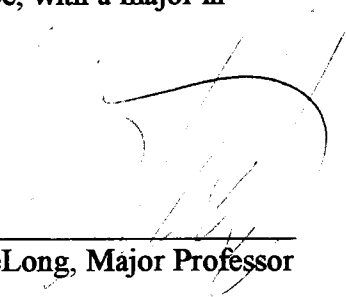


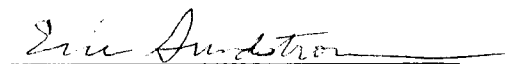
To the Graduate Council:

I am submitting herewith a thesis written by Christian Kasper entitled "A Design Process and Design Features to Accommodate Emerging Work Styles." I have examined the final copy of this thesis for form 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.



Dr. A. J. DeLong, Major Professor

We have read this thesis and
recommend its acceptance:





Accepted for the Council:



Associate Vice Chancellor and
Dean of the Graduate School

**A Design Process and Design Features to Accommodate
Emerging Work Styles**

**A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville**

**Christian Kasper
December 1997**

Dedication

To my love Roberta and our Boston Victor Hugo

Acknowledgments

My life is decentralized, and I owe thanks to many people all over the world and all over my life for helping me reach for this moment. You all know who you are. I could start at one end, with my family and friends to whom I owe my greatest debt, particularly my parents and my grandfather. My parents gave me always great freedom, but they also expected me to be responsible for the consequences. They were very generous and gave me invaluable educational opportunities and instilled in me the desire and confidence to succeed. And, I must also thank Roberto and Ana for their support and understanding.

Or I could start at the other end with the faculty and graduate students in the Department of Interior Design and College of Architecture and Planning, the Department of Psychology, and the Department of Industrial Engineering for all they have taught me. I am particularly grateful to my thesis committee for their support and encouragement. They include: mentor and chair Professor Dr. A. J. DeLong, Professor Dr. E. Sundstrom, and Professor Dr. J. Rabun. They have read a number of revisions of this thesis and the merit and format of this work is in no small part due to their advises and suggestions.

In the middle there is a stream of other people whose input I wish to recognize. They include: Mrs. Shannon Bays who was always very critical yet objective. She helped me turn the manuscript into this thesis with her competent technical editing and writing suggestions; Mrs. Barbara Copeland and Mr. Tom Simpson from TVA's Facilities Services, and Mrs. Linda Delish, Mrs. Esther R. Fitzgerald and Mrs. Kathy Lam from IBM's Human Resources and Facilities Management for their invaluable insights and suggestions; the College of Human Ecology, the College of Architecture and Planning, and the Graduate School of the University of Tennessee for continuously awarding me a half-time assistantship position; and Professor Dr. V. Kupritz for her input earlier in the process.

In Sarasota at the Ringling School of Art and Design, I owe much to Professor and Head of the Department of Interior Design, Norman Hervieux and Professor Phil Hamilton. Both have inspired and encouraged me to indept study the field of environment behavior and have continuously shown interest in this study and allowed for many invaluable conversations.

Abstract

In this study a conceptual framework and the rationale for a new design process and facilities design features to accommodate emerging patterns of work are developed. A comprehensive literature review of current and interdisciplinary literature pertaining to new styles of working and new organizational forms is used to establish the framework and facilitate the discussion. It is reasoned that within the framework of current trends and developments, it is no longer sufficient to design facilities in traditional ways. This leads to the introduction of scale modeling as an effective design process method. Scale modeling engages the end user in decision making and creates a fundamental base for social relations, which are vital in today's organizational climate. Modeling is cost-effective and allows for reduced design time in a fast changing business environment. The study further reveals several facilities design features that must underlay this design process. Emerging patterns of work need adaptable and flexible multi-use environments. The physical environment needs to be conducive to facilitate learning and the creation of new knowledge. This can be accomplished with the design of an interactive environment and the opportunities for impromptu conversations and meetings. The study leads to the conclusion that the design process and the physical environment is a powerful management tool if designed, implemented, and managed correctly.

Table of Contents

Chapter	Page
I. Introduction	1
Purpose	1
Justification	2
Objectives	4
II. Relevant Literature and Discussion	6
The Organization in Context	6
Economical Framework	7
Changing Corporate Environment	10
The Workplace as Management Tool	15
The Workplace	15
Information Technology	20
Behavioral Issues in the Workforce	21
Corporate Culture	22
Knowledge Worker	24
Social Relations, Identity, and Status	27
Design and Planning for New Work Styles	31
User Participation, Democratic Decision Making, and the Design Process	32
Design Research and Process Methods Examined	38
Scale Modeling as a Design Research and Process Method	40
III. Conclusions and Discussion	45
Conclusions and Discussions in Context	45
Emerging Design Features and Concepts	48
The Scale Modeling Process Explained	50
Final Concluding Remarks	55
Future Research	56
Bibliography	58
Vita	68

Glossary

- The terms *alternative officing*, *alternative office concepts*, *alternative workplace strategies*, *re-engineered work processes*, *ecological concepts* and *virtual working* are in this study interchangeably used. They refer to new and inclusive ways of working and new organizational forms. All terms view the office as an inclusive process facilitator and not solely as a place. These office processes involve a wide range of tools but are certainly not limited to the office as a physical place. They involve individuals working by themselves and as members of a group or team, when, where, and with the tools that they feel they need to be intellectually productive. Other identical terms used in current literature include “high involvement workplaces” or “high performance organizations.”
- The terms *alternative work spaces*, *alternative office environments*, *alternative office structures*, *alternative office designs* and *re-engineered work spaces* are through out this study interchangeably used. They refer to physical work environments that support new ways of working.
- *End-user*, *employee*, *participant*, and *customer* are interchangeably used and refer to people in the organizational context.
- *Functional inconvenience* refers to what Becker (1990) calls deliberate design of inefficient adjacencies. This is based on Allen’s research where the latter suggested that people located nearest those with whom their job requires them to interact frequently are efficient but not effective. Functional inconvenience is intended to promote long-term effectiveness.
- *Hoteling* refers to an alternative office strategy which must provide an inclusive and supportive environment by demand.
- *Information Age* refers to what Drucker (1993) calls the “postcapitalist” period. In that the basis of the economy and the value of labor has shifted from production of goods to organizing all economic activity around the production of information.
- *Knowledge design* refers to effective facilities designs that an organization may use for alternative officing.
- *Knowledge worker* refers to a person who in the performance of the daily job is involved in some sort of a decision-making process (i.e., analyze, decide, and collaborate) (Baloga & Cornell, 1992).
- *Learning organization* refers to a company which strives for workers to learn and develop skills to remain current with the ever changing job demands.
- *Modeling* refers to the use of scale models as a pre-design research or design process method.
- *Nine-to-five environments* are physical structures office management handbooks refer to since the 1950s [e.g., Ripnen (1974)].
- *Task-based design*, *user participation in design*, *democratic planning*, and *cooperative descision-making in design* are interchengably used and refer to collaborative design approaches by all stakeholders.

CHAPTER I

Introduction

Physical location issues are neither plain nor vanilla. In fact, space management may well be the most ignored--and most powerful--tool for inducing cultural change, speeding up innovation projects, and enhancing the learning process in far-flung organizations. While we fret ceaselessly about facilities issues such as office square footage allotted to various ranks, we all but ignore the key strategic issue--the parameters of intermingling (Peters, 1992, p. 411).

Purpose

This master's thesis study outlines a conceptual framework within which corporate management and design professionals, as well as a wider audience, can successfully understand design and manage alternative work spaces that foster learning, mental attachment, and commitment toward the organization. In addition, this study provides a framework that the research community can use to rethink design methodologies for pre-design research and establish needed empirical research in user participation in design in the context of changing business climates. The study focused and led to the underlying need for replacement of the traditional design process with an effective and cost-reducing process, like modeling, that supports the transition from a standard nine-to-five environment to alternative office concepts. A glimpse into the future was developed with informative suggestions about how to retrofit existing offices and build new ones so that they reflect management's intentions, and employees will use corporate space in new ways.

Justification

The field of alternative office planning and management is still in its early stages. Much of the material available is scattered throughout different disciplines, leading to the conclusion that little research has been conducted regarding a successful transition from standard nine-to-five environments to alternative office designs. Most of the material is presented as a new work concept that will revolutionize the workplace. This revolution, however, can also result in many privations if it is not carefully planned and implemented.

Offices are complex social and spatial organizations that very closely interact. As they go about daily tasks, workers behave in interrelated fashions involving broad social and behavioral issues. In alternative office structures, people begin to relate to one another differently, but sudden employee empowerment with the expectation to accept these new ways of relating and working is not a good idea. More like a tool such as information technology (IT) than an office organization system, alternative offices foster and create a way of communication that takes time to evolve in changing corporate cultures.

American corporations are flattening hierarchies, creating new teams of engagement with their work forces, and seeking to be more lively in all ways. Redundant and inefficient assets and the overall amount of space for the work force are being reduced, while high performance workplaces are being created to support high performance work. Companies are implementing many alternative workplace strategies that span the spectrum of industry, size, and geography.

These strategies offer new ways of coordinating work processes, organizational culture, information technology, and the physical workplace to improve the organization's performance and quality of work life. Each alternative strategy has particular value when

customized for the business objectives and processes of the work group. The potential of any one workplace strategy to add value to the total organization can often be increased when two or more are combined into an integrated approach. Then the workplace is designed and managed as a unified system that combines physical settings, information technology, work patterns and processes, and organizational culture.

Alternative officing is most effective when employees believe that this is an option that optimizes their time and energy. This often means that employees can control the type of environment they want and need for various tasks. This need for control leads to closer examination of traditional design and planning processes. The design process has such an overriding effect on the quality of the designed product or facility and the acceptance of its users that failure to closely examine its importance will only hinder a successful transition from a standard nine-to-five office environment to alternative officing. The key to success will be to communicate, to involve the employees in discussions of work environment and work style change, and to review and adjust situations that cause a problem to the individual or ability to perform. As a result, companies will see significant (1) payoffs in the work process, (2) greater efficiency through minimized cost, and (3) increased effectiveness through added value.

Because of smaller organizations, a shrinking workforce, and new forms of office sharing, the office spaces demand changes from quantitative to qualitative, and the office can in some instances be compared to a hotel. In a workplace managed like a hotel, activity centers and virtual offices are available to employees when they need them to support their work as individuals or teams. An employee does not necessarily own an individual office, therefore reducing overhead costs, but they receive excellent support

when needed. These employees are not treated as second class office workers, but are equal to regular office residents. They are the future workforce.

This re-conceptualization of the office workplace is a reality, and there will be no turning back. The multiple forces driving the change are causing fundamental shifts in business, government, and society. Inevitably, facility planners and corporate management will require new skills, attitudes, and approaches that emphasize flexibility, innovation, collaboration, empowerment, and service.

It is hoped that the following study will help define and outline a conceptual framework in a wider context that takes different variables into account. It will aid in defining the importance of social and behavioral issues and the design process for excellence while supporting a successful transition from standard nine-to-five environments to alternative officing. It will help business determine how and when to use alternative officing to the greatest advantage of the company and its workers.

Objectives

To accomplish the purpose of this study, the following objectives have been formulated:

1. To trace the current corporate climate of the world economy and the organizational ecology leading to radical changes in the 1990s.
2. To examine the workplace and information technology as effective management tools.
3. To trace the organizational workforce and behavioral issues such as corporate culture, status structures, and identity and how they operate in today's office from an anthropological and social psychological point of view.

4. To trace the design process in interior design and closely allied fields, such as architecture and planning, leading up to the innovative design research technique and method of modeling to facilitate customer participation.
5. To synthesize the information and form a conceptual framework for a redesigned process and design features to accommodate new styles of working.

CHAPTER II

Relevant Literature and Discussion

This chapter focuses on the foremost variables determining the changes in the business environment and behavioral issues leading up to new styles of working. The chapter reflects on current, pertinent, and interdisciplinary literature. Each section carries on discussions in the wake of changing business climates, with the purpose of identifying and assimilating pertinent issues to rationalize the design process and facilities design features that effectively support new styles of working and new organizational forms.

This chapter is broken up into four sections: The Organization in Context, The Workplace as Management Tool, Behavioral Issues in the Workforce, and Design and Planning for New Work Styles. Each section is further structured into subheadings that discuss the individual parts of each section. Each section heading is followed by a short introduction speaking to the framework and summarizing the main points leading to the design process and facilities design features.

The Organization in Context

This section is broken up into two subheadings--Economical Framework and Changing Corporate Environment. Economical Framework focuses on the transforming world economy, global competition, and the cost of doing business. Within these developments, several case study findings are cited that support evidence for the payoffs of re-engineered work spaces and ecological concepts.

Under the Changing Corporate Environment subheading the focus is on changes in the operating environments, downsizing, span of control, high performance knowledge work, and team based organizations. The discussion leads to the need for multi-use environments, flexibility, and adaptability to cope with these constant changes. The

discussion argues for a cost-reducing design process that facilitates fast changes and embodies group and social concerns so that committed and loyal employees are not lost.

Economical Framework

The phenomena of alternative office concepts is not being driven by concern about an organization's ability to create new knowledge and learning through social relationships, but by economics. It is hard to argue against economic factors, which are very compelling in alternative officing. Getting rid of traditional offices, whatever they might be, can save an organization enormous amounts of money in the short- or long-term but the question remains, "at what cost?" (Sutherland, 1997).

The world economy has undergone a radical transformation in the last two decades. Geographic and cultural distances and differences have been bridged significantly with the invention of jets, fax machines, global computer and telephone networks, and world television satellite broadcasting. This bridge permits companies to widen their geographic markets. But at the same time companies face global competition that forces them to produce higher quality goods and services with a smaller workforce and increasingly scarce resources. This trend might not hold true for every company at the present time or in every market segment, but it is certainly true for major corporations and may soon be the general trend (Brill, 1995; "Future Work," 1991; Gomain, 1989; Kotler, 1994; Nonaka & Takeuchi, 1995).

With the globalization of the economy, employers face many challenges other than competition, such as the ever-rising cost of doing business. Statistics published by the U.S. Bureau of Labor Statistics provide available evidence of rising labor costs ("San Francisco Chronicle," 1984). The cost of today's knowledge workers is the greatest operating expense for businesses. The trend of rising labor costs has a major impact on

profitability and creates a growing focus on sustaining competition through innovative concepts and work processes that foster productivity and effectiveness (Brill, 1995; Roark & Dowall, 1986; Nonaka & Takeuchi, 1995; Wingrave, 1995).

In the wake of higher costs, increased attention is given to “organizational ecology” concepts, a term coined by Becker and Steele (1995), and reflecting on the designed environment we interact with every day at work. “Its size, shape, layout, quality, furnishings, and equipment shape work lives at the same time as our behaviors, attitudes, and values shape the nature of that designed environment, and how it is used and the meaning we attach to it” (p. x). The ecology of the organization is often invisible, but nonetheless this strong force shapes how people work with each other and how well the organization performs when conditions require flexibility and quick responses to new demands (Becker & Steele, 1995).

The physical work space is more and more a recognized issue among progressive corporations for several reasons. The foremost reason is that a high performance worker functions better in a high quality environment, “like a formula one car functions better on a race course than on an African safari.” Further, several widespread reports of research findings about how the work environment affects individual, group and organizational performance suggest that more attention to design and planning pays off. Marginal investments in facilities can yield considerable payoffs in personnel through improved effectiveness, fewer errors, health, productivity, and job satisfaction (Becker & Steele, 1995; Brill, 1995; Gomain, 1989; Hartkopf et al., 1993; Sanders & McCormick, 1993). Two of the most comprehensive studies, the BOSTI study and the ORBIT-2 study, were the first ones to identify the building and organizational characteristics that influence job

performance, job satisfaction, satisfaction with the work environments, and ease of communication (Brill et al., 1985; Davis et al., 1985).

A growing body of corporate case studies offers conclusive evidence of office redesign's positive impact on productivity. For example:

[1] A Detroit-based insurance company designed its new office to incorporate team structures, ergonomic furniture, improved privacy, and new ... environmental systems. Pre- and post-occupancy evaluations showed a 137% decrease in time required to process client paperwork, a 9% drop in errors and defective claims, and a drop in absenteeism to 1.6% from 4.4% [sic]. [2] Amoco Corporation in Denver reported a 25% decrease in project cycle time, a 75% decrease in formal meeting time, an 80% reduction in duplicated files and [sic] 44% reductions in both square footage per employee and overall space costs by converting to a new office environment designed to facilitate team work. [3] Bank of Boston improved work performance, allowing the company to perform the same amount of work in 30% less space with 25% less staff by extensively renovating its new leased building. The project paid for itself in less than two years and created a showplace to attract new clients and further improve the business unit's profitability. (as cited in "Corporate America's Bottom Line," 1997, p. 18)

Another rising cost for organizations is facilities operation. Real estate costs represent an average of 25% of the assets of a large corporation ("Corporate America's Bottom Line," 1997). As Wingrave and others point out, property is the second largest expense after salaries. Office rents account for about 10% of operating expenses (Becker

& Steele, 1995; Duffy, 1997; Wingrave, 1995). In downtown areas rents have increased as much as 300% since 1977 (Roth, Stanton & Shapiro, 1983). In the past decade, these skyrocketing rents have led to the re-engineering of work processes and a radical rethinking of the way corporate real estate is handled, managed, and utilized. Numerous corporations have moved to new office developments in suburbs and have looked for new uses for unused office space, with the primary benefit of lowering cost. In several cities corporations have converted former office buildings into successful residential hotels or even low income housing (Brill, 1995). But whether a company is located in central city or suburban location, office and production space in general now has a premium price tag that companies can no longer afford to pay and they are looking for alternative ways out. As an example:

Andersen Worldwide will save at least \$1 million annually since it converted to a new open plan office layout for its Chicago headquarters that uses alternative office strategies to reduce significantly space needs (Duffy, 1997).

Changing Corporate Environment

The operating environments of corporations are facing constant changes in the 1990s. Some changes in the work world are happening to all workers, regardless of job type. Some changes can be seen around the world in major industrialized nations in Europe, North and South America, and Asia. These changes affect production floors as well as corporate offices (Brill, 1995; Kotler, 1994).

Business organizations have gone through a period of downsizing and rightsizing that has resulted in large-scale layoffs, a method widely used since the 1980s to reduce cost and increase efficiency. They have experimented with re-engineering, quality team

management programs, and numerous ways to restructure the work force. Yet research on downsizing shows negative effects such as lowered morale and decreased loyalty toward the company among remaining employees and long-term declines in company stock values after layoffs (Byrne, 1993; Cascio, 1995; Kotler, 1994).

These changes provide viable clues to what can be expected of businesses as we transition toward the 21st century. Corporate environments need flexibility to adapt simultaneously to planned and spontaneous changes. Business facilities will need to accommodate a multitude of changes, learning, work, and activities and, therefore, must become flexible and dynamic multi-use environments that enhance and facilitate the changing process of doing business.

The major challenge ahead for today's companies is how to build viable businesses in the face of rapidly changing marketplaces and environments. Businesses now are beginning to recognize that unless a company's stakeholders, customers, employees, suppliers, and distributors are nourished, the business may never earn sufficient profits for the stockholder. Companies are increasingly refocusing their attention on the need to manage customer-relevant processes. They are studying how tasks pass from department to department, the interaction between internal and external tasks, and the possible impediments to effective outcomes (Byrne, 1993; Kotler, 1994).

Within this context, corporations have realized that large, multilayered organizations that are centrally operated with specialization of functions (characterized by many hierarchial levels and relatively few people who report to each manager or supervisor level) have great difficulty responding to market shifts and customer differentiation (Daft, 1995). This mismatch is now suddenly being changed, and the organizational profile is shifting. Authority and the span of control is being brought down

to the lower levels of organizations and out to locations where information is available and vital knowledge is being created. Organizations are being “de-layered” (Batz, 1994), reducing the number of organizational levels, shifting to more autonomous profiles, and placing more focus on responding to market shifts and opportunities. This process has been a common response to the economic pressures of international competition (Cascio, 1995). And companies are about to understand the value of their knowledge workers (Brill, 1995; Buzzell & Ortmeier, 1995; Kotler, 1995; Nonaka & Takeuchi, 1995).

Companies today are striving for a high performance learning organization. Workers must learn to identify their core competencies and develop their skills to remain current with the changing job requirements. Business organizations must learn that their most significant competitive edge is the intellectual capital of their work force. Business and industry are becoming aware that ongoing training and learning is significantly important. Len Brzozowski (1995), owner of Robotron Corporation said:

There is a broad gap today between the skills of our work force and the needs of our business organizations. I am the president of a manufacturing company and I am concerned about my work force and whether they will have the skills I need for my company to survive. The only thing that differentiates us from any other company in the world is the skill, diligence and creativity of our work force (Detroit News, February 19, 1995, p. A15).

Previously practiced patterns of behavior need to be changed. The corporate facility environment needs to change to support learning, work, and the development of intellectual capital (Hase, 1997).

New organizations are being structured as cross-functional, multidisciplinary teams, focused on particular sets of products, customers, and services. These teams can be found in manufacturing, service projects, research and development, and management (Sundstrom, DeMeuse & Futurell, 1990). Companies today place a strong emphasis on team development, and many of them have realized that designers can provide effective office design solutions that help team members work better together, accelerate decision making, and improve efficiency ("Corporate America's Bottom Line," 1997).

Research and case studies have shown that when people work without walls and in close proximity to one another, communication becomes more frequent, managers become more accessible, and productivity rises. One of the most widely used ways in which designers support team development and improve access is by helping companies implement open plans with smaller, better organized work areas where team members are close to each other. Many open offices incorporate "neighborhood" areas for teams and other work groups to meet and interact. These companies have found that this type of office environment helps enhance departmental cooperation and interaction by reducing or eliminating the physical space and obstacles that can hinder spontaneous communication (Becker & Steele, 1995; Duffy, 1997; Miller, 1959; Sundstrom, 1986; Sundstrom & Altman, 1989).

Companies with team-based structures include IBM, Saturn, Boeing, Motorola, Proctor and Gamble, GE, and Federal Express (Dumaine, 1994). What all these organizations have in common is that they are redesigning jobs from very narrow tasks for individuals to job tasks for teams (Lawler & Cohen, 1992). Team-like relationships are sought within the office, as well as with customers and suppliers, to improve quality and

reduce the cycle time. As a result many business relationships in this wake are formed with the hope of promoting “Total Quality Management” (Hackman & Wageman, 1995).

The physical environment, technology, work processes, management style, and organizational philosophy and values now have to get in sync. Designers and management must create a dynamic workplace that supports diversity in work patterns, values cooperation, and collaboration and encourages creativity, innovation, and hard work. With this we see more attention to work concepts and models that embody group or social concerns (Becker & Steele, 1995; Brill, 1995; Moleski & Lang, 1982).

The outcome of this redesigned process and the new organizational structures is called “high involvement workplaces” or “high performance organizations ,” where the workforce is flexible and employees are often away from the corporate home office and integrated in cross-functional and cross-departmental teams. Many current office functions and tasks are done productively elsewhere, at any time and location that they can most effectively be accomplished. These moves and changes might happen daily, weekly or monthly depending on the task requirement (Becker & Steele, 1995; Brill, 1995; L. Delish, E. R. Fitzgerald & K. Lam, personal telephone communication, February 12 and June 4, 1997).

The focus therefore is on flexible and adaptable physical environments that can quickly be adjusted to ever changing situations and needs. Office space needs to be quickly reconfigured, therefore devaluing the traditional design process. Office spaces today need flexibility to be used by individuals and teams with more inclusive job descriptions (L. Delish, E. R. Fitzgerald & K. Lam, personal telephone communication, February 12 and June 4, 1997).

The Workplace as Management Tool

This section is divided up into two subheadings--The Workplace and Information Technology. The Workplace subheading focuses on the physical environment as an effective management tool and is looked at like information technology (IT) to support knowledge work. It focuses on today's work as an interactive and ongoing process between interdisciplinary groups, that requires access for speed in decision-making. Individual work spaces erode away and must be complemented with the right mix of group work spaces, lounges, and conference areas leading to functional neighborhoods. Several case study companies are mentioned and examined in the effort of alternative officing.

Under the subheading Information Technology, the current state of IT in the corporate world and how it affects the physical workplace and management strategies is summarized. The discussion highlights the need for facilities design features that allow for sufficient access and privacy while providing for fast changes. This leads to a design process that supports management's efforts to empower employees by allowing them to make design decisions that support their work styles. As an example, the IBM productivity centers are described with IBM's efforts on employee involvement in the design process. The workplace can only be managed as an effective tool if there is a design process and designs in place that effectively allow for inclusive, fast, and innovative changes.

The Workplace

With the rapid technology developments of the 1990s and an economy where the only certainty is uncertainty, the one source of lasting competitiveness is the knowledge of the work force and with it the requirement for a physical environment that enables further

and sustained competitiveness. It is also critical to analyze how equipment, space, and furnishings are allocated and used over time (Becker & Steele, 1995). While many companies would argue that they have evolved considerably since the 1950s, their offices still reflect the same structure office management handbooks [e.g., Ripnen (1974)] recommended years ago.

The nature of the workplace has shifted drastically from an individual working on one small part of a problem in an assembly line approach to autonomous cross-functional teams with total project responsibility. Offices can no longer be optimally productive through traditional workplace strategies because the traditional strategies do not correspond to the nature of work being done. Work is no longer a structured series of tasks, but an interactive and ongoing process. An increasingly greater discrepancy is rising between the way work is done and the spaces in which it is performed. While traditional office models emphasize individual spaces, workers are in fact engaged in more group work than ever. Valuable square footage is being wasted by cubicles and offices when it should instead be used for group work spaces, lounges, and conference areas. The answer is not to create solely group or team spaces but to provide both, depending on the task being performed (Becker & Steele, 1995).

Some physical settings may be more or less permanent. Other settings may be ad hoc, meeting the demands of the moment. A “knowledge design” may then be thought of as the collection of settings that an organization uses to enable learning and construction of knowledge. A design should support the ongoing social construction and learning of an organization, learning that is conceived of as continuous within a cultural world (Bruner, 1990, p.105).

In the interest of flatter hierarchies, improved team spirit, and the creation of knowledge, some companies are considering adopting uniform office space standards for all employees, regardless of title or seniority. Other companies are looking to adopt alternative office strategies such as hoteling. To implement these changes, designers help companies replace their status-based approach to design with a task-based approach that optimizes employee performance and improves morale. To accomplish this, designers must help employees and managers see individual work spaces as their tools rather than their territories (Mills, 1991).

Therefore, it may be useful to rethink the way we look at corporate facilities by moving from a traditional facilities management (FM) point of view to a more holistic way of information technology (IT). The underlying concept of IT is sharing and understanding knowledge with others, and this sharing may be facilitated by the physical environment. In this shift FM and IT should perhaps be renamed to infrastructure and tools, in that workstations and computers are looked at as one unifying variable, indispensable of each other--a tool creating the infrastructure of an organization. The physical environment is infrastructure on the one hand and a tool on the other hand to facilitate new ways of doing business (Sutherland, 1997).

Another increasingly important component of business today is speed and access. Access plays a key role in accelerating the decision-making process by supporting management's efforts to push decision-making power down in the ranks and by empowering teams of employees to work more efficiently. As more managers begin to embrace collaboration and flexibility as a way to increase productivity, they will value environments with fewer or no physical barriers ("Corporate America's Bottom Line," 1997). Companies are seeing that by creating "neighborhoods" or "clusters" of people

from different disciplines to work together on projects, they promote a less formal but more effective information flow (Mills, 1991). The mixed “neighborhood” was popularized by Christopher Alexander, who presented it in the mid-1960s to an audience of urban planners, but his argument applies to officing today as well. Alexander (1965) suggested that planned environments are boring because designers arrange them in military-like groupings rather than acknowledge the complexity of overlapping memberships.

Clusters need an environment in which people can see one another easily, and therefore [*sic*] are encouraged to communicate. In the past, companies wanted to avoid this situation believing that when people were talking, they were taking time away from work. But as work comes to involve ... more judgement about specific situations, efficiency can be increased when people consult quickly about how best to handle a circumstance. (Mills, 1991, p. 280)

Many companies are improving flexibility by implementing alternative office strategies. Modifying office strategies is one of the most effective ways that companies can improve productivity and optimize work space. Free address, hoteling, and shared space strategies most often yield cost savings, while group address, project team environments, and activity-based settings (such as conference areas) provide productivity increases.

A challenge of alternative office strategies is to provide the right mix of privacy and access. Apple Computer’s research and development complex in Cupertino, California, successfully met this challenge by combining semi-private and individual spaces where team members can come together to collaborate on projects. Many other

companies, including Andersen Worldwide, IBM, HP, Digital, AT&T, Intel, and Xerox, have designed new facilities with flexible, easily reconfigured spaces for individuals and teams and have replaced some offices with technology (Davenport, 1995; Duffy, 1997).

A financial crisis led IBM managers in Indiana to initiate alternative officing in 1993. Rather than eliminate 50 people from their payrolls, managers reduced real estate instead. Anyone having direct contact with customers lost their assigned desks and received tools (e.g., notebooks, cellular phones, pager, printer, modem, and software for all communication needs) to work anywhere at any time. IBM consolidated several locations of traditional office space into "productivity centers." These centralized facilities varied in size and offered diverse unassigned shared spaces and support services. This prototype launched IBM globally into alternative officing.

Since adapting this alternative office structures, IBM has transitioned nearly 60% of the company's 35,000 North American employees to working virtual. IBM considers its most successful "productivity center" to be in Rolling Meadows, Illinois. Designed by Chicago based architects Eastlake-Studio, it is home base for 300 to 400 employees. Three branch offices were consolidated into one productivity center, thereby reducing leased space from 220,000 to 42,000 square feet. The IBM facility management team and human resource managers point out that it was important that employees and work teams were involved in deciding how to plan the "ideal" situation and the overall look of the space. The resulting workstations offer varying degrees of privacy and are available on a first-come, first-served basis. Team and conference rooms accommodate different size groups and different types of projects. Managers and executives use workstations and team rooms in the same manner as their employees (L. Delish, E. R. Fitzgerald & K. Lam, personal telephone communication, February 12 and June 4, 1997).

Information Technology

The last decade has brought about significant and fundamental changes in high technology as well as how we use it and how we integrate it in our daily lives at all levels. As Gomain points out, "It has often been said by several experts in various fields that the current information revolution is comparable to the first industrial revolution in scope, not in kind." (Gomain, 1989, p. 2) Information technology (IT) impacts both production and consumption in all aspects of life.

Technology is becoming more portable, more friendly, more widespread, and more powerful (Brill, 1995; Wingrave, 1995). The cost of computer technology is dropping significantly while the power of microcomputers is improving daily. Technology is more portable and convenient to use given the exploding market for cellular telephones and increasingly powerful notebook computers with integrated fax and data modems (Becker & Steele, 1995; Brill, 1995).

Advances in technology, such as faxes, e-mail, cellular networks, pagers, computer-based groupware, and local networks, and most significantly the increased availability of the Internet, are the tools fueling the integration of IT in our lives (Davies, 1995; Gomain, 1989). The development of the "electronic highway" will further increase the power and range of work everywhere, by providing on-line remote access to an enormous variety of software, databases of all kinds, work files, electronic- and voice mail, full-color still and moving images, and sound (Brill, 1995; L. Delish, E. R. Fitzgerald & K. Lam, personal telephone communication, February 12 and June 4, 1997; Wingrave, 1995). New technology affects work not only in a simple cause-and-effect relationship, but also in a much wider context of management strategies, physical settings, operating systems, and the whole range of work processes (Wild, 1991).

Behavioral Issues in the Workforce

The section is broken up into three subheadings--Corporate Culture; Knowledge Worker; and Social Relations, Identity, and Status. The subheading Corporate Culture deals with the issues of the physical space, cultural rules, and socialization of the employee into a culture. The physical space and the level of identification with the workplace and relationships are discussed in lieu of familiarity with the culture to easily absorb changes in the work environment. Structural linguistic concepts are examined to explain the importance of a sense of belonging of every individual employee.

Under the subheading Knowledge Worker, the shift of work processes are discussed. The changes in the business climate lead to increased knowledge work and the need for the creation of new knowledge. The emphasis is on the construction of knowledge as a social process with the underlying key factors of personal commitment, sense of identity and the company's mission. The construction of knowledge takes place in settings involving minds, time, and place.

The subheading Social Relations, Identity and Status is dealing with the erosion of hierarchies and a widened span of control leading to a more democratic organizational structure. More collaborative forms of organization-based teams are discussed. The reward system is discussed in the light of democratic decision making in the design process, because organizational image, status, and identity with an individual office are no longer valid.

The discussion is leading to the need for employee involvement in the design process to build a fundamental base for employee relationships and the creation of ownership to effectively absorb constant changes and counterbalance the employee's fear

of loss of status in new and more fluid office environments. The physical environments need to be conducive to facilitating learning and the creation of knowledge with interactive environments. The physical environments need to facilitate and create opportunities for interactions and impromptu conversations.

Corporate Culture

“Culture is communication” (Hall, 1959), the way we exchange information, identity, work styles, beliefs, and values. Having an office doesn’t just give the employee a place to sit, it is also a place to get socialized into the culture of the company. Observing the behavior of other workers and having casual conversations with them is how one learns the way things are done. The corporate culture and the way that culture is communicated determines whether an employee holds a mental connection, commitment, and loyalty to a corporation. The corporate culture is a form of identification for the employee (Hall, 1976).

With the rise of downsizing and the fall of lifelong jobs, the employee has precious few reasons to be loyal to the company where he/she is working. This is especially true if the employee has no physical space to call his/her corporate home and to identify with (Davenport, 1995). The employee’s relationship to the corporation is determined by the level of identification. Frequent changes in the business climate and new ways of working can only be successfully absorbed and integrated if an employee is truly familiar with the culture he/she is living in and whether the employee experiences the culture as an insider or outsider of the system. Insiders understand the particular relationships in the culture, whereas the outsider does not and may not even be aware of them. The insider is part of the culture and understands the crucial nuances. This phenomena can easily be portrayed with the example of a foreigner arriving in another country and trying to understand or tell

jokes. Because the foreigner does not know the nuances and cultural differences, the jokes may appear dull and boring. As the outsider gradually becomes comfortable and competent with the new culture, the outsider becomes an insider.

To further explain the insider/outsider phenomena, it is useful to look at a model developed from a specific paradigm in structural linguistics that is sensitive to the concept of cultural reality and variability. According to Whorf (1964), grammatical and lexical categories of a language influence the perception and behavior of its speakers. The structural framework of a language creates conceptual boundaries of reality for its speakers. Everything outside these boundaries of the linguistic system is difficult to perceive because an individual does not have a linguistic way of encountering it. Therefore, people tend to construct a reality that is congruent with the structural framework of the language they learn.

Pike's (1967) etic/emic standpoints for the description of culture and behavior is important in this regard because it is fundamental to the structuring of our perception. The etic viewpoint studies behavior from outside a particular system. It is essentially how every outsider must approach a system that is unfamiliar. The emic viewpoint studies behavior from inside the system, as if one were a member of the culture. What the outsider sees when observing behavior in a different culture is what people actually do (etic). What the insider sees are the categories in the behavior that generate meaning (emic). Until the outsider learns how to classify the actual behavior into emic units, the outsider cannot decode the behavior meaningfully.

It is crucial for the corporation to understand the impact of the etic and emic viewpoints of a cultural system. This further should support the pressing issue of letting today's knowledge worker be part of decision making, starting with the design process of

the physical environment. The design process can build a fundamental base for employee relationships and the identification with the corporate culture to absorb constant changes. The employee must be treated as an insider rather than as an outsider of the corporate culture and, therefore, of the organization as a whole.

Knowledge Worker

The traditional office and its artifacts may soon be obsolete in the wake of recent developments. Electronic systems have streamlined the work force and eroded traditional hierarchies. Where they still exist, these hierarchies are little more than a hindrance for a high performing, learning organization. Flexibility and automation has resulted in smaller and highly technological firms, rapid outdateding of products, and a smaller but more skilled work force.

This in turn creates increasingly complex roles for each employee, bringing about a corresponding increase in knowledge that workers must possess in order to survive. With it also comes an increasing demand for a supportive physical environment. The majority of the work force today is engaged in "knowledge work" (decision-making processes of some sort) to such a degree that routine physical work is almost entirely eliminated (Sutherland, 1997; Mazzi, 1995; Hage & Powers, 1992). Baloga and Cornell (1992) of Steelcase coined the term "knowledge worker" to describe 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 industries, tasks have become more complex, technical, and unstructured and require more collaboration and group problem solving (Moleski & Lang, 1982).

Despite all this talk about brain power, knowledge work, and intellectual capital that a company possesses, few managers with the possible exception of the Japanese,

grasp the power they have available, let alone how to manage it. The most likely reason for this is that they fail to understand what knowledge is and what companies must undertake to take advantage of it. Further, knowledge is socially constructed in at least a dyad and is in an interactive process (Nonaka & Takeuchi, 1995; Sutherland, 1997). The construction of organizational knowledge (i.e., the construction of shared reality in which the company or organization assumes itself to be operating) is a social process (Berger & Luckmann, 1996; Searle, 1995). Social construction takes place in settings that have multiple components, and all settings involve the interaction of four variables (Sutherland, 1993) --one or more minds, time, space, and tools. The latter two might be interchangeable or combined as one.

Still ingrained in western management is Frederick Taylor's (1911) scientific management theory that describes people as units of production or Henry Ford's well-known view of the organization as a machine of information processing. This view, "Fordism," went so far that it implied a new kind of worker and a new society of mass consumption and increased leisure. It became the dominant industrial model for the fast growing market economies now considered the traditional industries. The Fordist industrial system broke the processes down into detailed tasks according to highly specified time and motion analyses. Management, conception, control, and execution were all separated into distinct hierarchies of function, which resulted in the deskilling of routine work at the point of production and the centralized codification of traditional practices into a core of managerial knowledge (Braverman, 1974). According to these views the only useful knowledge is formal and systematic data, procedures, and universal principles with quantitative measurements. Ford's famous quote, "Why do I always get a person if I hire a pair of hands?" is an example of this mentality (Laing, 1993).

Yet there is another way to think about knowledge and its role in business organizations, and this thinking can already be found in innovative Japanese companies. The secret of their success is the unique approach of managing “the creation of new knowledge.” The centerpiece to this approach is the recognition that creating new knowledge is not simply a matter of processing objective information, but rather depends on tapping the tacit and often highly subjective insights, intuitions, and hunches of individual employees and making those insights available for testing and use by the company as a whole. The keys to this process are personal commitment, the employee’s sense of identity with the corporate culture, and mission, and interaction with its employees (Noanka & Takeuchi, 1995).

Physical environment also plays a much more significant role in an individual’s social construction and extrapolated organizational knowledge than is commonly understood by management. It has long been known that students who take their exams in the same classroom where lectures were held tend to do better than students who take their exams in different classrooms. Pacanowsky (1995) calls this phenomena “context sensitive” learning and attributes it to the fact that “there are probably out-of-awareness associations that tie some of what we learn to the physical context of the room” (p.43). David Perkins (1992) suggested that “human cognition at its richest almost always occurs in ways that are physically, socially, and symbolically distributed. People think and remember with the help of all sorts of physical aids, and we commonly construct new physical aids to help ourselves yet more” (p.133). Edward Hall (1966) referred to the fact that in any culture the rules guiding how people deal with one another have strong spatial aspects. Within this normative perspective, Robert Sommer (1969) has contributed considerable information and work on institutional settings through his handling of

environmental implications of interpersonal and spatial norms. The strong relationship between memory (knowledge) and the environment hypothesized by the above authors and others has recently received empirical support from the work of neuroscientists like Schacter (1996) who is exploring “associative memory” and Damasio (1994) who is exploring the neurobiological underpinnings of human emotions (Sutherland, 1997).

If organizations focus on knowledge creation and learning, employees will become more complex and interactive. The work environments must support increasing communication among employees that will occur within a corporate environment. Therefore, designers and management can step out of designing for the individual job description titles and can design an ecological corporate environment for the new worker distinctions--Learning Worker, Knowledge Worker, or Wisdom Worker. The expansion of individual responsibilities and broadening of job descriptions not only impacts a company's recruitment and retention of employees, (Walkup, 1995), but also affects existing social relationships within the office.

Social Relations, Identity, and Status

New technology and re-engineered work processes change social relations and break down hierarchies because it forces employees to react spontaneously and creatively to problems as they arise. In a destabilizing economy with rapid changes, corporate hierarchy is detrimental but may be counterbalanced by a more horizontal and democratic organizational structure. Organizations have fewer hierarchical levels, fewer managers, and a wider span of control with more flexible work forces and more collaborative forms of organization-based teams (Becker & Steele, 1995; Kanter, 1991; L. Delish, E. R. Fitzgerald & K. Lam, personal telephone communication, February 12 and June 4, 1997; Sutherland, 1997).

In the traditional office there were four distinct classes of office workers: executive, manager, professional, and clerical. But in today's work environment only two of these classes, executive and professional are surviving. As might be imagined, organizational rank and status are often the biggest barriers to this necessary change. Executives do not like to shift to a more managerial role, former managers do not like to shift into the professional category, and professionals do not necessarily want to do their own secretarial work. However, it is no longer possible to resist these changes as work systems need to become more flexible and demand a broader definition of tasks and array of skills to accommodate the pace of the changing business world. Narrowly defined jobs create an incentive to delineate and guard territory. This fosters an environment that is not conducive to learning and change, which is fatal to today's offices.

Workers in alternative office environments risk or fear the loss of their social status. This in turn affects both office morale and the employee's ability to work effectively. Although the work environment is changing, alternative office strategies could produce the same backdrop of territoriality as was seen when open plans were introduced if it is perceived as a threatening change. Abandoning the idea that filling a position implies occupying one single space does not happen easily. Because people are accustomed to equating status and identity with an office of a certain location and size, they hold on to this equation even if it is no longer valid (Stone & Luchetti, 1985).

Since the office and physical possessions have come to represent the accomplishments and rank of an employee (Konar et al., 1982), neglecting them entirely can be devastating. Physical working environments can be expected to continue as a signal of status within organizations (Sundstrom, 1986), so the problem then is to fuse the employee's need for status and territory with the new ways of working that force the

elimination of both needs. Organizations are redesigning their reward systems through the use of bonuses and rewards for teams based on customer evaluations (Lawler & Cohen, 1992). Likewise the reward system with physical status symbols within the organizations should be rethought or distributed. IBM's "productivity centers" for instance have status demarcations by differential access privileges to sections and work areas or whole floors (L. Delish, E. R. Fitzgerald & K. Lam, personal telephone communication, February 12 and June 4, 1997). Sundstrom (1986) noted that control over accessibility to one's workplace has been associated with status. Companies should rethink the traditional way of conveying an image. What was expressed through status symbols such as location and office decoration (Ornstein, 1992) is proving irrelevant in the information age.

Employees constantly read the environment for cues about management's real intentions. Management has the opportunity to influence these messages through their decisions concerning the office environment. These decisions can be about how space is laid out as well as what it looks like or what color it is. Much thought needs to be given to design choices and the processes on which these choices are based. The kinds of resources allocated to users and the policies about how these resources can be used or changed implicitly lay out a vision or an agenda on how the system should work day-to-day. Employees will read these decisions for messages about intention, values, directions, and concerns and will compare them with more explicit written statements such as those found in annual reports and executive memos. When discrepancies exist, the designs and policies are believed to be true indicators of what leaders will choose to do when the "chips are down." (Becker & Steele, 1996).

However, professional employees and managers still expect to have the physical manifestations of status that accompanied their position in a more traditional office, even if

they no longer use them. By replacing a worker's physical identity with a more virtual one, alternative officing may undermine an office culture. Workers are understandably resistant to such a phenomenon (Duffy, 1997).

While employees of all ranks still judge their success through physical objects, most companies are located in buildings that were not designed for the way the organization operates. Most alternative office programs do not attempt to revise the existing structure of the office. Yet it makes no sense to invest heavily in sophisticated hardware, software, systems, and managerial strategies if old workplaces remain the same (Gomain, 1989; Hartkopf et al., 1993). Most models are not innovative and simply relocate workers instead of restructuring their relationship with one another and the office environment. Obviously, this results in alienation for those who have been removed or simply moved. Individuals value territory, privacy, and status and wish to express these spatially (Ellis, 1986).

The shift from assigned work spaces to shared work spaces, for instance, resembles a non-territorial office with positive and negative aspects (Sundstrom, 1986).

A critical implication of a mobile office staff that shares work-stations is a potential loosening of the psychological ties between people and the office. If employees spend part of their work time at home, they have more than just one place of work (unless they work exclusively at home). No longer would the job be identified completely with the office building. This could lead to a weakening of three processes ... important in the work environment: (1) the use of work spaces to symbolize status ...; (2) the tendency of workers to express their personalities through their work spaces ...; and (3) the capacity of the organization to convey its values to

employees through their work spaces The weakening of these symbolic bonds could conceivably lead people to feel less committed to the organization. At the same time, commitment by the organization to its employees could also weaken. (Sundstrom, 1986, p. 373)

The loss of mental connection, commitment, and loyalty to the office could be devastating and counterproductive to the corporation. It could conceivably lead to an unsuccessful transition from a conventional work form to a more autonomous and more democratic form. It could lead to loss of job satisfaction, which impacts office productivity, "through such factors as turnover, lateness, absenteeism, grievances, union activity, and the quality of work life" (Brill et al., 1984), and the lack of creation of new knowledge and learning. For example, substantial cost could occur when new products are not competitively developed due to a lack of internal communication and access or when highly qualified workers leave their job because of unhappiness and the as a result, the company needs to hire and train a new worker.

Design and Planning for New Work Styles

This last section is divided into three subheadings--User Participation, Democratic Decision Making, and the Design Process; Design Research and Process Methods Examined; and Scale Modeling as a Design Research and Process Method. The subheading User Participation, Democratic Decision Making, and the Design Process focuses on cooperative decision making and the need for a design process to facilitate increased acceptance of changes and improved communications and human relations. It focuses on the need for availability of and the ability to use alternative settings and the mechanism of control in the physical environment. Several case studies that successfully used cooperative decision making approaches are discussed.

Under the subheading *Design Research and Process Methods Examined*, the focus is on traditional methods and developments leading to innovative methods like modeling. It discussed the importance of a variety of research methods in the design process, because the assumption that the designer knows enough about human needs based on personal experience is no longer valid.

The subheading *Scale Modeling as a Design Research and Process Method* focuses on modeling as an innovative, cost-reducing method that involves people directly into research rather than treating them as the objects of research. The mutual involvement of participants and a number of positive influences are discussed. Modeling is discussed in the light of an engaging method that can elicit important behavioral information, foster communication, and allow for decision making at the same time. Modeling is projected as a method that allows for demonstration and experience of organizational benefits that otherwise remain abstract or unimaginable. Several other modeling methods and applications from full-scale modeling to scale modeling are discussed.

User Participation, Democratic Decision Making, and the Design Process

For several decades, there have been two archetypal situations for decision making about the physical environment. Professionals such as interior designers, space planners, and programmers establish user requirements and develop layouts and designs or a manager in the user group draws up some sketches of what he or she wants (Becker & Steele, 1995; Davis & Sziget, 1986). But to satisfy the needs of all stakeholders in the corporate culture, the workplace must accommodate everyone according to their needs. The workplace has to become more like a social system, with appropriate systems and support for individuals (Becker & Steele, 1995). Through a meaningful and cooperative design approach of the workplace, employers can facilitate improved employee

relationships that result in a more productive work environment and foster commitment, mental connection, communication, and loyalty to the company (Brill et al., 1984; Brill, 1995; Davies, 1995; Wingrave, 1995; Schwartz, 1995; Sundstrom, 1986).

Within the work setting, greater attention should be paid to providing opportunities and control by individual workers over their physical environment. As an example, Szilagy and Holland (1980) reported on a study of highly skilled professionals in the petroleum industry. The employees were involved in a move to a new office space in which social density was increased. The results indicated significant increases in job feedback, friendship opportunities, work satisfaction, information exchange, and task facilitation.

In the early 1980s, Union Carbide built a new headquarters building in Danbury, Connecticut, and made some quite radical changes. The offices were exactly the same size, for professionals or the president of a division. The furniture in the offices was not identical because Carbide wanted all employees to be able to select from a number of furniture packages those that most suited their own work style and sense of identity. All furniture packages were, however, of comparable cost. The results were not surprising. A study done by Frogatt (1985) found a higher level of employee satisfaction with the new office environment, and the disruption and cost of reconfiguring the environment every time someone was promoted were drastically reduced.

Participation allows people who will use the particular environment to be involved in the design decision process. Participation allows the individual or group to express self-identity and exert potentially greater control over the environment through the selection of equipment and arrangements (Brill et al. 1984; Sundstrom, 1986). Documented positive findings include positive relationships between various aspects of participation; increased

acceptance of managerial ideas and changes; cooperation between management and workers; improvement in productivity, morale, motivation toward organizational objectives, and commitment to organizational goals; and reduced turnover, absenteeism, grievances, tension, and stress (Singer, 1974; Lowin, 1968).

Allowing employees to participate in resolving organizational issues helps meet their needs for self-esteem, self-actualization, and autonomy, and improves morale and employee attitudes toward management. It is assumed that workers participating in decision-making are able to exercise initiative and creativity which lead to increased motivation, involvement and performance. (Brill et al., 1984, p. 297)

It has been demonstrated in numerous studies (Baron & Rodin, 1978; Seligman, 1975; Strickland, 1977) that the ability to have some amount of control over one's environment can reduce the negative effects of such environmental factors as crowding and noise. Research indicates that increased actual and perceived control will increase satisfaction, reduce stress, and enhance task performance (Averill, 1973; Barnes, 1980; Baron & Rodin, 1978). In an office environment where flexible control of the boundaries is more difficult, employees may exert control indirectly by moving to a more appropriate space. For instance, an employee may use an adjacent conference room for private telephone calls or conversations with clients or colleagues. Thus, the availability of and the ability to use alternative settings and mechanisms of control become important. Even more, it becomes imperative that during the planning process such alternative settings are planned and accepted by the employees.

The BOSTI study shows further evidence about the involvement of employees in decisions about the design of their offices by participation. The BOSTI study measured

participation with respect to a set of criteria called “the four bottom-line measures.” The four bottom line-measures--environmental satisfaction, job satisfaction, job performance, and supervisory/job performance--are considered to be the most important issues to an organization in terms of productivity increase. Employees who participated in the design of the office showed significantly greater satisfaction with the physical environment, greater job satisfaction, and better self-rated job performance (Brill et al., 1984). The BOSTI reports:

Does participation affect bottom-line measures?

Those who participate have higher “job satisfaction and satisfaction with the environment” than those who don’t. Increased satisfaction is a function of participation in and of itself, while increased environmental satisfaction can be attributed to environmental improvements resulting from participation. (Brill et al., 1984, p. 300)

Sundstrom (1986) in his book Work Places offered several plausible reasons for the importance of employee participation in the design of their environments.

First, participative design allows a form of self-expression, which may lead occupants to feel committed to their environments or to their organization. (Control over the environment could even create some form of psychological attachment to it.) Second, participative design may lead to better environments, by promoting better decisions. (At the very least, employee participation in design ensures that decisions are based on more information than if employees do not take part.) Third, participative design may be intrinsically satisfying. Fourth, it provides an opportunity for cooperation among workers. (Sundstrom, 1986, p. 233)

Participation has been discussed under a number of topics, such as participatory decision making, democratic leadership, industrial democracy, and more. Regardless of the content or scope of participatory arrangements, the concept is generally used to refer to some form of joint decision making. In the 1970s a whole movement developed to enhance the quality and effectiveness of office workers partly by involving employees in decision making about aspects of their work and its context (Davis, 1979; Davis & Cherns 1975; Trist, 1973). Joint design of a new organization and its physical environment has been used for the planning of many industrial facilities such as oil refineries, meat packing plants, and automobile factories. User participation for the design of the physical environment of an office is a subset of joint design for a total work environment. In participatory design, the basic planning decisions and later the detailed planning are done by a coalition that includes the actual users as well as technical experts such as interior designers, architects, and engineers. The technical specialists and professional experts initially provide knowledge and experience and later execute the decision of the planning group (Davis & Szigeti, 1986).

In some situations, user participation in planning appears to offer the organization and the individual employees substantial benefits over traditional design processes. Steele (1973) emphasizes the value to the organization of having its staff develop skills in working together by using group processes to design their work settings. This can enhance people's awareness of their physical work environment and can lead to a heightened sense of belonging and personal effectiveness. Change in traditional workplace patterns often raises fears by employees of being seen as less a part of the organization and of losing one's sense of belonging. Management fears the loss of a cohesive corporate culture. Offering comprehensive managerial and workplace support that responds to work

preferences and needs is one way to address these very legitimate fears. And it is one of the major tasks involved in planning and managing new workplaces. So, too, is a broad corporate effort to keep employees informed about, connected to, and engaged with the rest of the company and with their professional peers. The elements of an effective communications plan will be different as they are tailored to the needs, structure, and culture of each organization. But in general, a good communications plan will involve user participation in decision making, starting with the design process. Furthermore, staff members who have participated in the design process are in fact exercising control over their environment and becoming environmentally aware (Steele, 1973).

Davis, Gray, and Szigeti (as cited in Davis & Szigeti, 1986) report experiences similar to Steel's assertions described earlier with user participation in the design process for the office work environments for government employees. User participation resulted in much different plans from those that had been provided by design professionals. For instance, in large open plan office buildings, the designers decided that main circulation routes should run along the windows so everyone would have access to a view to the outdoors while walking around and that no middle managers or supervisors should have office space at the windows. The staff delegates reversed this and developed a plan that gave almost all subordinates and managers better access to a view and moved all main circulation to the interior. This plan also saved and provided a better functional environment.

User participation in the design process can also be a component of an organizational development effort, such as environmental change technology described by Conyne and Clack (1981, p. 117-149), who offer an environmentally based model of action research that builds upon several prior models. It involves a continuing flow of

steps from initiation through environmental assessment, change planning, change implementation, monitoring, modification, and stabilization to withdrawal. Conyne and Clack have elaborated on the meaning of environment to include organizational structure, characteristics of the setting and inhabitants, the social climate, and the reinforcement contingencies that exist in these settings. This is a concept that views human problems not exclusively in individuals or in their environments but in the interaction between the two. A concept that Becker and Steele (1995) call the “organizational ecology.”

Design Research and Process Methods Examined

Design is decision making, and the key to successful projects lies not only in the final form but also in the process leading to it (Broadbent, 1973). This process effectively allows for formal employee consultation and involvement, reflects a democratic attitude of management toward the workplace, and creates an atmosphere of trust and shared responsibility. The design process or strategy can be expressed as a sequence of techniques that generate an answer to a question and lead to the next question (Cross, 1984). The process of design is seldom simple and involves more than applied fashion or style (Pile, 1988). Design solutions must respond to diverse pressures that include formal ideas as well as human, environmental, and technical issues. The design process evolves from an interaction with people, events, problems, ideas, and images (Shoskes, 1989). The design process translates information from the requirements and constraints format into potential solutions the designer uses to meet required performance characteristics. Both the final form and the process leading to it are important. Poor design decisions can be costly to correct or can have lasting social implications (Gutman, 1988).

The assumption was for a long time that the designer knows enough about human needs based on personal experience. Yet, this assumption has proven wrong too many

times; therefore, the need arose for postoccupancy evaluations (POE) and pre-design research (PDR) as part of the design process (Bechtel, 1997). The use of systematic design processes for more complex projects has led designers to look at other disciplines and to collaborate with members of the social and engineering sciences, ergonomics, operational research, and others (Steven, 1975). Designers also employ the social and behavioral sciences for information and criteria with which to rationalize their design program and to evaluate solutions (Robbins, 1975). For example, territoriality, autonomy, social and behavioral techniques and unobtrusive measures, rank order, attitudinal questionnaires, and consensus surveys are all used to gather programming information. It has become common practice to use three or more methods because the message of social scientists has gotten through on the need for convergence of methods (Campbell & Fiske, 1959), that is, to have more than one method so that if the results are in agreement, one has more certainty of the validity of the results, and if they do not agree, one then suspects that something has gone wrong (Bechtel, 1997). Design process and research therefore considers the needs of special populations and how these populations interact with the physical environment. Methodological approaches vary according to the subpopulation involved (Zimring et al., 1986).

Although the environment is designed for the most part to accommodate certain explicit and implicit types of behavior, careful planning based on rigorous and relevant research is necessary to eliminate the possibility of undesired behavior. Once the opportunity for behavior is taken into consideration, it does not necessarily mean the desired behavior will occur. Consideration must also be paid to the norms governing people's activities in particular environments. The point is simple. Physical design, by itself, will not change behavior and guarantee teamwork. It can make some activities

more likely than others, and when in tune with the social and cultural system, it can create the kind of lively, interactive setting that supports collaboration (Becker & Steele, 1995). Edward Hall (1966) referred to the fact that in any culture the rules guiding how people deal with one another have strong spatial dimensions. Notions of privacy, for instance, differ from culture to culture but imply identifiable standards in a given setting. Within this normative perspective, Robert Sommer (1969) has contributed considerable information and work on institutional settings through his handling of environmental implications of interpersonal and spatial norms in such settings.

Bechtel et al. (1987), Zeisel (1981), and others explain the importance of observation as an unobtrusive method of data collection for basing design decisions. The practical application of surveys and other methods both as pre-design information gathering instruments (PDR) and for evaluation of the built environment (POE) ranging from micro to macro in scale have also been well documented in the literature. Pioneers in the field include Alexander (1977), Babbie (1995), Becker (1974), Dillman (1978), Farbstein (1982), Marans (1984), Pena (1977), Sanoff (1977), Sommer & Sommer (1986), Zeisel (1981), and Zube (1976).

Scale Modeling as a Design Research and Process Method

The past decades have seen the development of many innovative design research and process techniques, one of the most notable being modeling with scale model environments (1"=1'-0") (DeLong, 1976; Sanoff, 1991; Sommer & Sommer, 1986). Modeling becomes of particular value within the context of new forms of working. Modeling is versatile in its application and can be used for PDR and integrated in POEs. It involves people directly in the research rather than treating them as the objects of research. Modeling carries the elicitation of information a step further like no other method before.

The modeling process simulates actual day-to-day tasks and designs spaces that meet users' requirements. This process encourages users to become involved with each other and allows users to quickly and accurately express in a unique way what they need from and know about the particular environment and culture. Modeling is among the very few design processes and innovative design approaches that empower end users to actively participate in decision making during the design process itself.

From the very beginning of a project, it is extremely important to keep employees informed and involved. They need to know what is happening, where the process is leading, and which designs are being created and tested. Employee involvement can take the form of informal interviews, structured feedback from focus groups to the design team about preliminary designs for workstations and common areas (Becker & Steele, 1995), and the review of a scale model mockup of a section or entire floor of the building. The latter form promises to yield the largest and most effective impact. The key in the design process is to effectively elicit accurate tacit design information from lay people who are not trained in the communication of design problems. This gives users a chance to test layouts and provide feedback for adjustments, thereby meeting the goal of keeping an informed, enlightened, and interested workforce involved in the process of creating or changing their workplace.

Within the context of organizational change, modeling can be thought of as a kind of living simulation, a chance to experience altered states of consciousness associated with new ways of working. Scale-modeling allows organizations and employees to test new realities without involving great cost. Modeling projects make it possible to demonstrate organizational benefits that otherwise would remain abstract and, in some cases,

unimaginable. The goal is to transform abstract concepts into concrete experiences and to do it within the relevant context of the organization.

A facilities programmer and/or organizational development specialist may serve participants as an informed facilitator. This role involves facilitating the group process, ensuring that what a participant communicates is correctly understood and that facts are technically valid, and helping participants apply principles of decision theory and design methodology to their decision making. No technical specialist or professional expert has the authority to overrule the participant planning group, not even within his or her area of expertise.

Modeling brings a number of positive influences into the design process, such as:

- opportunities to bring employees together;
- development of a number of communication channels;
- support of diverse work habits;
- acknowledgment of the anxiety that change sometimes generates;
- a forum through which employees can learn about change;
- a participant interactive dialogue that releases tacit information that is critical to design decisions; and
- the fostering of naturally evolving identification with the culture of the work group.

As a result, spaces require fewer adjustments, if any, after they are built, and significant design time has often been saved. An example of modeling includes the case of a large quasi-governmental agency in North America. This agency has used modeling over the past several years for nearly 200,000 square feet, and they have been able to involve

virtually all employees in the process while reducing design cycle time and design cost on the average of about 50% (DeLong, personal communication, April 20, 1997).

Other examples of modeling include the following. A modeling kit representing building components was developed for a Canadian cooperative program by Bentz (as cited in Sanoff, 1991) so that families could visualize their selection of house design chosen from a variety of sources. For Council housing in central London, United Kingdom, architect Nabs Hamdi created a new series of communication aids to encourage user participation in the design process (Low, 1980). His tools allowed people to control the organization of their space while at the same time looking at possible consequences of their decisions. In Niederoesterreich, (Austria), an interdisciplinary consortium consisting of participants from the fields of architecture, sociology, environmental control systems, and structural engineering successfully used scale modeling for the framework of a 1973 architectural competition titled "Wohnen morgen-Hollabrunn." Modeling was used within the context of possibilities for individual housing and democratic planning and participation. Scale modeling (scale 1:20; see also DeLong, 1976) was introduced to the consortium by Joseph P. Weber, a Dutch expert on scale modeling. It was used with the clients to individually design and discuss 70 apartments (Dirisamer et al., 1978).

The Laboratory of Architectural Experimentation (L.A.E.) at the Ecole Polytechnique Federale in Lausanne, Switzerland, was instituted to allow a more tangible appreciation of design intentions during the design process. Modular blocks are used to construct full-scale mockups of prospective houses, permitting testing of the three-dimensional implications of two-dimensional plans. The L.A.E. was initially conceived as a teaching tool for architecture students at the Ecole Polytechnique, but rather than relying on untested mental images of what they design, students can actually build and experience

what they draw. The facility has also proven useful and insightful to practicing architects, clients, and public agencies in designing new or remodeled environments. The full-scale simulator has been used and proven successful for home design by members of a housing cooperative in Switzerland (Lawrence, 1983).

Duffy (1997) emphasized the use of scale model mockups as one data collection method for the programming phase for Andersen Consulting Worldwide's new office building in Chicago, Illinois. HOK (Hellmuth, Obata + Kassabaum, Inc., of St. Louis, Missouri), the primary consulting firm for Nortel (Northern Telecom), chose scale modeling ($\frac{1}{2}$ " scale) on a magnetic board as the method for data collection in the programming phase when they had only 11 months to convert 600,000 square feet of high bay manufacturing space into a "new wave" office environment for approximately 3000 employees. As a result the facility management team of Nortel proudly emphasized that every individual or team in "The City Brampton" could plan their own space. Postoccupancy evaluations show that Nortel employees are highly satisfied with their new office environment, and relatively few adjustments were needed after the new building was occupied in 1996 (Lopinski & Glancey, 1997).

CHAPTER III

Conclusions and Discussion

Conclusions and Discussions in Context

The framework of current trends and developments consequently leads to the conclusion that it is no longer sufficient to design facilities in the traditional way. Facilities managers, designers, and architects must learn to create solutions for the workplace differently than they have in the past. They must make indispensable decisions on new design processes--like modeling--for the planning and design of office environments that engage the end user and create a fundamental base for social relations in an organizational ecology. In addition, they must decide on a new design process--like modeling--that is cost-effective and allows for reduced design time in a fast changing business climate. Organizations can no longer afford to rely on traditional design processes that often take so long that by the time the actual plan is implemented the situation has already changed and the design is obsolete. These processes also leave out the people who actually know best what they need effectively to do a job.

Most authorities agree (Howell, 1993) that the most important aspect of future work environments is change. Evidence suggests that environmental change has caused conditions that lead to increased levels of dissatisfaction, displacement, and inefficiency among office employees (Spreckelmeyer, 1993). Therefore, the transition from a conventional nine-to-five job to alternative forms of work must involve careful planning and consideration. These new forms of work can only be successful by integrating the person, the arrangement, the business, and the appropriateness of each in that environment. Substantial employee relationships improve the chances of success by providing a necessary and cohesive anchor. As more people shift toward more

autonomous and democratic forms of work, companies will need to hold their employee's attention if they are going to keep committed, loyal, and productive employees.

Models for alternative office strategies must break down hierarchies and emphasize flexibility. Office environments must be chameleon-like and change depending on the types of tasks being performed. Not only are these types of environments more appropriate for the way offices operate today, but they are the only ones that allow employees to enter and leave the environment without giving up their status. Although offices are becoming less and less spatial, attention toward creating an enriching and supportive office environment is more crucial than ever with alternative office concepts. Today's office environment must be a range of generic work spaces with the flexibility to easily configure and reconfigure depending on the needs--more enclosure, less enclosure, a small-conference room, display and presentation spaces, or a place to relax. The work spaces must be so generic that they can be used by varying numbers of staff at different times, supplemented by highly serviced support spaces, technical resources, and meeting spaces that will transform the quality of the environment. This kind of spatial solution to new working patterns has been defined by Stone and Luchetti (1985) as "the multiple activity setting." This model is already being followed in some European countries and America where the dichotomy of open and enclosed space is replaced by work spaces in which large portions of individual offices are combined with a large degree of shared facilities and new work spaces where people share offices.

Generic spaces fused with information technology and electronics will change the quality of the office environment. The building design as a whole will move away from a modernist slant of Mies van der Rohe's glorification of the industrial building that expresses function. Solely expressing function is absurd, in that it inhibits change and

encourages conformity--accommodating functions is what works. The design will escape the industrial vocabulary and take on a new vocabulary of "iconography and electronics," and it will foster communication and interaction. The physical aesthetic of the building design will no longer be the sole defining influence, but rather be complemented or replaced with information technology and electronics, adapted from a vocabulary of the commercial world and expected by our society. The office building will foster and serve interaction, that is, the design will be understood and supported by a broad audience, common people and the highly educated alike. In a way, the building design will go back to the concepts of the 17th century baroque church, where the elaborate ornamentations are understood and appreciated by many, but where the complexity of the geometry and mathematics are primarily appreciated by the initiated.

The spatial and mechanical flexibility is particularly significant today for accommodating dynamic change inside, change that involves processes and technologies. There is a particular relevance of generic space in today's offices where dynamic functions change over time at a quick pace and where architectural essence is becoming no longer spatial but iconographic. Functions need to be accommodated rather than expressed, for change that is more characteristically revolutionary than evolutionary and that is dynamically wide in its range--spatial, programmatic, perceptual, technical, iconographic--where in our time functional ambiguity rather than functional clarity can accommodate the potential for things never dreamed (Venturi, 1996).

As the office changes from a space to perform routine tasks to an idea and decision center combined, supported and integrated with information technology, the workplace evolves into a different entity and achieves a new status in the corporate world. Businesses have the means to demand more of their facilities design and to insist that it be

made to work for them, not reinforce outdated office organization. Since employees will be working remotely at different times and at various organizational levels during the week, the workplace will become less formal. Informality encourages adaptability and discourages territoriality, and in informal environments, status distinctions become less important.

Emerging Design Features and Concepts

From a facilities planning viewpoint, these new styles of working and new organizational forms translate into seven fundamental design features and concepts that need to underlay the decisions made by employees, designers, and executive management before and during the modeling process. These seven fundamental design features are in part also influenced by previous work of Becker & Steele (1995).

1. Periodic meetings with senior management are necessary and will allow the facility management department to keep the facility plans consistent with corporate planning, allowing a seemingly rapid response to organizational change.
2. Certain decisions must be made by top management, largely without formal input from employees. These include choices about the site location, the basic building form and system, perhaps materials, and whether to use modeling as the design process method for the office design.
3. Unobtrusive accommodation of IT must be everywhere. This can be done through floor plinths, conduits that run along cornices, or lines within suspended ceilings. While this may seem trivial, supplying this kind of infrastructure gives an office the freedom to restructure itself in multiple ways without having to rewire or retrofit. This means that an office can support mobile individuals and groups working at their desks, in lounge areas, or in a conference room. Information must be available and accessible

everywhere and any time. It also allows groups to stake out space needed for a project and then assemble equipment and furniture in a way that facilitates getting the work done.

4. Load-bearing and nonload-bearing walls must be eliminated as much as possible. They inhibit flexibility and discourage the flow of communication; therefore, they must only be used to define major areas. Partitions must also be used sparingly. Erecting individual cubicles turns the office into a maze and again discourages communication. Instead, partitions should be used to form single corners so that workplaces can open onto one another.

5. Adjacencies must be approached with the intent to promote "functional inconvenience." The idea behind this is to encourage movement through a building, thereby increasing personal contact and communication among individuals and groups who might otherwise never meet. Project rooms, conference rooms, laboratories, and break areas must be distributed throughout the building rather than minimizing the travel distances between offices. The process of getting from one point to another in an office must take an individual through some office activity so that a sense of awareness, interaction, and participation is fostered. Finally, eliminate halls. Circulation spaces can double as work areas. A series of narrow passages creates wasted space. Of course, all of this only works if it can be assumed that the management policies encourage impromptu communication and doesn't project it as lost work time.

6. Mixed "neighborhoods" must be created where people from different disciplines--engineers and designers, marketing and finance people, and managers--share an area. However, this mixed "neighborhood" must be created with the intent to foster communication across disciplines and to establish working relationships through increased trust and greater tolerance for diversity in work and personal styles.

7. Activity generators must be created to maximize visibility between different floors and offices through the use of informal gathering places where employees run into each other, areas such as cafes or plazas in ancient European cities or metropolitan downtown areas. The key is to provide the right amount and quality of activity generators. Too many will decrease the likelihood of accidental meetings and people becoming acquainted with new faces. Too few will end up in crowded spaces and will not be well received in North American culture. Of course, organizational leaders need to set an example by using such spaces as they are intended, thus making it clear that it is acceptable and even encouraged to take work into these spaces.

The Scale Modeling Process Explained

The modeling process explained below is a combination of a summary of the Modeling Guideline, an unpublished white-paper written for the Tennessee Valley Authority (TVA) by B. R. Copeland and W. D. Robertson, Jr. (October 1994), in consultation with Dr. A. J. DeLong, professor of interior design at The University of Tennessee, and the personal experience with scale modeling research of the author. The Modeling Guideline details step-by-step all planning and preparation tasks to facilitate modeling sessions and how to complete or close the process. This summary is provided here, however, to highlight the main points of modeling and with explicit permission of the authors B. R. Copeland and W. D. Robertson, Jr.

Initially, it is very important to explain to executive management the value of the modeling process versus traditional design methods. It is imperative that facilities planners effectively sell this method and its added value to executive management. They need to understand the planner's role as a facilitator during the process and what customer participation will yield on the bottom line. Executive management needs to buy into the

idea and understand the value of the modeling process to receive full support and backing. This may seem trivial, but this fundamental issue must be addressed for a successful project start.

The modeling process consists of three parts: (1) planning and preparation, (2) conducting the modeling sessions, and (3) completing the process. Each part involves several steps. The key to successful modeling lies in being fully prepared and having a logical progression of parts and steps leading up to the actual modeling sessions.

Planning and Preparation. As with traditional methods of space planning and design, complete and accurate information up front ensures the delivery of on-target services. Obtain all pertinent background information about the customer and the project. Make use of other scientific PDR methods--participant observation and surveys--to obtain pertinent information to scientifically verify and compare with triangulation of methods the accuracy of the results that the modeling sessions will yield.

Use this information and current design guidelines and standards to determine the modeling pieces that are required. For instance, for workstations determine panel, component, and accessory requirements. For ancillary areas study building zoning concepts and review data from the background information and check special equipment needs.

It is important to think about real furniture needs and issues, such as availability, inventory, new purchases, and delivery times. It is imperative that the model furniture pieces needed in the modeling process and ordered from the manufacturer reflect exactly the actual furniture to be used in the built-out space. The furniture pieces need to be

manufactured with authenticity and with quality. Flimsy and inaccurate pieces will detract from the reality of the project and will not work for successful modeling sessions.

At this point a meeting should be set up by the project core team and include its representatives and the customer's upper management. The purpose of the meeting is to bring key members of all involved parties together to focus on the kick off of the project. The meeting must address the customer's vision, project parameters and scope, modeling schedule, customer's role, and other pertinent issues. During this meeting a decision must be made as to the site where the modeling session will be held.

After the groundwork is laid and agreement is reached with executive management, the customer's management needs to hold a vision session, that includes its members, all employees, and members of the project core team. The purpose is for management to discuss the project's rationale, vision, and parameters with everyone involved. The purpose is also to ensure that everyone understands the desired outcome of user participation in the project and what it will yield.

The ideal group size for a modeling session is six or less members. This is due to the practicalities of working with the model and to studies that show communication is impeded by larger modeling groups. Management needs to divide the customers into modeling teams and identify a team leader. These teams tend to evolve from logical divisions of tasks within the corporate structure.

Conducting the Modeling Session. At this point in the process, the preparatory work is completed, the sessions have been scheduled, and it is time to start modeling. During the modeling session the facilitators must keep in mind that the customers are entering an unknown territory and may feel uncomfortable. It is important to help the customers feel

confident in the modeling process and remind them of the seriousness and value of this method.

Some important points for the facilitators to keep in mind are:

- modeling sessions should not last longer than two or three hours;
- customers should be encouraged to rely on their feelings and instincts;
- customers should not be pressured, because they will invent a rationale just to complete the task;
- facilitators should question participants as to why rather than suggest why he/she arranged something in a particular way;
- design guidelines, codes, and standards should be translated to ensure that the modeled solution is possible to construct, otherwise this means the participant will need to remodel.

Before the actual project can be modeled, it is crucial to engage the customers in an orientation exercise. These exercises are designed to help orient the customer to the model. For instance, the facilitator can ask customers to position real chairs in the room so that the space between them is equivalent to the scale distance between the two scale model chairs. The purpose of the exercise is to get a feel for the relationship between scale model and the actual chair.

The actual process of modeling is made up of three different stages of modeling sessions--with team leaders only, with each modeling team one at a time, and with all modeling teams together. The stages are designed sequentially to build on the work and solutions generated in the previous one. Each stage targets a different customer grouping, moving from team leaders to individual teams to the customer group as a whole. In the

final stage with the whole customer group, the project design solution takes shape and is finalized.

The goal of stage one is to determine adjacencies. The task is to locate work groups or teams within the project space and is accomplished by modeling-team leaders who are empowered to act as representatives of their team.

In stage two each modeling team is scheduled to work alone at the model to create individual spaces. During these team sessions, each participant is asked to use model pieces to design his/her ideal environment for supporting his/her work process. Depending on the individual's work process, the space can involve a fixed workstation, file room, private spaces for making phone calls, a team table, a computer terminal for concentrated work, a drafting board, etc., and/or a combination thereof. The objective is to design the ideal environment in response to the work process. Conflicting needs will be resolved in the next stage. The creation of group and team spaces occurs also in this stage after each person has designed his/her own ideal work space in the preceding step. In this phase the goal is to bring team members together to decide how to integrate the individual solutions into a workable, cohesive whole-team space. In the final stage of modeling, all teams work together. Each team presents its design to the others, and the model is used to resolve conflicts until the optimum, agreeable solution is attained.

Completing the Process. After designing the team's collective space and after creating the whole customer space, the results must be documented with photographs, sketches, and/or video recordings. After documenting the collective spaces, the individual work spaces must be documented. For individual work spaces documentation, the use of a

35mm camera with date and time stamp or Polaroid© snapshots labeled with time and date are most effective.

At appropriate points in the process, CAD documentation can also be useful and can expedite the completion of construction documents later on. In some instances the projects can be built directly from the model. TVA has experimented with this and has found it to be more successful on smaller projects where the model can be moved to the construction site. After the model is sufficiently documented and the modeling sessions completed, the modeling pieces must be packed and inventoried and stored for future projects.

Final Concluding Remarks

This study certainly has its limitations and needs further empirical testing and research of modeling as an effective design process method and the emerging design features. Still, in conclusion this study suggests that with the current economic trends and changes in the business environment, the attention to the designed environment and the design process leading up to it are indispensable and may create a big advantage for companies that recognize their power. With the previously outlined seven fundamental design features and concepts underlying the design decisions of alternative office environments, the proper design process--modeling--can create an indispensable asset. This effective and cost-reducing design process may lead to a totally new use of the corporate facility as a tool to foster and encourage social interactions, learning, and the creation of new knowledge. A tool that allows for accurate design solutions in the short timeframes required today and the opportunity for unifying cooperation among workers may facilitate the first step for groundbreaking communication in a more than ever socially isolated society in the information age.

Future Research

Through this study, the author uncovered the need for empirical research on scale modeling during the design process that allows user participation and decision making. To investigate realistically the underlying implications of the design process in a field study situation, the involvement of several corporations, such as IBM, Digital, and Amoco, that deal with real problems in real time is essential. The studies should include cross-organizational samples, groups, and individuals. Future empirical research should address issues like reduction of costs in design time, increase of social interactions and communication, and satisfaction with both the designed environment and the premise that leads to effective work styles and a better quality work life.

Reduction of Costs in Design Time. Studies should be conducted to determine whether trends suggested in this study hold up to the promises and whether costs of design time can be reduced. These costs include the initial design costs, retrofitting of designed spaces after moving in, and responsive solutions to quick and sudden changes in the business environment. Studies should include both green field sites and remodeled environments.

Increase of Social Interactions and Communication. Studies should investigate the effects of democratic decision making in the design process, facilitated with modeling, on the interpersonal relations between employees and executive management. Does modeling lead to increased communication and foster a sense of trust and respect? Does modeling foster group cohesion? Does the design process foster a base relationship among employees and employers that is carried on beyond the initial design process? Does modeling effectively communicate the corporate culture to the newcomer?

Satisfaction with the Designed Environment Leading to Effective Work Styles and a Better Quality Work Life. As suggested in the study, satisfaction with the designed environment and the business climate should increase effectiveness. Changes should be easily accepted by employees, and employees should stay more loyal to the corporation due to a heightened sense of influence over decisions about the way work is performed. As a result, productivity should increase. An investigation into this issues and modeling will be indispensable in future research endeavors.

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Vita

Christian Kasper was born in Zurich, Switzerland, on June 30, 1969, and moved later to Klosters. He attended elementary and secondary schools in the public system of Zurich and Graubunden. After completing his secondary school education, he entered in the Gewerbe Schule Davos and the Berufsmittelschule Chur, where in 1989 he received a Certificate of Proficiency in Carpentry and Design. He then enlisted in the Swiss Army Reserves with the Corps of Engineers and served in active duty for the time required by the Federal Government of Switzerland. After serving his military duties, the author enrolled in the Gewerblich Industrielle Berufsschule Bern and the Schule fur Gestaltung, where in 1992 he received a complimentary Certificate of Proficiency in Interior Design and Furniture Design. While working on both programs leading to Certificates of Proficiency, the author continuously worked as an apprentice designer in companies affiliated with the schools, gaining practical experience and expanding his knowledge beyond school work.

After working for a year as a professional interior designer and project manager in Switzerland, the author entered the Ringling School of Art and Design in Sarasota, Florida, where in 1995 he received a Bachelor of Fine Arts in Interior Design and Space Planning. In August 1995, he enrolled at The University of Tennessee, Knoxville, to pursue a Master of Science in Interior Design. In December 1997, he received his M.S. Degree. While pursuing the Master of Science Degree, he continuously taught as a co-instructor and worked on various consulting projects through the Department of Interior Design under a half-time graduate teaching assistantship awarded on a competitive basis by the College of Human Ecology and the College of Architecture and Planning at The University of Tennessee, Knoxville. Over the years, the author has received several

awards for excellence in design and research. The author is a member of the Kappa Omicron Nu national academic honor society and a student member of IFMA, IIDA, and ASID.