work I do in groups." Responses were classified into two groups, those who felt their current environment was very effective (response 3 and 4) and those did not feel that their current work environment was effective in supporting their work (responses 1 and 2).

Current environmental support of individual activities. This was item #47, a question directly assessing the current environmental support for group activities. The responses ranged from strongly disagree(1) to strongly agree(4). The statement that the participants were to evaluate was: "My current workspace is very effective in supporting the work I do alone." Responses were classified into two groups, those who felt their current environment was very effective (response 3 and 4) and those did not feel that their current work environment was effective in supporting their work (responses 1 and 2).

Research Question 3: Environmental Choices Made in Support of Group Work

Overall space choices. The overall space choices were computed by arriving at a percentage of the total cost for each person for individual space choices and group space choices. These percentages were combined into an overall measure as well as broken down by work group to see if the choices for work groups were different.

Research Question 4: Willingness to give up individual space

Willingness to give up individual space. To answer this question, any subject who did not choose the largest individual space available under the budget situation, instead requesting

more group space was considered to be "willing to give up personal space for group space." Under the budget condition, Managers could choose a 10'x12' enclosed office, professional/technical workers could choose a 10'x10' enclosed workstation, and clerical workers could choose a 8'x10' enclosed workstation. If their actual choice under the budget condition was less than allowable, they were coded as willing to give up personal space.

Treatment of Data

The treatment of data consisted of frequency responses for many variables and chi square tests for independence. Chi squares were use to test for differences between work group, job level and personality for group work patterns. Any results with a probability of occurrence by chance of less than 5 times in 100 were considered significant.

Although the expected frequencies in testing for differences by work group were small (most were less than 5), Cochran (1954) noted that if the "chi square test has less than 30 degrees of freedom and the minimum expectation is at least 2 or more, use of the ordinary chi square tables is usually accurate." Chi square tests were conducted for work groups under these conditions. There were 5 degrees of freedom for each test and all expected frequencies were greater than 2.

In the other tests, job level and personality, the relaxed rule (Cochran, 1954) was used. The rule states that if few expectations are less than 5 and a minimum expected frequency of 1 is calculated, the regular chi square test is applicable. The data met these stipulations.

3

RESULTS

Preliminary data analysis includes the means, standard deviations and correlations between variables in the study as shown in Figure 3-1. There are several statistically significant correlations (at the $p<0.05$ level) illustrating relationships between variables. Most correlations can be considered in the weak to moderate range. The values used for the correlation matrix are the original values obtained from the research rather than the categorized variables used in later analyses.

A high amount of group work was directly correlated with high amounts of time spent in scheduled meetings and individual environment effectiveness. High amounts of group work were inversely correlated with time spent in another's office working, a preference for visual differentiation, and a preference for boundary control. That is, those employees who did more work in groups spent more time in scheduled meetings and were more satisfied with their current individual environment. This could be because the workers were spending more time away from their personal workspaces.

Individual environmental effectiveness was also inversely correlated with the preference for visual differentiation and boundary control. That is, those employees who were currently more satisfied with their individual environment, were less likely to prefer visual differentiation and boundary control. Their current environment probably already provided the types of control and differentiation that they felt was necessary to do their work.

The preferences for visual differentiation, physical separation and boundary control were all significantly correlated. This indicates that those employees who had a preference for one of the three boundary conditions may have a preference for all three. Although the correlations were weak to moderate, they indicated some agreement between variables and provide a foundation for the other data analysis techniques.

		Mean	SD	2	3	4	5	6	7	8	9	10	11
1	Group Work	3.39	0.837	0.15	.41*	0.05	-0.26**	0.20	0.25**	0.12	-0.05	-0.36*	-0.25**
2	Unscheduled meetings	0.702	0.307	-----	0.02	0.00	-0.24	0.21	0.2	-0.06	-0.18	-0.09	0.19
3	Scheduled meetings	1.08	0.67		-----	0.02	-0.20	0.23	0.08	-0.15	-0.18	-0.15	-0.15
4	Own office with others	0.794	0.639			-----	0.11	-0.21	-0.15	-0.15	0.23	0.21	0.13
5	Other's office	0.638	0.341				-----	-0.22	-0.27**	0.03	0.05	0.13	0.17
6	Conference rooms	0.968	0.663					-----	0.18	0.00	-0.11	-0.29**	-0.08
7	Indivdual Envt Effectiveness	3.25	0.957						-----	0.09	-0.18	-0.28**	-0.29*
8	Group Envt Effectiveness	2.56	0.848							-----	-0.18	0.00	0.03
9	Physical Separation	0.361	0.486								-----	0.35*	0.33*
10	Visual Differentiation	0.174	0.383									-----	0.29**
11	Boundary Control	0.261	0.444										-----

* Significant at the p<0.05 level
** Significant at the P<0.10 level

Figure 3-1. Correlation Matrix

Research Question 1: Group Work Patterns

The first question ,"What are the group work patterns observed in these groups in the organization?," included four facets for an overall description of the observed work patterns. They are: 1) amount of time spent in group work; 2) amount of time spent in group activities; 3) amount of time spent in group places; and 4) work products.

Amount of time spent in group work

This facet of the question deals with the reported amount of time spent in group work, described as:

> Consulting with others face to face on specific projects, formal or informal meetings, exchanging materials or information, whether it be in your office, or another office, in a dedicated meeting room, or somewhere in between

The choices ranged from '1 = Almost all of my time spent in groups' to '5 = Almost all of my time spent working alone.' The responses were grouped into two categories, those that reportedly spent at least 50% of their time in group work and those that spent less than 50% of their time in groups. Overall, 54% of respondents report that they spent half their time or more in group work. Chi square values indicated differences in amount of group work by job level ($p<0.05$), with 80% of managers reporting that they spent half their time or more in group work. Only 50% of technical and 24% of clerical workers reported that they spent half their time or more in group work. There were no significant differences in response rates for work group or introversion/extroversion. Chi square values are located in Table 3-1.

Amount of time spent in group activities

These question addressed the perceived amount of time respondents spend in group activities such as scheduled and unscheduled meetings. Responses were classified into groups of respondents who spent at least one hour in group activities and those who spent 1/2 hour or less in the activity for each question.

Table 3-1. Amount of Time Spent in Group Work

	1 hour or more	$\chi 2$	p
OVERALL	54%		
Group		5.229	0.3886
Fellowship Group	83%		
Computer Group	67%		
Training Group	55%		
Research Group	55%		
Evaluation Group	50%		
Business Group	25%		
Job Level		11.825	0.0027
Manager	80%		
Professional/Technical	50%		
Clerical/Secretarial	24%		
Personality		1.458	0.2273
Introvert	42%		
Extrovert	62%		

Analysis of the time spent in scheduled meetings indicated significant differences in responses by job level ($p<.05$). 47% of managers and 75% of professional/technical workers reported that they spent at least one hour a day in scheduled meetings. In contrast 100% of clerical/secretarial workers reported that they spent 1/2 hour a day or less in scheduled meetings. Analysis by work group and personality revealed no significant differences. Chi square values are located in Table 3-2.

Analysis of the time spent in unscheduled meetings again revealed significant differences in responses by job level ($p<.05$). 90% of managers reported spending at least one hour a day in unscheduled meetings. In contrast, less professional/technical workers (42%) and clerical/secretarial (41%) workers spent at least one hour a day in unscheduled meetings. Analysis by work group and personality revealed no significant differences. Chi square values are located in Table 3-3.

Percent of time spent in group places

This question also addressed respondents perceptions, this time focusing on the places where they spent their time working in groups. Responses were classified into groups of respondents who spent at least one hour in group activities and those who spent 1/2 hour or less in the activity for each question.

Analysis of the time spent in one's own workspace working with others and in another's workspace revealed no significant differences between any of the three classification variables. Chi square values for each question are located in Table 3-4 and 3-5.

Analysis of the time spent in conference rooms revealed significant differences in responses by work group and job level ($p<.05$). The work groups seem to fall out in three levels of conference room use. 90% of the Training Group reported spending at least one hour in conference rooms, while the Computer Group (67%) and the Business Group (50%) reported at lower levels, and the Fellowship Group (33%), the Evaluation Group (25%) and the Research Group (18%) reported the least amount of respondents spending at least one hour in conference rooms. 70% of managers reported spending at least one hour

Table 3-2. Amount of Time Spent in Scheduled Meetings

	1 hour or more	χ^2	p
OVERALL	34%		
Group		9.657	0.0856
Fellowship Group	33%		
Computer Group	33%		
Training Group	55%		
Research Group	9%		
Evaluation Group	63%		
Business Group	13%		
Job Level		15.383	0.0005
Manager	45%		
Professional/Technical	67%		
Clerical/Secretarial	0%		
Personality		1.186	0.2762
Introvert	50%		
Extrovert	33%		

Table 3-3. Amount of Time Spent in Unscheduled Meetings

	1 hour or more	χ^2	p
OVERALL	60%		
Group		0.773	0.9787
Fellowship Group	67%		
Computer Group	67%		
Training Group	64%		
Research Group	55%		
Evaluation Group	63%		
Business Group	50%		
Job Level		11.787	0.0028
Manager	90%		
Professional/Technical	42%		
Clerical/Secretarial	41%		
Personality		0.685	0.4079
Introvert	75%		
Extrovert	62%		

Table 3-4. Amount of Time Spent in Own Workspace Working with Others

	1 hour or more	χ^2	p
OVERALL	36%		
Group		7.6	0.1797
Fellowship Group	33%		
Computer Group	33%		
Training Group	27%		
Research Group	36%		
Evaluation Group	75%		
Business Group	13%		
Job Level		1.989	0.3699
Manager	45%		
Professional/Technical	42%		
Clerical/Secretarial	24%		
Personality		0.031	0.8608
Introvert	50%		
Extrovert	47%		

Table 3-5. Amount of Time Spent in Other's Workspace

	1 hour or more	χ^2	p
OVERALL	28%		
Group		5.733	0.3331
Fellowship Group	17%		
Computer Group	50%		
Training Group	36%		
Research Group	36%		
Evaluation Group	0%		
Business Group	25%		
Job Level		1.23	0.5407
Manager	20%		
Professional/Technical	33%		
Clerical/Secretarial	35%		
Personality		0.001	0.9763
Introvert	42%		
Extrovert	41%		

a day in conference rooms. In contrast, fewer professional/technical workers (42%) and clerical/secretarial (29%) workers spent at least one hour a day in conference rooms. Chi square values are located in Table 3-6.

Work products

This question dealt with the issue of whether the products produced by the work group were perceived as collective work products or individual work products. Overall, 88% of respondents perceived their work products to be collective.

Research Question 2: Current Workspace Effectiveness

This question included two measures of workplace effectiveness, individual environment effectiveness and group workspace effectiveness.

Individual workspace effectiveness

Overall results indicate that 81% of respondents felt that their current workspace effectively supported their individual work. Analysis by the three classification variables indicated no significant difference in response rates for current individual workspace effectiveness. Chi square values are located in Table 3-7.

Group workspace effectiveness

Results indicate that 48% of respondents felt that their current environment effectively supported their work in groups. Analysis by the three classification variables indicated no significant difference in response rates for current group workspace effectiveness. Chi square values are located in Table 3-8.

Research Question 3: Environmental Choices

There are two facets to this question, boundary issues, and environmental choices. Each of these will be discussed in the following sections.

Table 3-6. Amount of Time Spent in Conference Rooms

	1 hour or more	χ^2	p
OVERALL	49%		
Group		15.096	0.01
Fellowship Group	33%		
Computer Group	67%		
Training Group	90%		
Research Group	18%		
Evaluation Group	25%		
Business Group	50%		
Job Level		6.398	0.0408
Manager	70%		
Professional/Technical	42%		
Clerical/Secretarial	29%		
Personality		0.425	0.5142
Introvert	67%		
Extrovert	56%		

Table 3-7. Current Individual Workspace Effectiveness

	Very Effective	χ^2	p
OVERALL	81%		
Group		5.512	0.3566
Fellowship Group	100%		
Computer Group	83%		
Training Group	100%		
Research Group	100%		
Evaluation Group	100%		
Business Group	88%		
Job Level		1.546	0.4616
Manager	100%		
Professional/Technical	92%		
Clerical/Secretarial	94%		
Personality		0.469	0.4937
Introvert	83%		
Extrovert	74%		

Table 3-8. Current Group Workspace Effectiveness

	Very Effective	χ^2	p
OVERALL	48%		
Group		6.172	0.2898
Fellowship Group	33%		
Computer Group	33%		
Training Group	45%		
Research Group	64%		
Evaluation Group	75%		
Business Group	25%		
Job Level		2.488	0.2882
Manager	40%		
Professional/Technical	67%		
Clerical/Secretarial	41%		
Personality		0.281	0.596
Introvert	50%		
Extrovert	41%		

Boundary issues

Three questions were asked relating to boundary issues involving visual differentiation, physical separation, and boundary control. Results indicate no interest in having visual differentiation, physical separation or boundary control for these respondents. 63% of the respondents did not think their group performed most effectively when physically separated from other groups in the organization. 84% did not want their group to be visually differentiated from other groups in the organization. 74% of respondents felt that they did not need to have control over who entered their work group area.

Environmental choices

Total costs were computed for all environmental choices as a percent of the total cost of the environment per person. These were combined to give an overall picture of the choices made in the budget and non-budget situation. Figure 3-1 shows this overall picture. The overall choices will be discussed in terms of the comparisons between budget and non budget situations, including a breakdown of the space choices by work group.

Overall Choices. As shown in Figure 3-2, in both scenarios personal space was the largest part of the budget. In the non-budget situation personal space accounts for 50% of the total environment cost, while in the budget situation personal space accounts for 67% of the total environment cost. Figure 3-3 is an enlarged view of how the rest of the budgets were spent by respondents. As evidenced by the graph, there seem to be significant changes in the spending patterns before and after the budget situation. In the non-budget situation many choices were made that were not possible due to the budget in the second scenario. In addressing the constraints, respondents were forced to make choices to drop out some spaces while keeping others. These, presumably represent the most important needs of the group given this budget constraint. The largest percent of the budgets spent on group space included visitor chairs, a large shared conference room, work group layout, and a medium owned conference room. These were the items that respondents chose most often and were willing to spend their money on. Several spaces were chosen initially that were

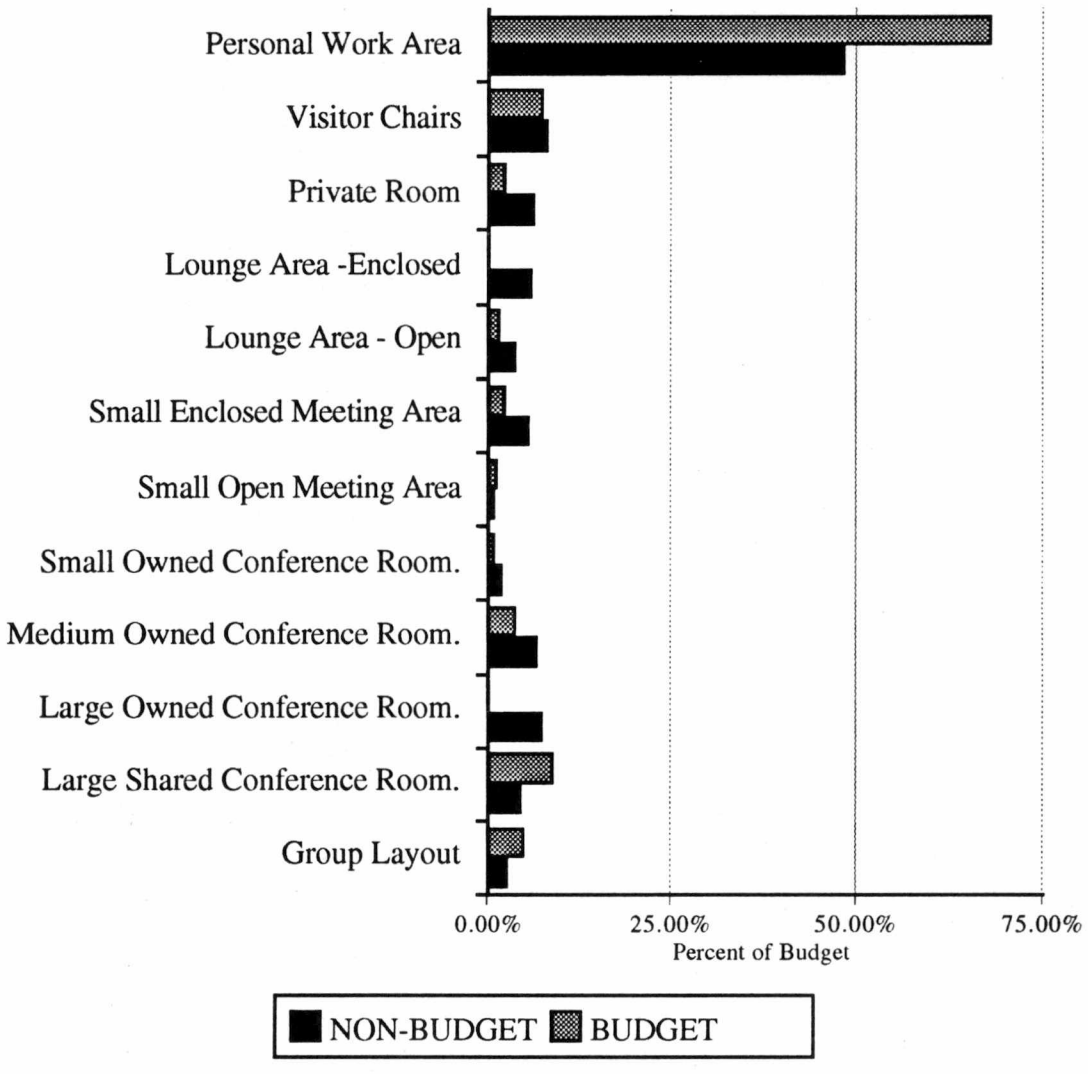


Figure 3-2. Overall Environmental Choices

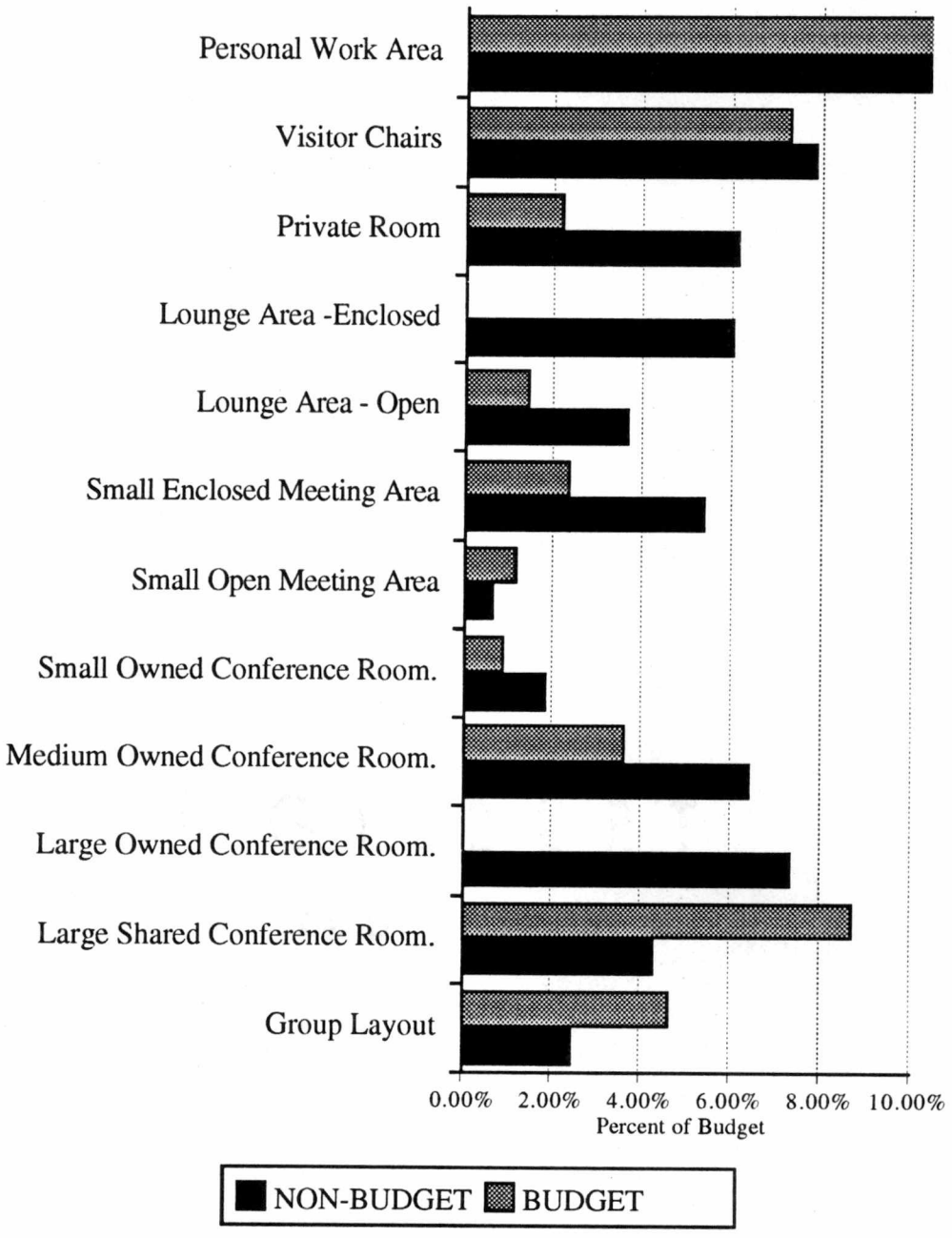


Figure 3-3. Overall Group Environmental Choices

dropped when faced with constraints i.e. enclosed lounge area, and a large owned conference room.

Choices by work group. Figure 3-4 shows the group space choices broken down by work group. Many of the groups agreed on some basic necessities of group work. Four of the five groups requested the group layout, four requested the large shared conference room, and all requested visitor chairs to some extent. Three of the groups seemed to be in agreement about what spaces they needed to be productive, while in the other three, respondents chose many different workspaces. This was in part due to the amount of budget available for spending on group space. Those who placed more importance on the individual environment, as evidenced by a larger portion of the budget, were in agreement about what spaces they needed to finish out their workspace. The other groups who spent less on the individual environment made a wider variety of choices of group space.

Research Question 4: Individual Space for Group Space

Overall, 41% of respondents were willing to give up some individual space for group space. Analysis by job level was the largest indicator of willingness to give up individual space with 80% of managers, 67% of professional/technical, and 14% of clerical/secretarial workers willing to give up individual space for group space. This could have been because the budget put a limit on what personal space a particular job level could choose. This gave managers a larger choice of personal space choices than professional/technical or clerical/secretarial workers. Analysis by work group and personality traits indicated no significant differences in response rates. Chi square values are located in Table 3-10.

Figures 3-5, 3-6, and 3-7 show the individual workspace choices made by job level. The dark bars on the graphs indicate the highest workspace level attainable by each job level. In the non budget situation, most respondents chose the enclosed offices. However, when faced with a budget which forced them to lower their individual workspace choices, many (41%) did not choose the largest office that they could, but instead chose a smaller office in order to increase their ability to acquire group space.

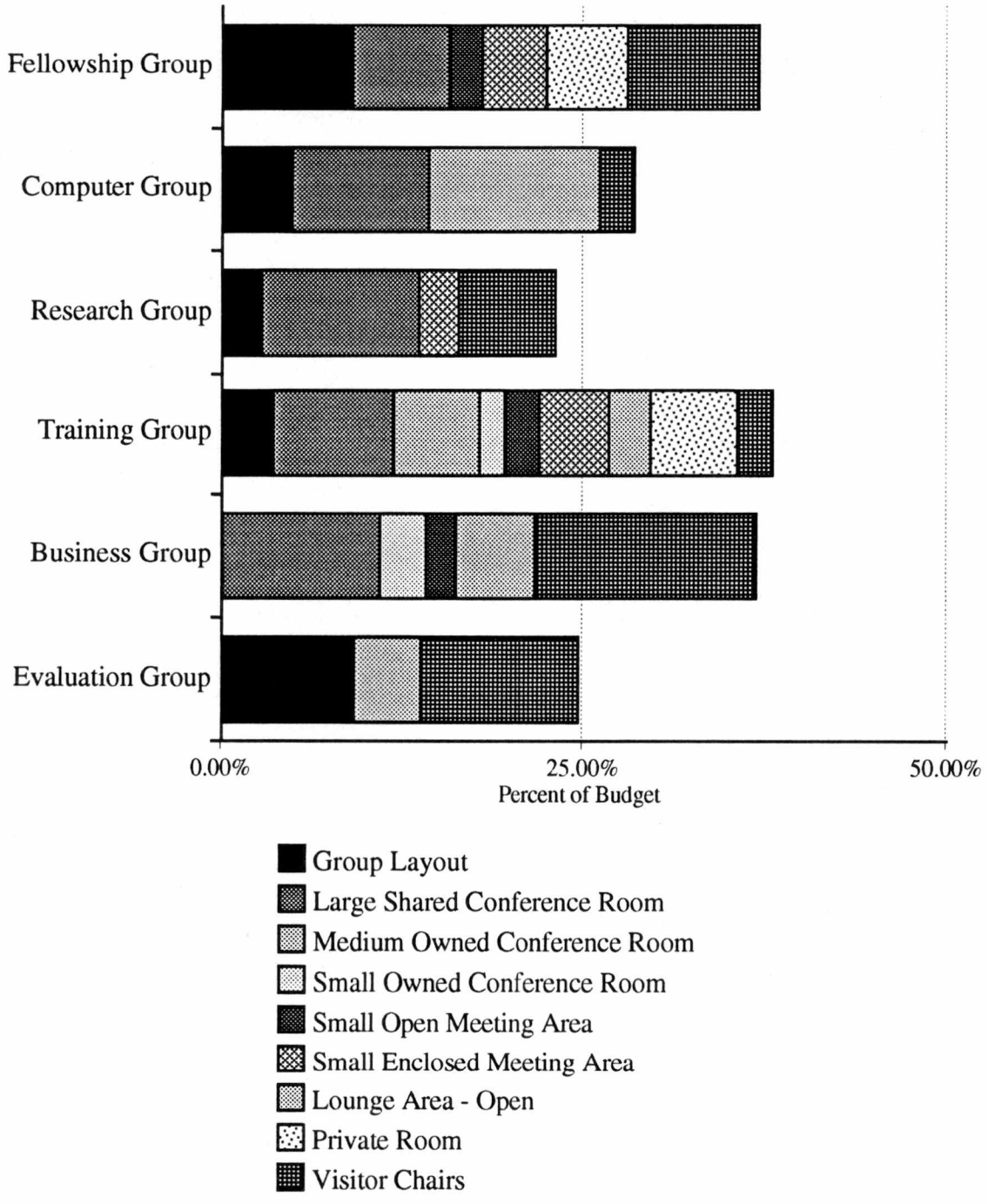


Figure 3-4. Group Space Choices by Work Group

Table 3-9. Willingness to Give Up Individual Space for Group Space

	Will Give Up	χ^2	p
OVERALL	41%		
Group		8.355	0.1377
Fellowship Group	20%		
Computer Group	0%		
Training Group	45%		
Research Group	38%		
Evaluation Group	75%		
Business Group	43%		
Job Level		7.304	0.0259
Manager	67%		
Professional/Technical	42%		
Clerical/Secretarial	19%		
Personality		0.234	0.6287
Introvert	45%		
Extrovert	36%		

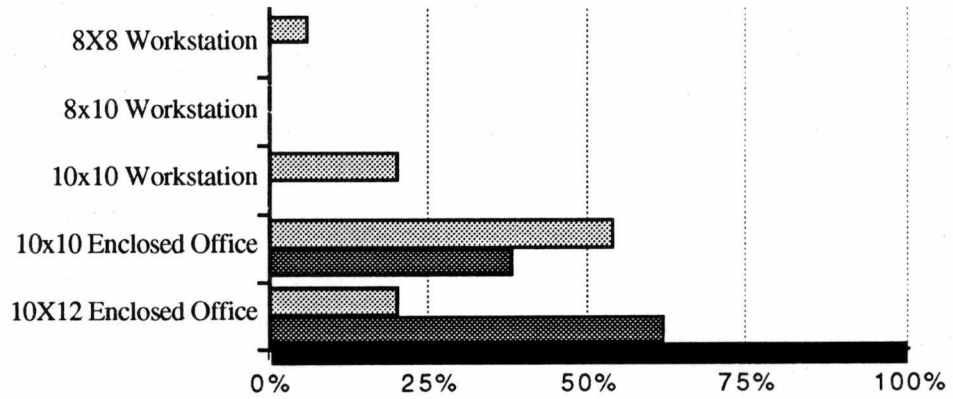


Figure 3-5. Individual Workspace Choices - Managers

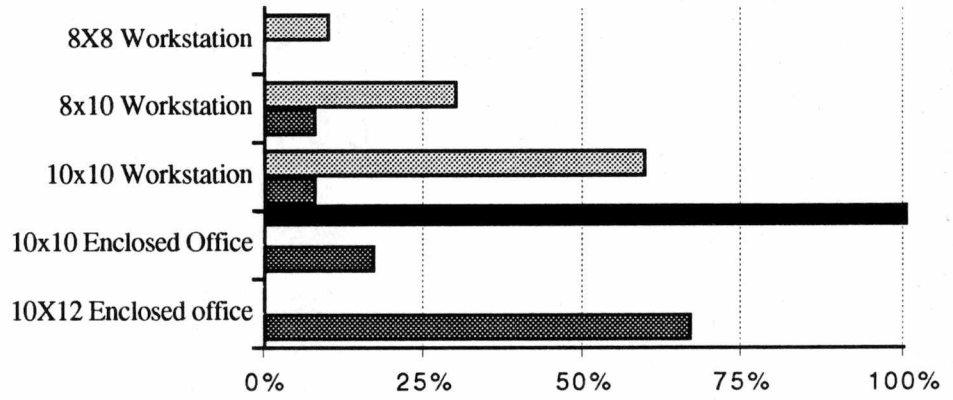


Figure 3-6. Individual Workspace Choices - Professional/Technical

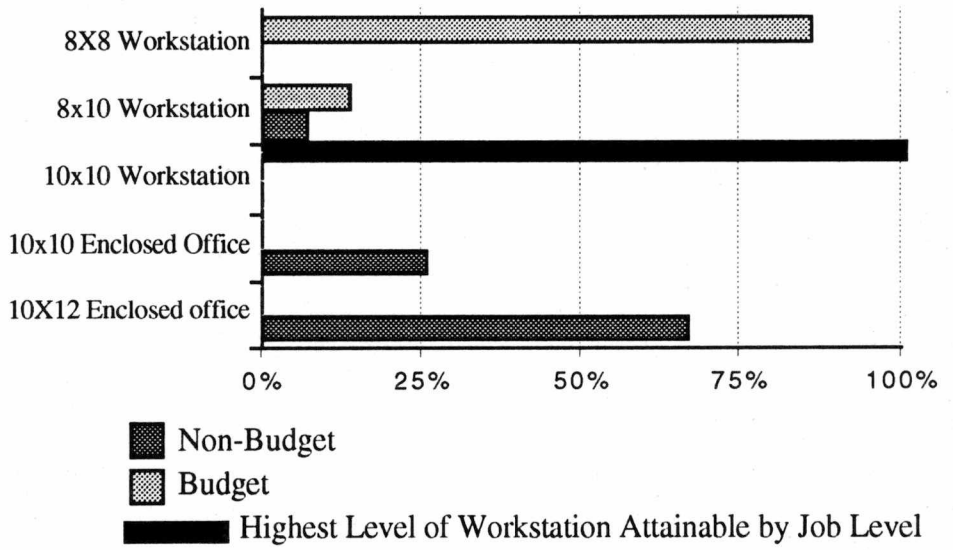


Figure 3-7. Individual Workspace Choices - Clerical/Secretarial

4

DISCUSSION AND CONCLUSION

Research Question 1

What were the group work patterns observed in this organization?

All levels of workers in this organization spent a significant part of their day in group work. 54% reported that they spent half their time or more in group work. Data analysis indicated that for time spent in group activities, job level was an strong indicator of response rates. Managers on average spent more time in group work than other levels. Clerical/secretarial workers spent the least time in group activities. Professional/technical workers often fell into the middle range and even surpassed managers in the percentage spending at least an hour a day in scheduled meetings.

While none of the three classification variables were related to time spent in offices engaged in group work (their own office or another office), both job level and work groups showed significant differences in response rates for time spent in conference rooms.

Overall, 88% of the respondents felt that they produced collective work products. This is an indicator that the work groups are not just collections of individual working under the same manager, but are indeed a group producing a collective output.

Overall, the personality trait of introversion/extroversion was not related in any of the tests to the measurement variables. This seems to indicate that although personality type can be influential in personal work style, it is not related to amount of group work done in this organization. It would seem then, that the work that individuals have to do in completion of their tasks is based on the job rather than individual personality characteristics.

Although job level was the primary indicator of group work patterns, this was to be expected based on job description and past studies. However, in comparison to data from the BOSTI study (Brill et al., 1984), it is apparent that time spent in group work, at least in this organization, shows an increase over BOSTI study figures. The comparison data are located in Table 4-1. The shaded cells in the current study portion of the table indicate an

Table 4-1: Comparisons to BOSTI Study (Brill et al., 1984)

	Manager					Professional/Technical					Clerical/Secretarial				
	Hours per day					Hours per day					Hours per day				
	1/2	1	2	3	4	1/2	1	2	3	4	1/2	1	2	3	4
BOSTI Activities															
Scheduled Meetings	24	53	20	2	1	53	38	6	4	0	71	26	3	0	0
Unscheduled Meetings	28	51	22	0	0	54	35	5	3	3	93	7	0	0	0
BOSTI Places															
Own Workspace	33	39	22	2	4	54	35	5	3	3	68	24	2	0	6
Others Workspace	30	52	16	2	0	63	29	7	1	1	75	16	6	2	2
Conference Rooms	33	46	19	2	0	59	31	7	2	1	83	15	2	0	0
Study Activities															
Scheduled Meetings	53	47	0	0	0	10	55	25	10	0	100	0	0	0	0
Unscheduled Meetings	10	55	25	10	0	55	36	9	0	0	59	23	18	0	0
Study Places															
Own Workspace	5	47	43	5	0	36	45	18	0	0	44	6	18	6	25
Others Workspace	50	33	0	17	0	55	36	0	0	9	75	25	0	0	0
Conference Rooms	26	47	21	5	0	50	30	20	0	0	69	12	19	0	0

Note: The shaded cells indicate an increase in percent of participants who respond with a given answer between the BOSTI study and the current study.

increase of at least 10% from the BOSTI figures. As evidenced in the table, managers and clerical/secretarial workers spent more time in unscheduled meetings, while professional/technical workers spent more time in scheduled meetings. All levels indicated an increase in time spent in their own space working with others. Professional/technical workers and clerical/secretarial workers also indicated an increase in the time spent in conference rooms. Although no statistical comparisons could be made because of the small number of respondents involved in this study, the trend toward increased group work is apparent.

Research Question 2

How do respondents feel their current environment supports their work in groups?

While 81% of respondents felt that their current individual environments supported their individual work, only 48% felt that their current group environments supported their work in groups. There were no differences between any of the classification variables, which seems to indicate that regardless of job level, work group, or personality, respondents were more satisfied with their individual environments than their group environments. This implies that environmental support of group work is lacking and needs to change in order to meet the needs of changing organizations.

Research Question 3

What physical environmental choices to respondents make in support of group work?

The respondents in this study chose several types of group spaces in support of their work in groups. In the non budget scenario, all group spaces were evenly chosen and constituted about half of their total environment budget. By forcing choices and trade-offs in the budget scenario, responses showed the most important spaces for group work. Overall the most agreed upon choices were a large shared conference room, work group layout, visitor chairs, and a medium-size owned conference room. These choices are very conservative, given the wide range of choices available in the study. The participants in the

study however, have not been exposed to many of the types of spaces. It is not therefore that the participants rejected the other spaces, but just didn't know enough about them to choose them given a budget constraint.

When choices were divided up by work group some trends emerged. Three of the groups, those that spent the smallest percentages of their budgets on group space, were in agreement about what sort of group spaces they needed to do their work effectively. Other groups, those that spent a large portion of their budgets on group spaces were less in agreement about what types of spaces they needed. This raises further questions about what the "real" needs of these groups are. In order to provide an effective design, more discussion and clarification of needs would be necessary.

One of the most important results of this exercise was the observed necessity of introducing a budget (or other constraint) to get individuals to make judgments based on actual limitations. Many choices that were originally made in the non-budget scenario were discarded when faced with a budget constraint. These may have been amenities that would be nice to have in an ideal world, but are not necessary for these respondents to accomplish work in groups. The information gained through this part of the exercise pointed to the importance of providing constraints when soliciting information from users. If no constraints are provided, users are liable to give the responses shown in the non-budget scenario. When faced with the actual design situation, designers must make choices about what spaces are *really* necessary to support work. In the non-budget scenario, there is little information to use in making decisions about what spaces to eliminate. In looking at the budget situation, many choices stand out as important for the groups, offering the facility manager more information to use in making the design decisions. The value placed on this part of the research indicates a desire (or necessity) to allow employees to decide what environmental choices more important to them rather than having designers and managers (people potentially unfamiliar with the specific group-work processes) make those decisions for them.

Research Question 4

Are participants willing to give up individual space for group space?

Results indicated that a surprising number of respondents (41%) were willing to trade some individual space for group space. This phenomenon was observed at all levels, but most markedly at the managerial level. This overall willingness seems to indicate that respondents realized the importance of group space to their everyday work needs are were willing to make individual concessions to acquire that group space.

Conclusions

Overall results of the study indicate that respondents from this organization do a significant amount of their work in groups. They felt that their current individual workspaces were more supportive of their individual work than their group spaces were of group work. When faced with a budget constraint, respondents still chose group spaces in which to conduct their work. A relatively large number of respondents were willing to trade individual space for group space.

These findings (an acknowledgement of more group work being done and a need for more group space to support that work) are likely typical of many of today's organizations which were originally designed for individual work. With the increase in group-based organizational structures, the importance of group environments will continue to increase. The results indicate the importance of reorganizing the workplace in order to encourage and promote effective group work. The fact that many respondents were willing to trade individual space for group space should not be a prescription for the new design of workspace. It merely indicates the importance respondents placed on their group spaces.

As compared to the data from the BOSTI study (Brill et al., 1984), results of the current study indicate support for the trend of the increasing amount of group work conducted in organizations. Although the BOSTI study was very informative for the time period, changes have occurred in the work process, indicating the need for large scale investigations on the effects these changes are having on office design and worker satisfaction. The BOSTI study demonstrated clearly that the physical environment in organizations had an effect on the satisfaction and productivity of the office worker. Now

it is time for the same type of study to be conducted keeping in mind the changing organizational structures.

Providing spaces for group work that better meet the needs of the group and the individual member—while adhering to a limited space and monetary budget—is a challenge that will be facing designers and facility managers in the very near future. It will be necessary to consider how to provide more group space in both a reconfiguration of the office environment and in new spaces. Designers need to investigate how to better allow group work to occur within the spaces provided in the organization. The challenge will be to be creative in our spatial solutions, not just react to the latest management fad.

Whatever the current physical layout of organizations, the future seems certain to include an increase in amounts and types of group spaces which will not only be mandated by top management, but also requested by each and every employee in the organization in response to changing organizational structures.

Limitations of the study

The were several limitations in the study. They included the effects of small samples sizes, the use of survey techniques, and the hazards of voluntary participation.

Small sample sizes. The sample for this study included only 6 work groups from one organization in east Tennessee. The results from this study may only accurate for this one organization or region of the country.

Survey techniques. The use of self-administered survey techniques is always suspect, since although each one should have been completed independently, there may have been collaboration between subjects skewing the data.

Voluntary participation. Subjects were chosen by their group leader volunteering his/her group to participate in the study. Perhaps those groups who did not participate felt differently about group space.

Future research

Some items for further research uncovered in the study include cross organizational

studies, group space investigations, and constraints in user participation.

Cross-organizational studies. Studies should be conducted cross organizationally to determine if the trends observed in this research are substantiated across organizations and across work group types.

Group space investigation. Investigate what effects group spaces have on individual and group work products and work process satisfaction. Do group spaces foster more cohesion between members, and provide enough personal privacy to satisfy office workers?

Constraints in user participation. As noted in the research, providing constraints to users provided more useful information for designers to use in their decisions about environmental supports. An investigation of types and uses of constraints should be conducted to determine what type yields that best data for environmental decision making.

BIBLIOGRAPHY

BIBLIOGRAPHY

Baloga, M. and Cornell, P. (1992). The basics for new environment architectures. Unpublished Steelcase working document.

Becker, F.D. (1973) A study of spatial markers. *Journal of Personality and Social Psychology, 26*, 439-445.

Brill, M., Margulis, S.T., Konar, E. and BOSTI. (1984). *Using office design to increase productivity* (Vols. 1-2). Buffalo, NY: Workplace Design and Productivity, Inc.

Cochran, W.G. (1954). Some methods of strengthing the common $\chi 2$ Test. *Biometrics, 10*, 417-451.

Cornell, P. and Brenner, P. (1993). Improving worker output. *Proceedings of the International Facility Management Association, 14*, 245-255.

Cutler, L. (1993). Changing the paradigm: Is it work place or work environment of the future? *Proceedings of the International Facility Management Association, 14*, 301-315.

Drucker, P. (1988). The coming of the new organization. *Harvard Business review, 88*(1),45-52.

Duffy, F., Laing, A., and Crisp, V. (1993). *The responsible workplace: The redesign of work and offices.* Boston: Butterworth Architecture.

Ferguson, G.S. and Weisman, G.D. (1986). Alternative approaches to the assessment of employee satisfaction with the office environment. In J. Wineman (Ed.) *Behavioral issues in office design.* New York: Van Nostrand Reinhold Company.

Future work. (1991). *The Futurist 25*(3), 9-19.

Hall, E.T. (1959). *The silent language.* Garden City, NY: Doubleday.

Hellriegel, D. and Slocum, J.W. (1980). Preferred organizational design and problem solving styles: Interesting companions. *Human Systems Management , 1* , 151-158.

Herman Miller, Inc. (1990). Facilities for project teams. Zeeland, MI.

Herxberg, F. (1976). One more time: How do you motivate employees? In W.R. Nord (ed.) *Concepts and controversy in organizational behavior.* Santa Monica, CA: Goodyear Publishing Company.

Szilagyi, A.D. and Holland, W.E. (1980). Changes in social density: Relationships with functional interactions and perceptions of job characteristics, role stress, and work satisfaction. *Journal of Applied Psychology, 65*, 28-53.

Jaffe, J. (1985). Of different minds. *Association Management, October*, 120-124.

Katzenbach, J.R. and Smith, D.K. (1993) The discipline of teams. *Harvad Business Review 71*(2), 111-119.

Kerlinger, F.N. (1986) *Foundations of behavioral research* (3rd ed.). Forth Worth, TX: Rinehart and Winston, Inc.

Kiersey, D. and Bates, M. (1984) *Please understand me*. Del Mar, CA: Prometheus Book Company.

Kleiner, B.H. (1983). The interrlationship of Jungian modes of mental functioning with organizational factors. *Human Relations, 36*(11), 997-1012.

Lyman, S.M. and Scott, M.B. (1967). Territoriality: A neglected social dimension. *Social Forces, 15*, 236-249.

McCue, K. and Zutz, J.C. (1992). Team-based organizations and group space. *Proceedings of the International Facilities Management Association, 13*, 397-406.

Moleski, W.H. and Lnag, J.T. (1982). Organizational goals and human needs in office planning.*Environment and Behavior, 14*(3), 319-332.

Oldham, G.R. and Brass,D.J. (1979). Employee reactions to an open plan office: A naturally occurring quasi experiment. *Administrative Science Quarterly, 24*(2), 267-285.

Richards, C.B. and Dobbins, H.F. (1957). Topography and culture: The case of the changing cage. *Human Organization, 16,* 16-20

Shaw, M.E. (1981). Communication Networks. In L.L. Berkowitz (ed.) *Group processes*. New York: Academic Press.

Somer, R. (1969). *Personal space: The behavioral basis of design*.. Englewood Cliffs, NJ: Prentice Hall.

Sundstrom, E. and Altman, I. (1989). Physical environments and work-group effectiveness. In L.L. Cummings and B. Staw (Eds.). *Research in organizational behavior* (Vol 11). Greenwich, CT: JAI Press.

Sundstrom, E., DeMeuse,K. and Futrell, D. (1990). Work teams: Applications and effectiveness. *American Psychologist, 45*(2), 120-133.

Sundstrom, E. (1986). *Workplaces*. New York: Cambridge University Press.

Sundstrom, E., Burt, R., and Kamp, D. (1980) Privacy at work: Architectural correlates of job satisfaction and job performance. *Academy of management Journal 23*(1), 101-117.

Taylor, F.W. (1911). *The principles of scientiific management.* New York: Harper.

Touliatos, J. and Compton, N.H. (1988). *Research methods in human ecology/home evonomics.* Ames, IA: Iowa State University Press

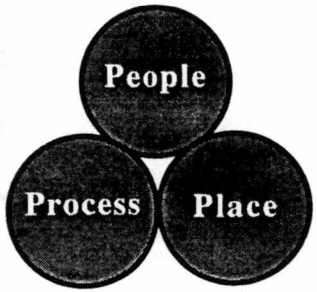
Whitaker, M.J. (1992). Future work and workplaces: Less monolithic and more pluralistic. *Proceedings of the International Facilities management Association, 13,* 1-28.

Whyte, W.F. (1943). *Street Corner Society.* Chicago: Chicago University.

Yin, R. (1993). *Applications of case study research.* Newbury park, CA: Sage Publications.

Appendix

Part 1:
Facility Survey



Please read and sign the consent form before beginning the survey. Thanks!!

PERSONAL PREFERENCES *

Please check the response that most relates to what you would do in a particular work situation.

8. At a party do you
❑ interact with many, including strangers ❑ interact with a few known to you

9. At parties do you
❑ stay late, with increasing energy ❑ leave early, with decreased energy

10. In your social groups, do you
❑ keep abreast of other's happenings ❑ get behind in the news

11. In phoning do you
❑ rarely question that it will all be said ❑ rehearse what you'll say

12. In company do you
❑ initiate conversation ❑ wait to be approached

13. Does new and non-routine interaction with others
❑ stimulate and energize you ❑ tax your reserves

14. Do you prefer
❑ many friends with brief contact ❑ a few friends with more lengthy contact

15. Do you
❑ speak easily and at length with strangers
❑ find little to say to strangers

16. When the phone rings do you
❑ hasten to get to it first ❑ hope someone else will answer

17. Are you a person that is more
❑ easy to approach ❑ somewhat reserved

* These questions are taken from the "Kiersey Temperament Sorter" in the book Please Understand Me by David Kiersey and Marilyn Bates (1984), Prometheus Nemesis Book Co., Del Mar, CA.

PERSONAL DATA

Instructions: Please respond to all parts of each question. If one part does not apply, please note it and go on to the next one. If there are any questions that you don't feel comfortable answering, please skip them and note the reason.

Please check the response that applies to you.

1. SEX: ❑ M ❑ F

2. AGE:
❑ 18-24 YEARS
❑ 25-35 YEARS
❑ 36-45 YEARS
❑ 46-55 YEARS
❑ Over 55 YEARS

3. Years with ORAU:
❑ 0-2 ❑ 12-15
❑ 3-5 ❑ 16-18
❑ 6-8 ❑ 19-20
❑ 9-11 ❑ 20+ years

4. Years with current work group:
❑ 0-2 ❑ 12-15
❑ 3-5 ❑ 16-18
❑ 6-8 ❑ 19-20
❑ 9-11 ❑ More than 20 years

5. Which of these best describes your job level?
❑ Manager ❑ Professional / Technical ❑ Clerical / Secretarial

6. How satisfied are you with your job?
❑ Very satisfied
❑ Somewhat satisfied
❑ Not too satisfied
❑ Not at all Satisfied

7. Do you believe that the office layout and physical furnishings affects job performance?
❑ Yes, strongly affects performance
❑ Yes, mildly affects performance
❑ No, does not affect performance
❑ Don't know

PATTERNS OF WORK

ACTIVITIES

For each of the following activities, estimate how much time you spend doing each on a typical work day. Place a check in one of the boxes to indicate your response.

	About 1/2 hr. or less	About 1 hour	About 2 hours	About 3 hours	4 Hours or more
18. Sitting back and thinking	☐	☐	☐	☐	☐
19. Unscheduled meetings	☐	☐	☐	☐	☐
20. Scheduled meetings	☐	☐	☐	☐	☐
21. Telephone calls	☐	☐	☐	☐	☐
22. Reading, writing, dictating	☐	☐	☐	☐	☐
23. Drafting or drawing	☐	☐	☐	☐	☐
24. Using a computer	☐	☐	☐	☐	☐
25. Copying or distributing documents (xeroxing, mailing)	☐	☐	☐	☐	☐
26. Getting or filing papers	☐	☐	☐	☐	☐
27. Typing	☐	☐	☐	☐	☐
28. Personal activities (lunch, coffee, etc.)	☐	☐	☐	☐	☐
29. Other:(Please Describe_____ _____)	☐	☐	☐	☐	☐

30. How much of your time during an average day do you spend working in groups?

WORKING ALONE: Reading, writing, computer use, telephone, e-mail
WORKING IN GROUPS: Consulting with others face to face on specific projects, formal or informal task meetings, exchanging materials or information,whether it be in your office, or another office, in a dedicated meeting room, or somewhere in between.

- ☐ Almost all of my time is spent in groups
- ☐ Most of my time is spent in groups
- ☐ About half my time is spent in groups
- ☐ Most of my time is spent working alone
- ☐ Almost all my time is spent working alone

31. How many of each type of project do you participate in at any given time?

	0	1-2	3-4	5-7	more than 8
Short term (one week to three months in duration)	☐	☐	☐	☐	☐
Medium Term three months to one year in duration)	☐	☐	☐	☐	☐
Long term (More than a year in duration)	☐	☐	☐	☐	☐

PLACES

The following is a list of places. Please estimate how much time you spend working in each one on a typical work day. Place a check in the box at right to indicate your response.

	About 1/2 hr. or less	About 1 hour	About 2 hours	About 3 hours	4 Hours or more
32. My work space working alone	☐	☐	☐	☐	☐
33. My work space working with someone else	☐	☐	☐	☐	☐
34. Someone else's work space	☐	☐	☐	☐	☐
35. Special task areas (copy room, library)	☐	☐	☐	☐	☐
36. Aisles, lounges, lunchrooms	☐	☐	☐	☐	☐
37. Conference, meeting rooms (within my building)	☐	☐	☐	☐	☐
38. Out of my building	☐	☐	☐	☐	☐
39. Other:(Please Describe_____ _____)	☐	☐	☐	☐	☐

WORK-SPACE EFFECTIVENESS

The following is a list of statements about the current state of your workplace. Please place a check in the box at right to indicate your response.

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly
40. It is very difficult to have a confidential conversation in my workspace	❑	❑	❑	❑
41. I am often distracted by seeing other people when I am trying to work	❑	❑	❑	❑
42. I am often interrupted at my workspace by people stopping to chat as they go by	❑	❑	❑	❑
43. When I meet with someone at my workspace, we can easily work side-by-side on the same papers	❑	❑	❑	❑
44. There is always a convenient space to have a spur of the moment meeting with a few other people	❑	❑	❑	❑
45. When I need information from my co-workers in order to do my work, I usually have to go out of my way to get it	❑	❑	❑	❑
46. When I need information from my supervisor in order to do my work, I usually have to go out of my way to get it	❑	❑	❑	❑
47. My current work space is very effective in supporting the work I do alone	❑	❑	❑	❑
48. My current work space (including current group areas) is very effective in supporting the work I do in groups	❑	❑	❑	❑
49. If the office layout were improved, it would be easier to get work done	❑	❑	❑	❑

50. How often do you close the door to your workspace (if your work space does not have a door skip to #52)

- ❑ Never
- ❑ Once in a while
- ❑ Sometimes
- ❑ Frequently
- ❑ Constantly

51. For what reason do you close your door? Rank the choices with 1 being least often to 4 being most often .

- ____ So that your own conversation can not be overheard
- ____ So that you will not be bothered by other people and their noise
- ____ As a signal that you need to work without interruption
- ____ To avoid being observed
- ____ For another reason, please describe_____
- ____ I do not close my door.

52. In addition to being part of an official division I consider my self to be part of a smaller, distinct group that works together.

- ❑ No (Skip to #60)
- ❑ Yes (go on to #53)

53. In my work group almost all of us work near one another

❑ No ❑ Yes

54. My work group functions best when physically separated from other people

❑ No ❑ Yes

55. I prefer the workspaces of my group to look somehow different from the workspaces of other groups.

❑ No ❑ Yes

56. I prefer my work group to have some way of controlling who comes into our group's area

❑ No ❑ Yes

57. How are rewards assessed in your program?

- ❑ as a group
- ❑ individually
- ❑ don't know

58. How would you describe your program's purpose?

- ❑ same as organizational mission
- ❑ specific program purpose that MY program is responsible for

59. How would you describe your products/services?

- ❑ Individual work products
- ❑ Collective work products

60. Please describe the purpose of your program and the specific tasks you perform.

Purpose: _____

_____

_____

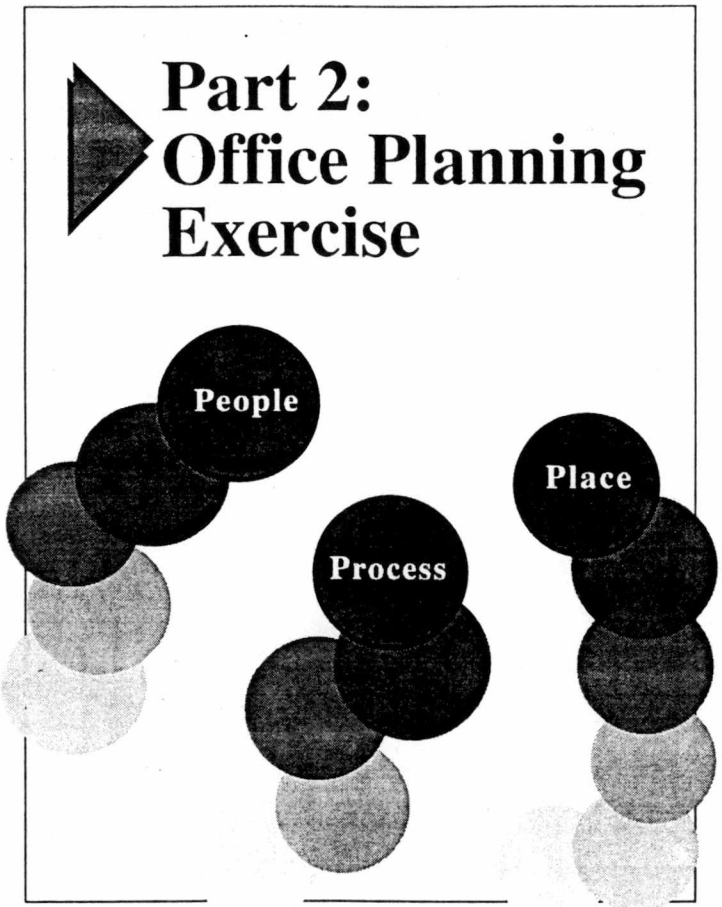
Specific tasks you perform to help fulfill the purpose

_____

_____

_____

END OF PART 1
PLEASE GO ON TO THE EXERCISE, PART 2



Part 2: Office Planning Exercise

INSTRUCTIONS

Imagine that your company is purchasing a new building and management would like you to participate in the design of your workspace in order to provide effective environments for you and your program. They want you to consider your individual needs as well as the need for group space based on the activities and tasks associated with your work. In the first scenario, you will be asked to choose all of the things that you feel your group would need to function effectively and arrive at a total price for the environment. In the second scenario, in order to meet a budget need, management has given each employee an allotment of "currency" with which to purchase certain options necessary for effective work. The allotment is based on your current job level.

There are a few rules that must be followed in the planning of your environment:

1. You may choose only one individual work space

2. You may choose as many different types of group spaces as you feel would be useful to your program. You may even purchase more than one of the same kind of space, i.e. 2 small group work areas.

3. If a budget figure is provided, you may not spend more than the allotted budget.

4. You may spend less if you are satisfied that this environment will meet your needs. Management may even reward you for being frugal!

SCENARIO 1: NEW BUILDING - PRE-PLANNING STAGE

Management has determined that your company needs a new building, but has not decided on a budget for interior space planning and design. They would like you to choose all of the environmental features that you believe you need to work effectively. Please refer to the specified colored cards to help make your decisions. Place a check in the box (❑) to the left of the items you request and place the total for each goup in the blank provided. If there is a "n/a" in the #Requested column, you may only have one of these items. For the others, if you want more than one, you must multiply the number that you want by the price. For example if you feel your group needs 2 conference rooms to seat 6-10 people, the cost would be 2*$5=$10 When you have made all your choices, place a total in the appropriate blank as computed from all your environmental choices

	# requested	Cost	Total Cost
1. LAYOUT (please check 1) **(Pink Card)**			
❑ Standard Layout	n/a	$0	
❑ Work Group Layout	n/a	$2	_____
2. SHARED SPACES (check as many as you would like) **(Yellow Card)**			
A. Conference Rooms			
❑ 11-20 people, shared by floor (Limit 2)	____	$2	
❑ 11-20 people, exclusively for use by program	____	$15	
❑ 6-10 people, exclusively for use by program	____	$5	
❑ 5 or fewer people, exclusively for use by program	____	$3	_____
B. Small Meeting Spaces			
❑ Table with 4 chairs open to adjoining areas	____	$2	
❑ Table with 4 chairs enclosed with 66" panels	____	$4	_____
C. Lounge Areas			
❑ Couch two chairs and end tables open to adjoining areas	____	$5	
❑ Couch two chairs and end tables enclosed with 66"panels	____	$7	_____
D. Private Room			
❑ Private Room with phone and work area	____	$5	_____
3. INDIVIDUAL WORK AREAS (Check only one) **(Blue Card)**			
A. Personal Work Area			
❑ 8'x8' Workstation with 66"panels on 4 sides	n/a	$3	
❑ 8'x10' Workstation with 66"panels on 4 sides	n/a	$6	
❑ 10'x10' Workstation with 66"panels on 4 sides	n/a	$13	
❑ 10'x10' Enclosed Office	n/a	$17	
❑ 10'x12' Enclosed Office	n/a	$20	_____
B. Visitor Chairs			
❑ No visitor chairs	n/a	$0	
❑ Visitor Chairs	____	$2	_____
		TOTAL	_____

Please total the cost of the environmental features you requested. ____▲

QUESTIONS ABOUT SCENARIO 1:

Please respond to the following questions about the environmental choices you made.

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly
1. I feel that this individual work space would provide a boundary for my personal area	❑	❑	❑	❑
2. I feel that this individual work space would be private enough for my work	❑	❑	❑	❑
3. I feel that there is enough seating in the individual work space for the amount of visitors I receive	❑	❑	❑	❑
4. I feel that this individual work space would be comfortable to work in	❑	❑	❑	❑
5. I feel that the office design provided by these choices would support my work in group	❑	❑	❑	❑
6. I feel that this office design provides ample meeting space for the procedures of the program	❑	❑	❑	❑
7. All things considered I feel that this would be an effective workplace for my program	❑	❑	❑	❑

8. Please list and describe the reason you chose 2 of the group spaces from the previous page:

Group Space 1:_____

_____

_____

_____

_____

Group Space 2:_____

_____

_____

_____

_____

SCENARIO 2: NEW BUILDING - BUDGET PLANS

After determining that they had only a certain amount to spend on the building due to budget cuts, management has decided on a budget for the interior layout and design. They would like you to choose the environmental features that you need to work effectively based on the following budget. Please refer to the specified colored cards to help make your decisions.

Job Level	Budget Dollars to Spend
Management	$23
Professional/Technical	$15
Clerical	$10

	# requested	Cost	Total Cost
1. LAYOUT (please check 1) **(Pink Card)**			
❑ Standard Layout	n/a	$0	
❑ Work Group Layout	n/a	$2	_____
2. SHARED SPACES (check as many as you would like) **(Yellow Card)**			
A. Conference Rooms			
❑ 11-20 people, shared by floor (limit 2)	____	$2	
❑ 11-20 people, exclusively for use by program	____	$15	
❑ 6-10 people, exclusively for use by program	____	$5	
❑ 5 or fewer people, exclusively for use by program	____	$3	_____
B. Small Meeting Spaces			
❑ Table with 4 chairs open to adjoining areas	____	$2	
❑ Table with 4 chairs enclosed with 66" panels	____	$4	_____
C. Lounge Areas			
❑ Couch two chairs and end tables open to adjoining areas	____	$5	
❑ Couch two chairs and end tables enclosed with 66"panels	____	$7	_____
D. Private Room			
❑ Private Room with phone and work area	____	$5	_____
3. INDIVIDUAL WORK AREAS (Check only one) **(Blue Card)**			
A. Personal Work Area			
❑ 8'x8' Workstation with 66"panels on 4 sides	n/a	$3	
❑ 8'x10' Workstation with 66"panels on 4 sides	n/a	$6	
❑ 10'x10' Workstation with 66"panels on 4 sides	n/a	$13	
❑ 10'x10' Enclosed Office	n/a	$17	
❑ 10'x12' Enclosed Office	n/a	$20	_____
B. Visitor Chairs			
❑ No visitor chairs	n/a	$0	
❑ Visitor Chairs	____	$2	_____
		TOTAL	_____

Please total the cost of the environmental features you requested. ____

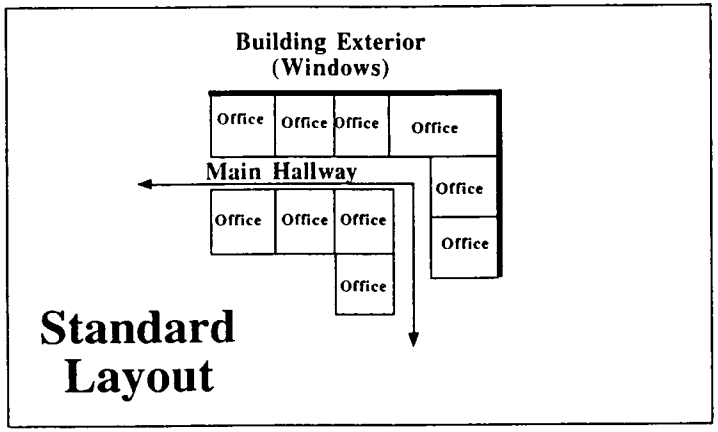
QUESTIONS ABOUT SCENARIO 2:

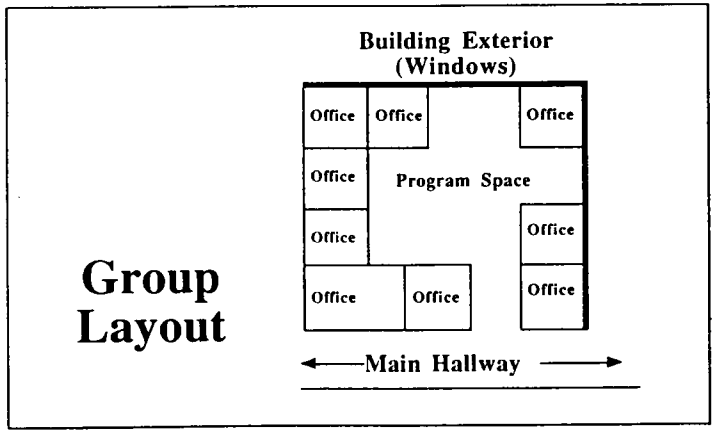
Please respond to the following questions about the environmental choices you made.

	Disagree Strongly	Disagree Somewhat	Agree Somewhat	Agree Strongly
1. I feel that this individual work space would provide a boundary for my personal area	❑	❑	❑	❑
2. I feel that this individual work space would be private enough for my work	❑	❑	❑	❑
3. I feel that there is enough seating in the individual work space for the amount of visitors I receive	❑	❑	❑	❑
4. I feel that this individual work space would be comfortable to work in	❑	❑	❑	❑
5. I feel that the office design provided by these choices would support my work in group	❑	❑	❑	❑
6. I feel that this office design provides ample meeting space for the procedures of the program	❑	❑	❑	❑
7. All things considered I feel that this would be an effective workplace for my program	❑	❑	❑	❑

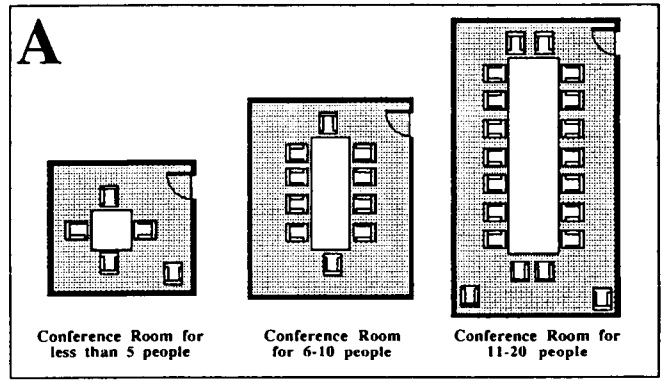
Please go on to the next page

1. LAYOUT

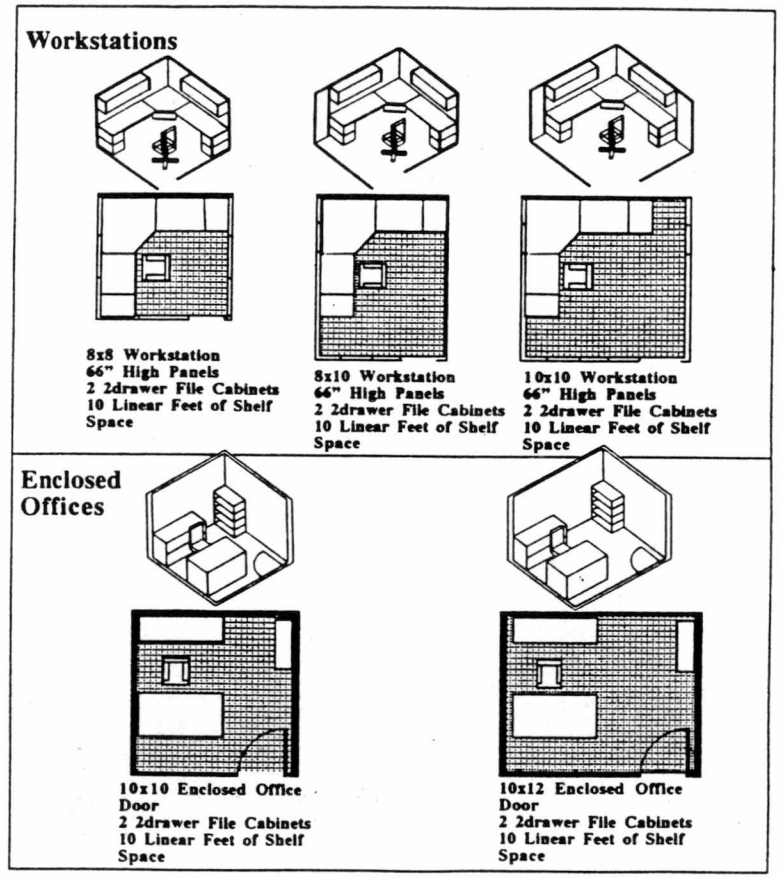




2. Shared Spaces



3. INDIVIDUAL WORKSPACES



VITA

Amy E. Crumpton was born in Corpus Christie, Texas on September 11, 1969. She attended elementary through high school in North Little Rock, Arkansas. In August, 1987 she entered Arkansas College, where she continued for 2 years. She married Joe Crumpton in June of 1989 and enrolled at Mississippi State University in August of that same year. She received her Bachelor of Science in Home Economics, Interior Design Option in May of 1992.

Amy enrolled at the University of Tennessee in August of 1992 to pursue a Master of Science in Interior Design and in December, 1994 she received her M.S. Degree. While in the program she worked part time in the Office of Facilities Management at Oak Ridge Associated Universities (ORAU), received the U.T. Chancellors Citation for Professional Promise, and received a scholarship from the International Facilities Management Association and Gensler and Associates.

She is currently employed as a research associate in the Office of Facilities Management at ORAU.