

Pattern Language: A Design Tool for Collaborative Work Environments

by

Deepika Sangoi

A Thesis Presented in Partial Fulfillment  
of the Requirements for the Degree  
Master of Science in Design

Approved November 2011 by the  
Graduate Supervisory Committee:

Diane Bender, Chair  
William Heywood  
Beverly Brandt

ARIZONA STATE UNIVERSITY

December 2011

## ABSTRACT

Interior design continues to re-define itself as a discipline that presents designers with new problems that require innovative solutions. This is particularly true in the case in office design. The transformation of the office environment from the standard bullpen configuration to today's dynamic, flexible, and open floor plans has required new design methodologies that incorporate tools and technologies that are readily available to interior designers.

Today, increased use of teams in the workplace challenges interior designers to create environments that accommodate both group and individual tasks (Brill, Weidemann & BOSTI associates, 2001). Collaboration has received considerable attention as organizations focus on productivity and reducing costs to compete in a global economy (Hassanain, 2006). Designers and architects should learn to create environments that respond to dynamic, moveable, and flexible work methods.

This web-based research study explores the use of pattern language as a new tool for designing collaborative work environments. In 1977, Christopher Alexander and his associates developed 'Pattern language' (Alexander, Ishikawa & Silverstein, 1977) as a design formulation methodology. It consists of a series of interrelated physical elements combined to create a framework for design solutions.

This pattern language tool for collaborative work environments was created based on research by Lori Anthony (2001). This study further builds upon current trends and research in collaborative work environments. The researcher conducted a pilot test by sending the web-based tool and an online questionnaire to all graduate students and faculty members in the fields of interior design and

healthcare and healing environment (HHE). After testing its validity in The Design School at Arizona State University, the same tool and questionnaire was sent to the employees of one of the leading architecture and interior design firms in Phoenix, AZ.

The results showed that among those design professionals surveyed, the majority believe pattern language could be a valuable design tool. The insights obtained from this study will provide designers, architects, and facility managers with a new design tool to aid in creating effective collaborative spaces in a work environment.

*Aashish, I made it!*

## ACKNOWLEDGMENTS

I am particularly grateful to my committee chair, Dr. Diane Bender, for her exceptional support, direction and guidance throughout the entire research process. I am indebted beyond words to her for being such a special mentor. I would also like to thank Dr. Beverly Brandt and Dr. William Heywood for motivating and sharing their fabulous wealth of knowledge.

I would also like to thank Gensler Phoenix team for providing an excellent example of a collaborative workplace. In particular, I would like to thank the Principal designer at Gensler, Beth Harmon-Vaughan who was kind enough to get me the necessary data for the study.

I would like to thank the entire faculty at The Design School for being supportive of my research and providing valuable guidance. Finally, I would like to thank all my friends and family for their support.

## TABLE OF CONTENTS

	Page
LIST OF TABLES .....	x
LIST OF FIGURES .....	xi
LIST OF DEFINITIONS .....	xii
CHAPTER	
1 INTRODUCTION .....	1
1.1 Background .....	1
1.2 Scope of Study .....	2
1.3 Objectives of the Study and Research Questions .....	3
1.4 Significance of the Study .....	3
1.4.1 Pattern Language as a Design Tool .....	3
1.4.2 Collaborative Work Environments .....	5
1.5 Conceptual Framework .....	7
1.6 Thesis Organization .....	7
2 LITERATURE REVIEW .....	9
2.1 History of Open Office Planning .....	9
2.2 Collaboration at Work .....	16
2.2.1 Social Dimensions of Collaborative Work .....	17
2.2.2 Individual Aspects of Collaborative Work .....	18
2.3 Factors Affecting Collaborative Work Environments .....	18
2.3.1 Community Connections .....	18
2.3.2 Welcoming Entry .....	19
2.3.3 Public Spaces that Tell a Story .....	19

CHAPTER	Page
2.3.4 Main Street Thoroughfare.....	20
2.3.5 Social Hub .....	20
2.3.6 Town Halls.....	21
2.3.7 Team Huddle Space.....	21
2.3.8 Heads-down Space .....	22
2.3.9 Work Areas on Wheels.....	22
2.3.10 Technology Access .....	23
2.3.11 Let there be Light.....	23
2.3.12 Vertical Surfaces .....	24
2.3.13 Comfortable Work.....	24
2.3.14 Wide Stairways.....	25
2.3.15 Stay Close .....	25
2.4 Conclusion.....	26
3 METHODOLOGY .....	27
3.1 Introduction.....	27
3.2 Research Design.....	27
3.2.1 Approach .....	27
3.3. Phase One.....	28
3.3.1 Review of Literature.....	28
3.3.2 Research Statement.....	28
3.3.3 Pattern Language Website .....	28
3.4 Phase Two .....	29
3.4.1 Research Instrument Identification: Online Survey.....	29
3.4.2 Description of the Online Survey Instrument .....	30

CHAPTER	Page
3.5 Phase Three .....	31
3.5.1 Facility Identification .....	31
3.5.2 Pilot Study .....	31
3.6 Phase Four .....	33
3.6.1 Data Collection .....	33
3.7 Conclusion.....	33
4 RESULTS OF DATA ANALYSIS .....	34
4.1 Introduction.....	34
4.2 Participants.....	34
4.3 Sample Demographic Data .....	34
4.4 Data Analysis.....	35
4.4.1 Community Connections .....	37
4.4.2 Welcoming Entry .....	37
4.4.3 Public Space that tells a Story .....	37
4.4.4 Main Street Thoroughfare.....	37
4.4.5 Social Hub .....	38
4.4.6 Town Halls.....	38
4.4.7 Team Huddle Space.....	38
4.4.8 Heads-down Space .....	38
4.4.9 Work Areas on Wheels.....	38
4.4.10 Technology Access .....	39
4.4.11 Let there be Light.....	39
4.4.12 Vertical Surfaces .....	39
4.4.13 Comfortable Work.....	39



CHAPTER	Page
4.4.14 Wide Stairways .....	39
4.4.15 Stay Close .....	39
4.4.16 Addition of any Pattern(s) .....	40
4.4.17 Removal of any Pattern(s) .....	40
4.4.18 Revision of any Pattern(s) .....	40
4.4.19 Overall Usefulness of Pattern Language Tool .....	40
4.5 Conclusion .....	40
5 DISCUSSION AND CONCLUSION .....	42
5.1 Introduction .....	42
5.2 Discussion of Results .....	42
5.2.1 Work Areas on Wheels .....	42
5.2.2 Vertical Surfaces .....	44
5.2.3 Wide Stairways .....	46
5.3 Addition of patterns .....	47
5.3.1 Access to Outdoors .....	48
5.3.2 Fun at Work .....	49
5.3.3. Color and Feel of the Space .....	50
5.4 Limitations of the Study .....	51
5.5 Future Implications .....	52
5.6 Conclusion .....	53
REFERENCES .....	55
APPENDIX .....	61
A PILOT STUDY - EMAIL LETTER .....	61
B PILOT STUDY - SURVEY .....	63

APPENDIX	Page
C PILOT STUDY - FOLLOW UP EMAIL .....	72
D PATTERN LANGUAGE WEBSITE .....	74
E RESEARCH - EMAIL LETTER .....	94
F RESEARCH - SURVEY .....	96
G IRB APPROVAL .....	103

## LIST OF TABLES

Table		Page
1.	Office Philosophies and Office Concepts .....	14
2.	Sample Demographics SPSS Frequency Output.....	34
3.	Percentage Distributions, Means & S.D for Fifteen Patterns for Collaborative Work Environments .....	35
4.	Percentage Distributions, Means & S.D of the Overall Usefulness of the Pattern Language as a Design Tool .....	36

## LIST OF FIGURES

Figure		Page
1.	Conceptual Framework for Collaborative Work Environment.....	7
2.	Atrium of the Larkin Building, 1906, Buffalo, NY .....	9
3.	Bullpen Setting in a Call Center .....	10
4.	Example of Buerolandschaft Workplace .....	12

## LIST OF DEFINITIONS

1. Collaboration: Two or more people working together over time to produce a joint product or other outcome (Kraut, Edigo, & Galegher, 1990), effective collaboration entails both individual focused tasks and interactive group work (Heerwagen, Kampschroer, Powell, & Loftness, 2004).
2. Knowledge work: The work that occurs primarily because of mental processes rather than physical labor such as planning, interpreting, developing and creating products and services using information, data or ideas as the raw materials (Heerwagen, Kampschroer, Powell, & Loftness 2004).
3. Open office: The work environment featured by the absence of internal walls between workstations, either of all workstations, or a majority of workstations.
4. Telepresence system – It is a high-end videoconferencing system and service usually employed by enterprise level corporate offices. Telepresence conference rooms use state-of-art room designs, video cameras, displays, sound-systems and processors, coupled with high-to-very-high capacity bandwidth transmissions.

## Chapter 1

### INTRODUCTION

#### *1.1 Background*

In today's world, work in offices is more knowledge-intensive and cognitively complex, shifting from data processing to the creative application of ideas and information (Laing, 2006). Among the most important changes in the nature of work in offices is that it has become more interactive and collaborative (Lawler, 2001). The physical environment is still important but its role is changing. Today's organizations use physical environments to emphasize brand, reinforce engagement, and anchor loyalties. Work environments are becoming hives of social activity and hotbeds for creative and innovative interactions (Langhoff, 2007). Twenty-first century workplace design is being affected by the changing economy (Hassanain, 2006). As is the case within every field, workplace designing also has new problems that require innovative solutions. Organizations have started realizing that merging people with specific specializations in a cohesive group is more successful in achieving both organization and economic goals.

Parallel to the emergence of work teams, the focus has shifted to the socio-psychological needs of the workers. These are needs that address human nature, interests, or affairs (Oseland, 1999). Stephen Kosslyn (2007), a professor of psychology at Harvard University, has noted that people often grapple with problems in groups, be they formally designated teams or casual huddles around the water cooler. Just as a mechanical calculator can extend a person's mental capacities, other people help to extend personal intelligence—both in a cognitive sense (as required to solve problems) and in an emotional sense (as required to

detect and respond appropriately to emotions and those of others). In this way, he explains, other people can serve as extensions of one's own brains by filling in for their individual cognitive and emotional limitations. Based on Gensler's survey in 2008, organizations have realized a strong link between workplace quality and business performance. Workplace quality, the company's ranking within its sector, profitability, innovation, overall job satisfaction, and retention of employees are closely linked.

Today's employees are perceptive regarding the style and design of their environment. Many companies are finding that providing a productive, flexible, and dynamic work environment can be a critical asset in attracting and retaining valuable employees (Earle, 2003). Today, interior designers and architects have to address both the socio-psychological and physical needs of the employees.

This study will explore the possibility of using pattern language as a valuable tool for designing a collaborative work environment. Pattern language is a design formulation methodology developed in 1977 by Christopher Alexander and his associates. The insights obtained from this study will provide designers, architects, and facility managers with the informational tools necessary to create effective collaborative spaces.

### *1.2 Scope of the Study*

The focus of this study is to develop a tool which could be readily useful to design the collaborative work environment. In order to develop this tool, the researcher needs to consider several things such as:

1. The tool should be based on current trends and research.
2. The tool should be simple, quick, and easy to understand.

3. The tool must address both the physical and socio-psychological needs of the user.

The purpose of the research study is to explore the effectiveness of pattern language as a design tool.

### *1.3 Objectives of the Study and Research Questions*

The objectives of this research study are to:

1. Redevelop pattern language for collaborative work environments based on related recent research.
2. Identify the factors that are important in designing collaborative work environments.
3. Test the pattern language for collaborative work environments for its usefulness as a design tool by obtaining feedback from expert designers.

The underlying research question for purposes of this study is:

How useful is pattern language as a design tool for designing collaborative work environments?

### *1.4 Significance of the Study*

To understand the significance of the study, this section provides rationale for the following:

1. Pattern language as a design tool
2. Collaborative work environments

#### *1.4.1 Pattern Language as a Design Tool*

For the purpose of this study, pattern language was explored in terms of a design tool. The American Society of Interior Design (ASID) selected author Christopher Alexander's 'Pattern language' as one of '25 Products that Rocked design' (Blixt, 2001) in 2001. He also received a special citation from ASID in



2005. Published in 1977, the Alexander's book consists of 253 patterns. Each pattern consists of a title, picture/illustration representing the pattern, description of the pattern, and the justification section. This makes it easier to understand each pattern without conscious effort. Pattern language can be thought of as a set of graphic design guidelines that integrate context. Instead of graphic standards that prescribe primarily sizes or minimum clearances, pattern language provides a more powerful method to combine socio-psychological factors in a graphic and written format into the interior design process (McLain-Kark, 2001). In a pattern language, individual patterns are not isolated. The structure of the language is organized by scale, considering for example, something as large as building complex to something as specific as main entrance.

Although pattern language has been influential in the architectural and urban planning disciplines, an unusual venue for its use and implementation has been among healthcare professionals (Khambaty, 2000) and software developers (Coplien & Schmidt, 1995). Using Alexander's model as a framework, software developers have rallied around the use of pattern language for developing new products, improving processes, and evaluating problems and solutions (Coplien & Schmidt, 1995). It is appropriate as a design tool due to the following reasons:

1. It simplifies the process from large and complex system;
2. It provides a way to document and share the expertise in an independent fashion;
3. It allows the user to use it in infinite ways without ever utilizing it in the same way twice;

4. Documenting the patterns and referring to it when designing helps a less experienced professional to create quality output;
5. It helps to communicate the guidelines quickly.

The concept of pattern language coupled with a more efficient method of communication such as the internet was explored in this study. From day-to-day e-mails to checking codes, the World Wide Web has become an integral part of communicating in the field of Interior design (Piotrowski, 2007). Therefore, this research will explore the possibility of using web-based pattern language for collaborative work environments as a valuable design tool. Likewise, developing a pattern language for collaborative work environments will provide an effective team experience that, in turn, will enhance a socio-psychological satisfaction while achieving organizational goals.

#### *1.4.2 Collaborative Work Environments*

There is a strong belief that there exists a direct relationship between the success of a business, and the design of the workplace (Shuman & Scott, 2002). Supporting this view, Johansson, Frost, Brandt, Binder, & Messeter (2002) stated that the process of designing contemporary workplaces in office buildings requires a new approach in order to address the upcoming challenges adequately. Among the most important changes in the nature of work in an office is that it becomes more interactive and collaborative (Lawler, 2001; Nadler, 1997), and more dependent on social skills (Heerwagen, Kampschroer, Powell, & Loftness, 2004). The scale, complexity and multi-disciplinary nature of tasks as well as the ever specialized workforce make high quality collaboration more and more critical for the efficiency, profitability and competitive advantage of organizations (Duffy & Powell, 1997; Ilozor, Lover, & Treloar, 2002).

Although collaboration was only used sporadically in the United States from the 1960s to the 2000s, it has become a work method that has influenced many corporate restructuring plans in the past decade (Van Aken, 2000). The International Facility Management Association (IFMA) in 2007 reports that between 2002 and 2007, the amount of space devoted to conference, training, and break out areas in the workplace increased 17%. The causes are management's desire for more collaboration and the reduction of individual workspace footprints (Steelcase, August 2008).

Compared to the past, people are spending less time seated at their office desks and more time moving about the workplace, collaborating and holding impromptu meetings with co-workers in secondary office space settings (Workspace Inc., 2002). In 2001, BOSTI Associates carried out a workplace study of 13,000 office workers in 40 business units in multiple industries. The self-reported results revealed that 14% to 22% of an average working day is spent away from one's own workstation when people are in the office. Taking into account the time working away from the office, the 2002 Steelcase Workplace Index (SWI) survey of 977 office workers identified that only one-half of the work week (20 out of 40 hours) is spent working at one's own desk. The SWI survey, administered among thousands of office workers, has found collaboration and comfort as two keys to productivity in the workplace (Steelcase, 2002).

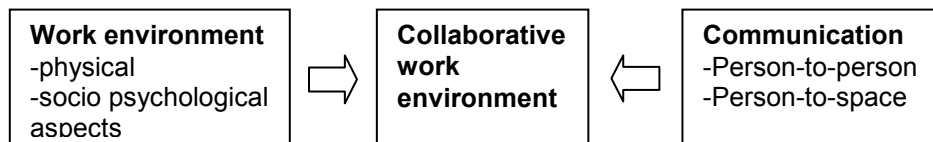
The Microsoft Office Personal Productivity Challenge (PPC) Survey (2005), which drew responses from more than 38,000 participants worldwide, revealed that 5.6 hours out of an average of 45 hours each week are spent in meetings; whereas the Steelcase Workplace Index (SWI) Survey reported, on average, 7 hours per week are spent in meetings. Besides scheduled meetings,

large amounts of interaction at work are actually unplanned. There are many impromptu and short-duration communications for various purposes, for example networking, seeking information, and problem solving.

Responding to this intense interest in collaboration, the design professions, consulting community, and furniture industry have all developed new workplace concepts, spaces, tools, and furnishings intended to support these flexible, dynamic work methods (Heerwagen, Kampschroer, Powell & Loftness, 2004).

### *1.5 Conceptual Framework*

Based on the major aspects of the collaboration in the work environment and the review of the literature, the following conceptual framework was developed. As illustrated in figure 1, the framework identifies resources for work environments and communication as the two major aspects of collaborative work environments. In terms of work environment, the study is focused on physical and socio psychological aspects. In case of communication the study is focused on interaction between person-to-person and person-to-space.



*Figure 1.* Conceptual framework for collaborative work environments

### *1.6 Thesis Organization*

This chapter established the foundation for the study on the changing nature of today's work environment. This chapter also described the background of the topic, the scope, objective and significance of the study, the research question, the conceptual framework of the study, and the thesis organization.

**Chapter 2** is a review of brief history of workplace evolution, existing literature on socio-psychological and physical constructs in work environments, and elements of spatial workplace environments. Fifteen patterns of collaborative work environments are briefly summarized from the literature.

**Chapter 3** deals with methodology and discusses the strategies used to develop, collect, and organize the data required for the study. The topics discussed include: research strategies used in this study, research tool selection, participant selection, research procedures for data collection, data organization, and analysis.

**Chapter 4** discusses the results. It presents the data collected from the research study. It also provides evidence to answer the researcher's hypotheses presented in section 3.4.1 (p. 27) about the usefulness of the pattern language tool for designing collaborative work environments.

**Chapter 5** deals with the discussion and conclusion of the study. This chapter reviews results from the data presented in the previous chapter. In addition to providing conclusions, it also talks about the limitations of the current study and implications and suggestions for future research. Finally, this chapter explains how this study contributes to the existing body of knowledge within the field of collaborative work environments.

## CHAPTER 2

### Literature Review

#### *2.1 History of Open Office Planning*

The history of open office planning is relatively new with its origination dating to the mid-1950s. Open-plan workplace is a general term to describe a work environment, characterized by the absence of internal walls between workstations either of all workstations or a majority of workstations. An extreme type of open-plan is known as the “bullpen”. It is a huge, truly open room with undifferentiated endless rows of neatly ordered desks, without barriers between office workers.



*Figure 2.* Atrium of the Larkin Building, 1906, Buffalo, NY.  
(Source : Laing, 2006)

A famous early example of an office building with a bullpen setting is Frank Lloyd Wright’s Larkin Building in Buffalo, New York (figure 2), built in the beginning of the twentieth century. In this mail-order enterprise, on six floors and in the atrium, employees sat in rows of small desks or opposite each other, answering inquiries and processing orders under the observation of their

supervisors (Hua, 2007). Employee workstations were among the tens or hundreds of identical workstations, with minimum definition of personal space. Only supervisors and managers had individual closed offices, often separated from the rest of the work area by glass walls.

The bullpen settings were further encouraged in the mid-twentieth century in the United States with the spread of deeper plan office buildings, made possible by air conditioning and fluorescent light (Pile, 1978). Some new bullpen settings are less top-down and less status-rich, as well as more humane in terms of desk size and arrangement. These settings can be in work areas for routine tasks with a low level of task complexity and independency, such as call centers (Figure 3).



*Figure 3.* Bullpen setting in a call center  
(Source: Marnot & Eley, 2000)

The “buerolandschaft” (or office landscape) design concept, which originated in Germany in 1959 by the Quickborner team led by Wolfgang and Eberhard Schnelle, was the first spatial expression of the intention to reflect and enhance the flow of communication between individuals and groups (Hassanain, 2006). Office planning was viewed as an obscure method of situating people in spaces that had no geometric symmetry and no perceived organizational layout. Although this new concept originated in Germany, much of Europe was hesitant to adopt this radical new way of planning and believed that the “office landscape”

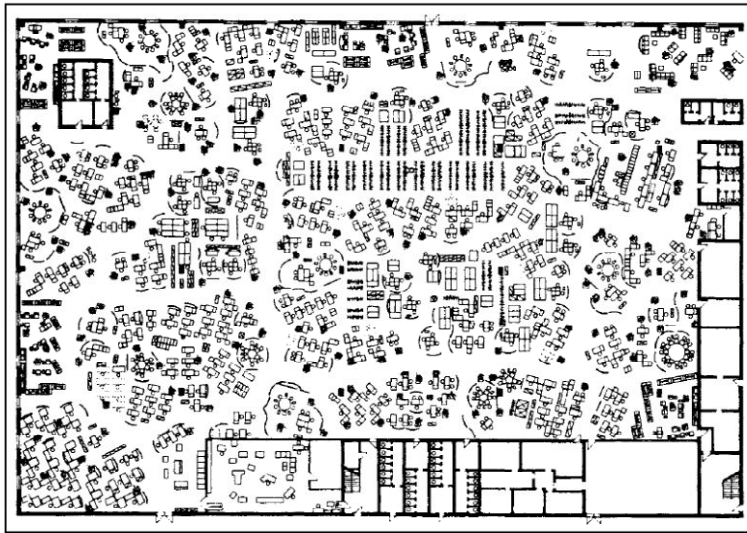
concept of planning was hindered with many restrictions and dictated the manner in which the office was designed (Anthony, 2001).

The layout solution of office landscaping is based on the work pattern in respective organizations and aims to use the design of the workplace to support better communication. “The flow of paper-based and visual communication between individuals and groups was used to determine the layout of the office. The concept resulted in very open layouts, all interior walls being removed. The large deep space was used to accommodate concentric rings of lines of communication between groups” (Laing, 2006, p.36). On a Buerolandschaft floor plan, freestanding mobile panels were positioned and repositioned to reflect changes in work process and correspondent team configuration (Pile, 1978) (figure 4). The space-saving features and the flexibility to accommodate changes helped this type of open-plan and its variants to spread in both Europe and North America. The ‘Buerolandschaft’, originally invented in Germany, returned to Europe as ‘landscape or open plan.’ Duffy made a critique of the office landscaped office concept in 1975. The essential promise of Buerolandschaft was that “it seemed the closest approximation to a service which it was felt architects and interior designers were failing to supply- the detailed planning of interior space by people who understood something of design and organizational structure” (Duffy, 1992; Laing, 2006, p.37)

At the same time in United States, the 1960s office landscaping concept was evolving as new planning method. The original intention of this layout solution also included reducing symbolized hierarchy in the workplace. According to Arnold (2002), the office landscaping concept was a reflection of social change. Instead of sitting in rows facing the head of department, staff could move



about at their own will without spatial or hierarchical restrictions. New places such as meeting facilities and coffee areas were put into the workplaces in proximity to workstations to support informal communication. Though epitomized by freedom of communication and informality, the popularity of Buerolandschaft did not last long, because of its intrinsic disadvantages i.e., low privacy and overwhelming acoustic distraction.



*Figure 4.* Example of Buerolandschaft workplace (Source: Laing, 2006)


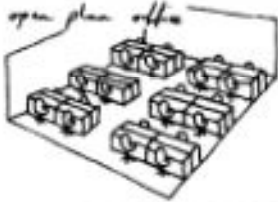
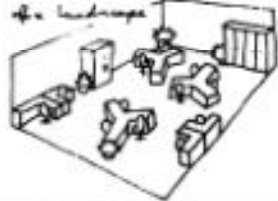
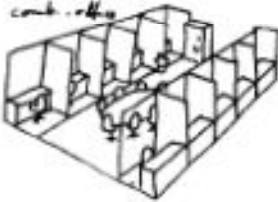
Other efforts to explore workplace layout solutions include the application of cityscape in office buildings. The Scandinavian Airline System (SAS) office building was a famous example using a “main street” with various public or shared service and amenity spaces to link “neighborhoods” of work areas (Duffy, 1992). The daylight main street provides opportunities for impromptu meetings and interactions.

Unlike in northern Europe, the economic factors, mainly “return-on-investment”, remained the key driver in workplace design and office building development in the Anglo-American world. In the US, since larger proportions of office buildings are built to lease than in Europe, workplace design has not been

tailored to the needs of specific organizations or occupants (Laing, 2006). Along with the introduction of system furniture, pioneered by the Herman Miller's "Action office" (Pile, 1978), the "cubicle", or sometimes "panel-based" open plan settings gradually became the predominant setting for open-plan workplace. Robert Probst (working for Herman Miller in the USA) introduced Action office system introduced in 1964. It is still widespread today. This system gave designers the opportunity to provide workers with individual work areas, centralized filing, and acoustical privacy.

The panel system sparked excitement in the office furniture industry and soon the furniture manufacturing giants Steelcase, Haworth, and Knoll each had their own version of system office plans. Throughout the 1970s and 1980s, enhancements such as electrified panels, additional storage components, and upgraded fabrics and finishes provided workers with better work environments that fulfilled a multitude of requirements (Laing, 2006). Interior designers and architects became accustomed to designing with panel systems and including the "ice-cube" tray layouts in office designs. These layouts satisfied the need for privacy and individual work; collaborative meetings and work requiring interaction typically occurred in a conference room.

Table 1 briefly summarizes the four representative workplace layout solutions in the history of the modern office building. Despite the layout variances, studies show surprisingly how little office work environments have changed in the past century, particularly when looking at space and time usage (Duffy, 1992; Laing, 2006).

Office concept	Office philosophy	Time of emergence	Number of people
 <p><i>cellular office</i></p>	Representative arrangement	1950s	1- 2 persons Up to 4-6 persons
 <p><i>open plan office</i></p>	Organizational flexibility	Mid 60s	>20 workstations
 <p><i>office landscape</i></p>	Ergonomic work environment	Late 60s	6-20 workstations
 <p><i>comb. office</i></p>	Communicative space structure	1980s	1-person cellular offices with multi-functional zone

*Table 1. Office philosophies and office concepts*  
(Source: adapted from Harrison et al. 2004)

In the 1990s, attention in office design turned to communication. Group work and teaming became important as the use of teams in organizations was increasing (Laing, 2006). The need for a designed layout that incorporates both a space for private work as well as areas for group interaction became requirements for interior design. A balance between the open design of office landscaping and the individual private cubicle became the challenge for designers in the 1990s (Laing, 2006). Furniture manufacturers responded to

these challenges by introducing mobile furniture such as movable screens, storage pedestals, and conference tables. No longer were designers able to block in row after row of cubicles. Designers needed to create teaming environments as constantly changing dynamic spaces. The new furnishings for teaming environments provided challenges in accommodating cabling and communication connections yet responded to the new alternative ways of conducting work.

Approaching the twenty-first century, the strong driving factor for the changes in workplace design and space management is the fast advances in information and communication technology (Laing, 2006). New workplace concepts were made possible by new technology and were promoted by the economic advantage that came along with that technology. Before the 1990s, most workplace spatial design solutions were based on the assumptions that workstations or offices are owned by individual office workers. More recent approaches recognize the fact that more and more tasks can be done remotely. Considering the amount of time that an employee spends in meetings, individual workstations are not occupied for 45-50% of the time on average of a typical work day (Steelcase, 2002). By making the workstations standardized and more work digitized, office workers are able to share workstations with a group of co-workers, by reserving available desks when one needs to work in the office. This concept is called hot desking or free address, which results in obvious advantages in space efficiency. The number of workstations provided in this type of workplace is usually 50-80% of the actual number of employees (Harrison, Wheeler & Whitehead, 2004) or the number of workstations in a traditional workplace. Other approaches based on similar design and management

concepts, such as hotelling or red carpet, can further reduce the space needed and the real estate costs. However, the new workplace concepts are also facing issues such as difficulties in managing reference materials, eliminated personalization opportunities desired by office workers, missing physical hints that help to manage work, which could be seriously counter-productive in some cases. Overall with the progress in technology and economic factors, the distributed workplaces are feasible. According to Harrison, Wheeler and Whitehead (2004) the social importance of the physical workplace is likely to be increasingly emphasized.

## *2.2 Collaboration at Work*

Working in teams may not be a new concept. In recent years, there has been a steady shift away from independent, heads-down work toward more collaborative, team-based activities (Brand, 2008). The two elements of effective collaboration, accomplishment of individual concentrated tasks and high quality team work, have very different and even contradicting requirements for the workplace spatial environment. To design a workplace for effective collaboration, the designer has to address the tension between concentrated work and interactions effectively through spatial design schemes.

The workplace is not just about cubicle or office. It is about the appropriate combinations of space, protocols, technology, and tools that support the nature of work and keep employees productive, satisfied, and loyal (Rice & Mitchell-Ketzes, 2002). As stated by Becker (2004), a collaborative work environment features highly diverse places that recognize, accommodate, and even celebrate, the values of giving people lots of choice in where, when, and how they work.

### 2.2.1 Social Dimensions of Collaborative Work

As collaboration entails both individual focused tasks and interactive group work, this research study is divided into two sections. The section on the social dimensions of collaborative knowledge work focuses on the interactive aspect of collaboration. The section on individual aspects of collaborative knowledge work focuses on solitary work and behaviors.

The social dimensions of collaboration include three components: awareness, brief interaction, and collaboration. These dimensions differ in purpose and time frame

*Awareness* relates to the eavesdropping concept presented by Sims (2000), which is the idea that office occupiers have a general awareness of what is going on in the office environment just by overhearing office conversations. Heerwagen et al. (2004) proposes that the key physical requirements to ensure that the awareness dimension is supported are visual and aural accessibility.

*Brief interaction* includes functional communications (e.g. fact checking, passing on information and asking questions) as well as social interactions such as quick personal exchanges, bantering, and joking. These types of interactions typically last less than one minute (Reder & Schwab, 1990). The line of sight or visibility within an office environment can influence the amount of interaction within the office (Heerwagen, Kampschroer, Powell & Loftness, 2004).

*Collaboration* involves two or more people working together over time to produce a joint product or other outcome (Kraut, Edigo & Galegher, 1990). Collaboration can be long duration interactions (eg. problem solving sessions and demonstrations) that last many hours as well as short duration interactions that last just a few minutes. Short collaborations often occur spontaneously, for

instance, to discuss the importance of new information or to explore preliminary ideas that are later developed (Kraut et al., 1990).

### *2.2.2 Individual Aspects of Collaborative Work*

As noted above, collaboration is defined as a system of behaviors that includes individual, focused work as well as interaction among individuals. To be effective team members, individuals must have the time, space, and tools to do work that can only be done alone, such as reading, writing, thinking, searching for information, and synthesizing information into internal knowledge structures. The need for privacy in a workplace is a multi-layer construct, including the need to control access to the workspace, to limit distraction and interruption, and to be able to communicate informally with others (Rashid & Zimring, 2004).

### *2.3 Factors Affecting Collaborative Work Environments*

Based on the above literature review on the collaborative work environment, the following fifteen factors are explained which affect such work environments. These factors have evolved in consideration of the physical and socio-psychological factors affecting the workplace.

#### *2.3.1 Community Connections*

In response to ever growing markets, increasing worldwide competition, and fast technological development, employees are striving to find work-life balance (Earle, 2003). Today's worker rarely works an eight-hour day in one place. Striving to find a balance between home and work has been an influential factor in the evolution of alternatives like working from home and telecommuting (Gibson, 2003). As workdays are longer compared to before, those who spend the majority of their time in the office are forced to run errands and manage personal affairs during lunch and break times. Convenient access to

amenities near the office allows the worker to accomplish these tasks in a timely and efficient manner.

### *2.3.2 Welcoming Entry*

The entry to an office or building is the transitional element that invites or welcomes an employee to work. A unique and well-designed entry communicates an inviting gesture to the employees and the visitors. This welcoming aspect has to be balanced by the need to secure the entry and separate its publicly accessible spaces from the office areas. Based on independent research by the American Society of Interior Designer (ASID), the physical workplace ranked in the top three when examining the factors that contribute to job satisfaction (Earle, 2003). Building entries should be reflective of the image a company wishes to portray and be distinctive in their use of materials and architecture.

### *2.3.3 Public Spaces that tell a Story*

The public spaces within an office should communicate the company story. These areas are visited by clients and guests and should reflect the corporate philosophies and goals by being an extension of the overall image portrayed by the company. Having a space to display or portray oneself represents organizational identity (2008, Steelcase). The public spaces within an office environment should communicate these philosophies and goals by clearly defining the company in terms of how the organization functions. These spaces should be integral elements in the overall design concept and be reflective of the company's structure and organization.



#### 2.3.4 *Main Street Thoroughfare*

The Main Street thoroughfare is the centralized major artery connecting public spaces within the office environment. This thoroughfare should be an integral part of the design concept and provide workers with impromptu places to communicate and share information. With the demand placed on the workplace to provide environments that respond to flexible work, these main corridors become more than simply paths of travel. Heerwagen et alia (2004) identify the benefits to the knowledge worker of ad hoc brief interactions with colleagues. According to that research brief interactions can be both intentional and unintentional, and can occur in many locations, i.e., at people's desks, in the corridor, and near central services. The location of the brief interaction can be considered an "information exchange" (Heerwagen et al, 2004). Observational studies have found that interactions are often the result of movement patterns and spatial visibility that make workers available for recruitment in conversations (Backhouse & Drew, 1992; Penn et al., 1999; Rashid et al., 2004). Pathways that meander around workstations and shared equipment such as printers or photocopiers provide more opportunity for ad hoc encounters. The researchers conclude that designing space to maximize visibility will also maximize the number of interactions among coworkers (Herman Miller, 2008).

#### 2.3.5 *Social Hub*

During the day, the path to the coffee machine is well traveled (Anthony, 2001). Providing a café at a central location of the office, that is equipped with comfortable seating and necessary communication tools, gives employees a place to interact informally. Leverage social networks and break down silos by offering a centrally located casual space, such as a café or coffee bar. Food and

beverages are a draw, but collaborative tools make the space more effective. Settings where people can work in the open makes them more accessible to other employees. A social hub often becomes the psychological center of the workplace (360-Steelcase, Feb 2010).

### *2.3.6 Town Halls*

Town halls are informal multi-functional congregational places. These areas are used for large or small meetings and are typically available to all company employees. Group areas may even need more attention paid to social "channeling" and other symbolic details than personal work areas, since 60 percent of what people learn occurs informally, and much of this happens within teams (Brand, 2009). Not all meetings need to be formal and enclosed within four walls. Open and re-configurable congregational areas provide space for impromptu gatherings as well as company meetings. Having meeting spaces of various sizes helps to accommodate diverse team requirements (Stegmeier, 2008).

### *2.3.7 Team Huddle Space*

A team huddle space is a place conveniently located to all members within a team to support meetings, brainstorming, and problem solving activities. Group work is not "open" work and should be supported with designated team areas for interactive communication and brainstorming (Brill, 1998). There is increasing demand for dedicated team collaboration spaces that restricts access to the rest of the employees and allows work in progress to remain in place for days, weeks, and months at a time (Stegmeier, 2008). As Wineman and Serrato states (1998) working groups of any type should have easily accessible space available for the group to meet face-to-face. Such spaces encourage

collaboration across boundaries within the organization. Available, easily reserved, and well-equipped meeting spaces facilitate impromptu meetings.

To understand the team environments, data from the field of cognitive, social, and environmental psychology were integrated by Haworth, Inc. and the two team rooms were studied at two major advertising agencies. Based on this study the rate of participation in meetings seemed higher in the team area than in the conference rooms (Brand & Augustin 2009).

### *2.3.8 Heads-down Space*

A sense of personal space provides employees with the opportunity to balance privacy with interaction. Sometimes one needs a place where one can focus on a task, have a private conversation or phone call, or distance oneself from interruptions. It is important in a dynamic teaming environment to provide personal work areas or zones for employees who seek privacy (Mudgett, 2000). Workers assess their privacy at two levels: the functional level, related to separateness and freedom from distraction in order to concentrate; and the psychological level, related to exclusivity, status in the organization, and environmental control (Vischer, 2005). Since office work can be considered as both individual and collaborative in nature, the office environment must aim to achieve maximum interaction while at the same time not affecting concentrated individual work (Haynes & Price, 2004).

### *2.3.9 Work Areas on Wheels*

Team members respond to varying demands and tasks that require mobility and flexibility in their physical surroundings. Furniture and equipment should respond to user needs. Furniture within the team space should be versatile and easy to reconfigure (Facilities Programs, 1993). Mobile tables,

drawer pedestals, storage units, white boards, and chairs provide the opportunity for team members to reconfigure their physical environment based on activity requirements. Moreover, teams keep varying and shuffling based on the current projects of the company. Designers should provide flexible tools to support the creation and sharing of knowledge. This means everything from interior walls to digital devices to furniture, accessories, and supplies (Thorp & Darling, 2009).

#### *2.3.10 Technology Access*

Providing access to technology in all formal and informal team spaces helps employee to connect with colleagues and clients across the globe. Access to technology at all formal and informal team spaces helps to collaborate with far-flung colleagues (360-Steelcase, Feb 2010). It also helps to share digital information instantly and with everyone in the group (360-Steelcase, Feb 2010). Collaborative spaces with access to power, wireless network, and LCD projection, where everyone can see the information and interact with it, are effective for collaboration.

#### *2.3.11 Let there be Light*

Having windows (as opposed to no windows) in a room may increase its social desirability; the larger and taller windows the better they are (Brand, 2009). Users' assessment of lighting quality is more related to the amount of light than to its quality (Vischer, 2005). Research also shows that window views influence cognitive functioning, especially distant views or views of nature. The cognitive and psychological benefits of views may result from the ability to weave mini-mental breaks into ongoing work, thereby restoring attentional capacity and the ability to concentrate (Kaplan, 1995, 2001). Uninhibited access to windows and views to the outside improve worker satisfaction (Stegmeier, 2008). Whether

windows enhance task efficiency for a room's occupants remains controversial, although moods and emotional tone can be improved by natural light (Brand, 2009). The nature of the task is important when considering windows. Typically, if the room is well lit (ideally with natural light), a high or sloped ceiling encourages social interaction (Brand, 2009).

### *2.3.12 Vertical Surfaces*

Vertical surfaces such as whiteboards, projection screens, and chalkboards support sharing and discussing ideas within the workspace. The design and location of visual displays and artifacts also influence the effectiveness of knowledge transfer and the coordination of efforts among group members (Herman Miller, 2008). As knowledge work is a largely cognitive activity, its processes are mostly invisible. Tacking surfaces, white boards, and technological tools such as projection and large video displays allow people to illustrate ideas and post thinking-in-process to make the work visually accessible to the group, aiding memory and the organization of tasks and materials. Users feel that the display areas available make it easier to analyze data for trends, patterns, and comparisons. The display of team thinking in the team rooms makes the creators feel proud of their work (Brand & Augustin, 2009). Placement that allows ready viewing and evaluation by people as they sit at work or move along a routinely traveled corridor can heighten shared awareness (Heerwagen, 2004).

### *2.3.13 Comfortable Work*

Workstation comfort and spatial comfort have a direct impact on functional comfort and the performance of work. They affect both collaborative teamwork productivity and individual task performance (Vischer, 2005).

Ergonomics becomes an important factor if the task requires lengthy conversations. To maximize social exchange, furniture should provide no cues to relative status within the group (Brand, 2009). Improving ergonomics in the work environment primarily creates a safer and more healthful workplace. The organization may experience other benefits as well such as increased productivity, work quality, and morale.

#### *2.3.14 Wide Stairways*

Stairways are interaction nodes. Having wide stairways may enhance impromptu interactions among employees. To optimize interaction and communication, one workplace strategy calls for no building in a work complex to be more than five stories high (Stegmeier, 2008). Wide staircases increase the opportunity of colleagues coming in contact with one another on a regular basis (Stegmeier, 2008).

#### *2.3.15 Stay Close*

People collaborate more when they are in proximity to others. Easy eye contact between people, and between people and information, could make idea sharing more likely. Hearing others allows for mentoring through "eavesdropping" and sharing information informally throughout the day (Sims, 2000). Separation by more than 30 meters is equivalent to being in different buildings, if not in different geographical locations (Allen, 1971). Even within this 30-metre range, those nearest to one another communicate more than those at a greater distance. Since Allen's (1971) landmark studies on communication patterns in office settings, other researchers have confirmed the importance of propinquity for informal communications (Kraut et al., 1990; Serrato, 2002). Designers should

keep things close: beyond 50 feet, spaces don't get used, whether it's a meeting room or a café (Steelcase, 2010).

#### 2.4 *Conclusion*

This chapter reviewed the literature on the evolution of open office planning, the collaborative work environment, and discussed fifteen factors that are important for collaborative workspace. Studies in the literature review revealed that it is important to address both the individual and social aspects of the work environment, in order to improve the collaboration in a work environment.

Collaboration at the workplace is increasingly becoming an integral component of the work environment. The quest to uncover appropriate design tools will continue within the design community as industry increases the demand for collaborative work environments.

## CHAPTER 3

### Methodology

#### *3.1 Introduction*

This chapter discusses the strategies used to develop, collect, and organize the data required for this study. The topics discussed include: research strategies used in this study, research instrument selection, participant selection, research procedures for data collection, and data organization and analysis.

#### *3.2 Research Design*

##### *3.2.1 Approach*

The methodological process that is used for this research started with a literature review to create the pattern language website, followed by developing a survey for data collection, data analysis, and documentation of research findings. The study examined two areas of the collaborative work environment: the physical and the socio-psychological. The data analysis process chosen for the study is a series of independent sample t-tests. The data was analyzed using statistical analysis software (Statistical Package for the Social Sciences, SPSS).

The study was divided into four phases. Phase one consisted of gathering published research material related to collaborative work environments and developing the website based on pattern language methodology. The collected material was also used for developing the literature review presented in Chapter Two. Phase two consisted of developing the research instrument. Phase three involved facility identification and pilot testing of the research instrument. Phase four consisted of sample selection, with subsequent data collection and preparation of data analysis. The following paragraphs describe the research phases in detail.



### 3.3 Phase One

#### 3.3.1 *Review of Literature*

The review of literature examined relevant research on collaboration, current trends in work environments, and individual and social aspects of collaborative workplaces. This study examined credible publications such as peer reviewed journals, white papers from leading office furniture industries, and topical books. Based on the dates of the reviewed articles and other resources within the studies, it is apparent that the range of references in this field has expanded within the past ten years.

Heerwagen et al. (2004) concludes that given the high interest in the topic of collaboration, there is surprising dearth of research on the link between collaborative work processes and space. Responding to the intense interest in collaboration, the design professions have a challenge to explore an appropriate tool to respond to dynamic, flexible, and collaborative work environments. This thesis supplies that tool.

#### 3.3.2 *Research Statement*

Based on the preceding literature review, the below research hypothesis was developed to direct the research. Research statement: The entire pattern language is perceived as useful and important design tool for designing collaborative work environments.

#### 3.3.3 *Pattern Language Website*

A website called a pattern language for collaboration environments was designed by the researcher for this study at Arizona State University (ASU). ASU provides every student with personal website space. The researcher used this free domain to create the website with basic knowledge of website construction.

This website includes the fifteen patterns discussed in Chapter Two. A home page introduces the concept of pattern language and describes collaborative work environments. Fifteen patterns for collaborative work environments are highlighted in blue and listed on the left side of the home page (Appendix D). A link to the survey is also highlighted in bold blue on the left side of the home page. Each of the 15 patterns is organized to include a title, a picture representing a physical example of the pattern, a short description about the pattern, and a justification section which links to the sources. Following the format of Alexander's (1971) pattern language, the website is organized by scale, considering for example, the broad connections to the community down to something as specific as a vertical surface. The website also includes a summary and reference section (Appendix D).

### *3.4 Phase Two*

#### *3.4.1 Research Instrument Identification: Online Survey*

As the researcher is exploring the possibility of using a web-based design tool for designing collaborative spaces, having an online survey was appropriate as the targeted population will be using the internet to explore and use the tool. The past decade has seen a tremendous increase in internet use and computer-mediated communication (Nie, Hillygus, & Erbring, 2002). During the twentieth century, there were great advances in the techniques and technologies utilized in survey research, from systematic sampling methods to enhanced questionnaire design and computerized data analysis (Evans & Mathur, 2005). The online survey methodology is better than a traditional survey if it is used appropriately (Evans & Mathur, 2005). Research has shown that the advantages of an online survey are flexibility, speed, convenience, ease of data entry and analysis,

question diversity, low administrative cost, global reach, controlled sampling, large sample easy to obtain, required completion of answers, and control of answer order. Major potential weaknesses of the online survey are its perception as junk mail, its impersonal nature, limited time access, cost involved, respondents' lack of web experience/expertise, privacy issues, and low response rate (Evans & Mathur, 2005).

In this study, the researcher developed an online survey through Google Docs due to its various advantages such as free access, unlimited questions, ease of use, and unlimited time period. The sample population had knowledge and access to the internet. As the sample population received the email from its employer, the response rate was high and prompt. In this study, the weaknesses of online survey were overcome and thus its choice was justified.

#### *3.4.2 Description of the Online Survey Instrument*

The online survey questionnaire was emailed to a study sample. This questionnaire consisted of three pages. The first page included a cover letter and consent form (see Appendices B & F). By clicking the "continue" button on the first page, the study participants indicated their agreement to participate. The consent form indicated that participation was voluntary and participants would remain anonymous. It also provided the researcher's contact information for potential concerns and questions. The second page included three demographic questions, fifteen questions on the importance of each pattern, three open-ended questions about the possible addition, deletion and revision of any patterns, and one open-ended question on the usefulness of the tool. The fifteen questions based on the importance of each pattern were framed to respond to a five point Likert scale with one being the least important and five being the most important.

For the pilot study, an additional four questions were added regarding any issues with the clarity of the website, survey, pattern language, and total time to complete the survey. The survey tool assessed qualitative aspects such as workers' physical and socio-psychological needs as a way to aid designers and planners.

### *3.5 Phase Three*

#### *3.5.1 Facility Identification*

One collaborative design firm was required for participation in this research study. The workplace should have an open office that facilitates formal and informal collaboration. Gensler - a leading global architecture, design, planning, and strategic consulting firm - was chosen for the study. For more than 45 years, Gensler has been a pioneer in creating places that enhance the quality of work and life. Today, Gensler has more than 2,000 professionals networked across 35 locations (Gensler, 2011). Flattening the organizational hierarchy supports the objectives of transferring knowledge more quickly and improving collaboration to achieve more innovative results. The Gensler office in downtown Phoenix has an open office concept. Beth Harmon-Vaughan (2009) (Principle at Gensler, Phoenix) believes that collaboration among the many design disciplines is necessary to work on today's complex projects. This workplace encourages employees to be more collaborative by providing open workspaces and informal meeting points.

#### *3.5.2 Pilot Study*

Although information is currently known and documented about pattern language, what is not known is the feasibility of using it to establish criteria in designing collaborative spaces. The purpose of this research was to explore the

possibility of using pattern language in a way never imagined by its creators. A pilot study was conducted to test the logistics and content of the online survey proposed for Phase Four. Suggestions provided from this sample group were used to revise the existing survey and process before the actual survey was administered. To test the pattern language tool, an online survey and website were created and sent to graduate students and faculty members in the interior design and healthcare and healing environment programs at Arizona State University. As many students in the healthcare and healing environment program have an interior design background, they were included for the sample. The email was sent to a sample of 30 designers - both graduate students and faculty members - out of which nine designers responded to the survey.

Based on the nine responses, the length of time to complete the process of reading through the pattern language on the website and answering the online survey ranged from 3 minutes to 25 minutes with a mean time of 11.36 minutes. This is important because a shorter response time will increase the chances of a larger return rate for study itself. The overall access to the website had no negative feedback. The clarity of the pattern language and survey also had no major issues. One designer suggested that having the definition along with the survey would make the task easier. There were no issues with the clarity or understanding of the website, survey or the pattern language. Hence, as there were no major issues regarding the website or survey, no revisions were made for the actual research study.

### *3.6 Phase Four*

#### *3.6.1 Data Collection*

Data collection consisted of a survey instrument to assess the importance of each of the 15 patterns and overall usefulness of the pattern language as a design tool.

An email (see Appendix E) was sent to the Principle designer of Gensler, Phoenix to forward it to all the employees at that office location. The email included the details of the study with the links to the online survey and the pattern language website. Detailed step-by-step instructions were given to be followed in order to participate in the study. The Principal was also requested to participate. Two weeks were allotted to complete the online survey.

### *3.7 Conclusion*

This chapter discussed the research methodology and described the means for conducting the research. It also included the participants and process involved in the study. The following chapter will provide the results of the online survey instrument.

## CHAPTER 4

### Results of Data Analysis

#### *4.1 Introduction*

This chapter presents the data collected from the research study. It also provides evidence to answer the research statement presented in section 3.3.2 about the usefulness and importance of pattern language as a design tool for designing collaborative environments. The results are presented in three parts. The first part of the chapter discusses the three questions pertaining to gender, age, and job title. The second part discusses the fifteen questions pertaining to the importance of each pattern in a collaborative work environment and the third part talks about the overall addition, removal or revision of any pattern(s) and one question pertaining to the overall usefulness of the design tool.

#### *4.2 Participants*

The survey was sent to all the employees at the Gensler Inc. office in Phoenix, Arizona. Of the thirty employees, twenty-six employees participated in the survey. For a response rate of 86.7%, the majority of participants were male (69.2%).

#### *4.3 Sample Demographics Data*

Demographic data requested from participants included age, gender and job title. The majority of participants were between the age of 26 and 40 years (80.8%). The rest 19.2% of the participants were between the age of 41 and 60 years. The majority of the sample had a design related background (96.15%). The summary of the demographic data is represented in Table 2.

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
<b>Female</b>	8	30.8
<b>Male</b>	18	69.2

<b>Age</b>	<b>Frequency</b>	<b>Percent</b>
<b>26-40</b>	21	80.8
<b>41-60</b>	5	19.2

*Table 2.* Sample Demographics SPSS frequency output

#### *4.4 Data Analysis*

The survey results were analyzed with the aid of the Statistical Package for Social Sciences (SPSS) software. To calculate the mean and standard deviations of subjective evaluations, statements were given numerical values of 1 to 5, with 1 being the least important and 5 being the most important. Table 3 shows survey results. It is representative of the scale based on the importance of each pattern in the collaborative work environment. Table 4 is a representative of the data based on the usefulness of pattern language as a design tool. The means of responses ranges from as high as 4.72 to as low as 3.00. Each individual response will be discussed next.



*Table 3.* Percentage distributions, means, and standard deviations for fifteen patterns for collaborative work environments.

<b>No.</b>	<b>Pattern language</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>N</b>	<b>M</b>	<b>SD</b>
3.A	Community connections	0	1	4	10	11	26	4.19	0.85
3.B	Welcoming entry	0	1	5	9	11	26	4.15	0.88
3.C	Public space that tells a story	0	1	5	11	9	26	4.07	0.85
3.D	Main street thoroughfare	0	1	1	15	9	26	4.23	0.71
3.E	Social hub	0	1	5	12	8	26	4.04	0.82
3.F	Town halls	0	2	2	10	12	26	4.23	0.91
3.G	Team huddle space	0	0	5	10	11	26	4.23	0.77
3.H	Heads-down space	0	2	2	11	11	26	4.19	0.89
3.I	Work areas on wheels	3	3	6	11	3	26	3.30	1.19
3.J	Technology access	0	0	2	9	15	26	4.5	0.65
3.K	Let there be light	1	0	0	8	17	26	4.54	0.86
3.L	Vertical surfaces	1	4	9	6	5	25	3.4	1.12
3.M	Comfortable work	0	0	1	5	19	25	4.72	0.54
3.N	Wide stairways	4	5	6	7	3	25	3.0	1.30
3.O	Stay close	0	1	3	13	9	26	4.15	0.78

Least important- 1, Most important - 5, N- Number of response, M- Mean, SD- Standard Deviation

*Table 4.* Percentage distribution, mean and standard deviation of the overall usefulness of the pattern language as a design tool

	1	2	3	4	5	N	M	SD
Usefulness of the pattern language tool	0	0	5	6	15	26	4.38	0.80

1-Least useful, 5-Most useful, N-Number of response, M- Mean, SD- Standard deviation

#### *4.4.1 Community Connections*

Twenty-six design professionals responded to the pattern language regarding community connections. The overall results show a relatively positive response with a mean of 4.19 and standard deviation of 0.85 in terms of its importance in the collaborative work environments.

#### *4.4.2 Welcoming Entry*

The welcoming entry pattern language elicited a relatively positive response (mean=4.15, standard deviation=0.88) from the sample of twenty six responding design professionals.

#### *4.4.3 Public Space that tells a Story*

Twenty-six design professionals responded to the pattern language regarding public space that tells a story. The overall results show a relatively positive response with a mean of 4.07 and standard deviation of 0.85 in terms of its importance in the collaborative work environments.

#### *4.4.4 Main Street Thoroughfare*

In the pattern language pertaining to main street thoroughfare, twenty-six design professionals responded to this pattern. The overall results show relatively positive response with a mean of 4.23 and standard deviation of 0.71 in terms of its importance in the collaborative work environments.

#### *4.4.5 Social Hub*

A total of twenty-six design professionals responded to the pattern language regarding social hub. The overall results yielded a relatively positive response with a mean of 4.04 and standard deviation of 0.82 in terms of its importance in the collaborative work environments.

#### *4.4.6 Town Halls*

Twenty-six design professionals responded to the pattern language regarding town halls. The overall results in terms of its importance in the collaborative work environment showed a relatively positive response with a mean of 4.23 and standard deviation of 0.91.

#### *4.4.7 Team Huddle Space*

Twenty-six design professionals responded to the pattern language regarding team huddle space. The overall results show a relatively positive response with a mean of 4.23 and standard deviation of 0.77 in terms of its importance in the collaborative work environments.

#### *4.4.8 Heads-down Space*

The heads-down pattern language elicited a relatively positive response (mean=4.19, standard deviation=0.89) from the sample of twenty six responding design professionals.

#### *4.4.9 Work Areas on Wheels*

Twenty-six design professionals rated work areas on wheels pattern relatively negative with a mean of 3.30 and standard deviation of 1.19 in terms of its importance in the collaborative work environments.

#### *4.4.10 Technology Access*

Twenty-six design professionals responded to the pattern language regarding technology access. The overall results show a relatively positive response with a mean of 4.5 and standard deviation of 0.65 in terms of its importance in the collaborative work environments.

#### *4.4.11 Let there be Light*

Let there be light pattern language elicited a relatively positive response (mean=4.54, standard deviation=0.86) from the sample of twenty six responding design professionals.

#### *4.4.12 Vertical Surfaces*

Twenty-five design professionals rated vertical surfaces pattern relatively negative with a mean of 3.4 and standard deviation of 1.12 in terms of its importance in the collaborative work environments.

#### *4.4.13 Comfortable Work*

Twenty-five design professionals responded to the pattern language regarding comfortable work. The overall results show a relatively positive response with a mean of 4.72 and standard deviation of 0.54 in terms of its importance in the collaborative work environments.

#### *4.4.14 Wide Stairways*

Wide stairways pattern language elicited a relatively negative response (mean=3.0, standard deviation=1.29) from the sample of twenty-five responding design professionals.

#### *4.4.15 Stay Close*

The stay close pattern language elicited a positive response (mean=4.15, standard deviation=0.78) from the sample of twenty six responding

design professionals.

#### *4.4.16 Addition of Any Pattern(s)*

Fifteen designers responded to this open-ended question about the addition of any pattern(s) to the existing pattern language for collaborative work environments. The majority of responses focused on the addition of fun at work, access to outdoors, and color and feel of the space patterns to the tool.

#### *4.4.17 Removal of Any Pattern(s)*

Seventeen designers responded to this open-ended question about the removal of any pattern(s) to the existing pattern language for collaborative work environments. The majority of responses focused on the removal of wide stairways pattern from the pattern language tool.

#### *4.4.18 Revision of Any Pattern(s)*

Thirteen designers responded to this open-ended question regarding the revision of any pattern(s) to the existing pattern language for collaborative work environments. The majority of responses had no specific issues regarding any of the existing pattern languages.

#### *4.4.19 Overall Usefulness of Pattern Language Tool*

Twenty-six design professionals responded to the overall usefulness of pattern language as a tool for designing collaborative work environment. The overall results show a relatively positive response with a mean of 4.38 and standard deviation of 0.80.

### *4.5 Conclusion*

Chapter four revealed the data results from the employee survey instrument. The table presented the importance of each pattern and overall usefulness of the design tool from a total of twenty-six employee-participants.

The following chapter will discuss the results according to the research statement posted in section 3.3.2.

## CHAPTER 5

### Discussion and Conclusion

#### *5.1 Introduction*

This chapter discusses results from the data presented in the previous chapter. In addition to providing conclusions to the research statement, this chapter also provides limitations of the current study and implications and suggestions for future study. Finally, this chapter also explains how this study contributes to the existing body of knowledge within the field of collaborative work environments.

#### *5.2 Discussion of Results*

Results of the data analysis of employee surveys help address the research statement: The entire pattern language is perceived as a useful and important design tool for designing the collaborative work environment. The researcher developed the pattern language tool to understand the importance of each pattern in a collaborative work environment and the overall usefulness of the tool. Based on the current study results, three patterns received relatively lower importance compared to the rest of the patterns. Work areas on wheels, vertical surfaces, and wide stairways pattern were identified as having low importance. These patterns also had a higher standard deviation due to a diversity of opinions. The three patterns will be discussed in detail due to the variation in responses.

##### *5.2.1 Work Areas on Wheels*

Twenty-six design professionals responded to the pattern language regarding work areas on wheels. The overall results show relatively negative response with a mean of 3.30 and standard deviation of 1.19 in terms of its

importance in the collaborative work environments. The unusual fact observed in the statistics is that based on the Likert scale, a sample size between the age of 41 to 60 rated this pattern as three and below three (where five being the most important and one being the least important). The majority of the sample between the age of 21 to 40 rated this pattern on the positive side of the Likert scale.

Existing research suggests that digital youth are adept at operating among multi-media influences and interruptions. Conversely, baby boomers (born between 1946-64) often feel distracted by similar influences, and so prefer to have some space between themselves and others, to better focus on their work. That is not to say they cannot multitask. Indeed, they may be performing a number of different tasks. It is to say that baby boomers may prefer a quieter space in which to conduct their activities (Stegmeier, 2008). On other hand, gen Y workers can focus their attention and activity with laser-like precision on a specific task. It's not uncommon to them working intently on a laptop or smart phone screen amid a chaotic work environment. They can settle quickly in a lounge chair or a corner of a project room, deploy ear buds, iPod, and a zen-like focus to shut out distractions and get a job done (360-Steelcase, 2009).

Age is equated with rigidity, youth with flexibility (Jeska, 2002). Based on this statement, it is suggested that baby boomers are not very adaptable to changes in flexible work environments.

A study carried out in 1996 (Steelcase), showed that 85% of all Americans, particularly older people, personalize their workplace with photos, plants, or a radio. The strong desire for personalized design was explicitly recognized in this study as a counter-reaction to the standardization of the work



environment. By contrast, younger employees often find other factors to foster their identity (Klauck, 2002) such as latest gadgets.

The second reason for having received a lower importance rate for the work areas on wheels pattern could be that it gives less opportunity for privacy and personalization (Vischer, 2005). Privacy is closely associated with retreat from distraction, control over information and social interaction, as well as with enclosure and status. People assess their privacy or territory at two levels: the functional level, related to separateness and freedom from distraction in order to concentrate; and the psychological level, related to exclusivity, status in organization and environmental control (Visher 2005).

The study by Groves (2010) shows that physical environment must be able to adapt to various technologies, varying work styles and differing project requirements. Overall, the space needs to be flexible and work areas on wheels is an important pattern that addresses the flexibility factor.

Based on the existing literature, it clearly indicates that work area on wheels is an important pattern for collaborative work environments. Yet, based on the statistics from this study, it is seen that baby boomers may experience a loss of privacy and lack of personalization in flexible work environments.

### *5.2.2 Vertical Surfaces*

Twenty-five design professionals responded to the pattern language regarding vertical surfaces. The overall results showed a relatively negative response with a mean of 3.4 and standard deviation of 1.12 in terms of its importance in the collaborative work environment. Based on the existing pattern the modes for idea sharing include whiteboards, projection screens, and chalkboards. As various advanced interactive devices were not included, fifty-six

percent of the sample rated this pattern as three and below on the Likert scale.

Due to advancement in technology, various tools are developed for group collaboration and communication such as collaboration using iPads, interactive whiteboards, and video conferencing.

Electronic whiteboards have been around for several years. Connected to a personal computer, these whiteboards could act as interactive, touch-screen monitors with print and save capabilities. In addition, whatever was written on them could be printed and downloaded. People unable to attend the meeting can refer to the documents and gain knowledge (Schrum & Benson, 2002).

The demand for a better conferencing experience with remote participants has risen rapidly to reduce travel time and cost, to increase productivity, and to leverage the global workforce (Koh, 2010). Compared to just audio, adding a video stream to audio can reduce the cognitive load in determining who is talking. It has several benefits including the ability to show understanding, forecast responses, and use gestures to emphasize a point (Issacs & Tang, 1993; Sellen, 1995). There are many new devices and novel technological approaches for communication available today such as Skype, the iPad 2, and the telepresence system. Telepresence gives an experience of high quality lifelike video and the feel of sitting in one room (Szigeti, McMenamy, Saville, Glowacki, 2009). The iPad 2 enables the flexibility of video conferencing at any place provided that there is wireless internet accessibility (Berte, 2011).

Despite all the available advanced technology, one of the top workplaces, Google, has chosen to go with an inexpensive idea for knowledge sharing throughout its facility. According to the Google office study by Groves (2010), nothing communicates better than the plentiful whiteboards scattered throughout

Google spaces, from team areas to coffee lounges, and especially next to the pool tables. These are ever present reminders that shared thinking is valued and that ideas can happen anywhere, even in the corridors. Google has maintained a great physical environment without lavish expense, and as a result, a sense of fun and passion runs through the business.

Overall, the vertical surfaces pattern can be revised for future study and could include various technological tools available today that could enhance the knowledge sharing experience. With these additional tools, it is suggested that the results of future study on this pattern would be more aligned with recent research.

### *5.2.3 Wide Stairways*

Twenty-five design professionals responded to the pattern language regarding wide stairways. The overall results showed a relatively negative response with a mean of 3.0 and standard deviation of 1.29 in terms of its importance in the collaborative work environments. The building in which Gensler is located is on the 13<sup>th</sup> floor of a multi-story office complex occupying a part of the floor plate. Sample participants used elevators to access the office floor. Because the Gensler office is occupied in a single floor, there is no internal staircase. The sample participants were requested to consider their present work environment and rate the patterns based on the importance in a collaborative environment. One of the reasons for this negative rating could be the absence of an internal staircase at Gensler. The sample population chosen from a multi-storied office space with an internal staircase could be a better option to experience its benefits and rate this pattern more accurately.

A research study by Stegmeier (2008) states that to optimize interaction and communication, the workplace strategy called for no building on campus to be more than five stories high; and wide staircases increased the opportunity of colleagues coming in contact with one another on a regular basis. A participant in the study by Groves (2010), in the Aardman animation facility stated, “Now if I have an idea I can literally run upstairs and speak to someone- the amount that happens on the stairs and in the canteen is amazing” (p.23). The designer of the space explains that its design is such that the flow of traffic encourages people to bump into each other. With this in mind, the stairs in that facility are wide enough to pass by an impromptu meeting, while the landing spaces act as junctions where people can pause for long periods of time (Groves, 2010).

In response to the open ended question regarding the removal of a pattern, wide stairways was the only pattern highlighted by the majority (19.2%) of the sample. Overall, the pattern can be revised to include elevators. It is suggested that facilities with an internal staircase be surveyed to assess its importance in future research.

The results showed that sample participants rated the pattern language of work areas on wheels, vertical surfaces, and wide stairways on the negative side of the Likert scale. Based on the results, the researcher analyzed the data and carefully reviewed the literature to understand the diversity in responses. This section discussed in details these three patterns with higher standard deviation.

### *5.3 Addition of Patterns*

The section of the chapter discusses the potential addition of patterns suggested by the sample participants. Fifty eight percent of the sample population responded to the open-ended question regarding the addition of

patterns. The majority of the responses focused on the addition of access to outdoors, fun at work, and color and the feel of the space to the existing pattern language on collaborative work environments.

### *5.3.1 Access to Outdoors*

To break the monotonous work routine, there should be an access to outdoor environments for employees to get refreshed. The research study by Stegmeier (2008) suggested that uninhibited access to windows and views to the outside improve worker satisfaction. Loftness, Vischer and Tanis (2008) stated that access to the natural environment is one of the important factors in an office environment. One needs to reduce the size of office floor plates to increase the amount of natural environment i.e access to outdoors such as courtyards or balconies. Even high-rise buildings can be naturally ventilated, as demonstrated by the recently completed Commerzbank by Foster and Partners in Frankfurt and the RWE tower in Essen by Christoph Ingenhoven (Loftness, Vischer & Tanis, 2008). As suggested by Groves (2010), the Dreamworks animation facility wants its employees to slow down and take advantage of the surroundings as it allows them to think more creatively.

Kathy Altieri, production designer at Dreamworks stated:

It's such an intense creative endeavor, making these films- and the intensity can last for years- pounding out story ideas, figuring out how to make a fold in fabric look right, reviewing the shots until your eyes bleed. Being able to walk outside for fifteen minutes provides you with that release you need as a creative person to allow a solution to float to the surface (Groves, 2010, p. 46).

These studies show that access to an outdoor environment is one of the important factors while designing an office environment. Based on credible literature and suggestions by the sample participants, access to the outdoors could be one of the patterns that is important in a collaborative work environment.

### *5.3.2 Fun at work*

David Kelley, CEO and founder of IDEO, believes that the company's fun work environment is key in fostering its high level of innovation (Butler, 1999). A fun work environment intentionally encourages, initiates, and supports a variety of enjoyable and pleasurable activities that positively influence the attitude and productivity of individuals and groups (Ford, McLaughlin, & Newstrom, 2003). Providing various recreational facilities in the campus or complex could be one of the reasons to attract and retain employees. The research study at Google workplace by Groves (2010) suggests that Google is committed to ensuring that people are healthy and happy. Their facilities provide swimming pools, gyms, games rooms, subsidized massage and hairdressing, volleyball courts, and wifi connected shuttle buses. These are all smart solutions to the everyday problems that people face when trying to be at their best. The 'work hard, play hard' mantra is woven throughout every second at Google (Groves, 2010).

The video games developing facility named Electronic Arts is situated in the south of San Francisco. It houses hard-working passionate people who are encouraged to play whenever possible since they are trusted to get the work done (Groves, 2010). People at their facility play more than just computer games, from fairground games to air hockey, scrabble, Wii, basketball or pool.

There are numerous articles in the popular press suggesting the importance of fun at work for improving employee morale and productivity (Mariotti, 1999, McGhee, 2000; Meyer, 1999). Thus fun at work could be a resourceful pattern while designing collaborative work environment.

### *5.3.3 Color and Feel of the Space*

Interior elements of the workplace facilities directly influence workers' comfort and efficiency (Hassanain, 2006). The interior of a workplace should be designed to consider workers' needs. This results in positive change in the productivity of the workforce (Hassanain, 2006). Elements that designers and facility managers need to consider include layout of the workspace, interior materials, lighting system, air quality, furniture, fixtures, furnishings, signage, color planning, and operation and maintenance (Sogawa, Nitanaï, Shokawa, Horiguchi, Moriyama, Nakada, Ichikawa, Adachi, Ochiai, & Hagino, 2002). A research study by Stegmeier (2008) stated that workplace aesthetic expectations include colors in the environment, a high-tech look, and the overall feel of the space. Having a rotating art collection, reflecting the brand and culture of the organization, also improved workplace satisfaction. Stegmeier (2008) also suggested that the office interior is essential to make a statement to potential new clients and/or job candidates the moment they step off the elevator.

With a spaceship, slides, igloos and firemen's poles, Google's office spaces sound more like a themed adventure park than the working environment of a global brand (Groves, 2010). Yet while Google has developed a reputation for goofy-sounding offices, what lies beneath the bright colors, lava lamps and yoga balls is a deep understanding of the drivers behind creative thinkers and how the environment can play a huge role in making challenging work fun. By

developing and nurturing a relaxed, playful and fun atmosphere, more profound human connections are created among people, reducing the fear factor and ensuring good work gets done. A slide isn't a childish gimmick; it is an efficient way of descending from floor to floor. Colored exercise balls are good for employee postures, and are inexpensive and fun. Having good space to work affects the psychological comfort of the employees (Groves, 2010).

Based on responses to the addition of patterns, access to outdoors, fun at work, and color and feel of the space are patterns that could be added to the pattern language design tool for collaborative work environments.

#### *5.4 Limitations of the Study*

This section of the chapter will briefly discuss several limitations and constraints related to this study. Due to the breadth of the study, the focus of the research was restricted to one business typology. Since many workplaces today are collaborative, this research could be conducted with other workplace typologies such as law offices, healthcare facilities, and businesses having different workplace environments.

Generalizability of findings may be limited to a designers' workplace. The findings of the study were only based on the work environment of the sample, who were architects and designers. The results of the study may vary if the participants were put in a different work environment, or if a different sample set were chosen from a different work environment.

Due to the absence of an internal staircase at the Gensler Phoenix office, the results pertaining to importance of the wide stairways pattern have been influenced. The researcher firmly believes that an opportunity to study offices



with internal stairways may provide better conclusions regarding the wide stairways pattern.

The age brackets used for the study was too broad which included both Gen X and baby boomers. Having smaller age brackets would have helped to understand the distinct characteristics of any particular generation.

### *5.5 Future Implications*

There are several implications for future research related to this study. Just as software developers have found a web-based venue for sharing information using a pattern language, this research suggests that such a tool may be helpful for interior designers creating teaming spaces. Having access to this powerful tool at the designer's desktop could enable the designer to supplement the language, thereby building and refining the tool for future use by other design professionals. Although this language is not intended to be used as an instructional manual, its usefulness as a tool for design development could be very relevant. Future research can use the pattern language as an evaluation tool by modifying the survey and conducting focus groups to improve collaboration in an existing work environment.

As this study was exploratory, further research is needed to continue studying the usefulness of the pattern language as a design and evaluation tool. Perhaps further evaluation of the revised language by a sample of office designers might prove beneficial. Additionally, testing the pattern language tool across other work typologies (i.e., law, healthcare) would further validate its benefits as a design tool. Creating a language for other environments such as retail, hospitality, and healthcare spaces may prove commendable and beneficial to designers. The sharing of this information on a website is the key to its

success and implementation. Further research and implementation of this language will help further the communication between design research and design practice.

### *5.6 Conclusion*

This study provided research on the web-based tool for designing collaborative work environments. Conclusions are drawn based on the initial literature review, the pattern language website, and survey instrument data. Employees from Gensler rated each pattern based on its importance in a collaborative work environment. The majority of patterns received a positive rating on the Likert scale. The results also showed that work areas on wheels, vertical surfaces, and wide stairways received relatively lower ratings and much higher standard deviations compared to the rest of the patterns. Based on employees' insight and experience, the majority of responses focused on the addition of patterns to address access to outdoors, fun at work, and color and feel of the space. The results also showed that among those design professionals surveyed, the majority believe that a pattern language could be a valuable design tool ( $m=4.38$ ;  $sd=0.80$ ).

The results showed a diversity of opinions pertaining to the work areas on wheels pattern from the reviewed literature due to a difference in work style and culture of different generations of people. The vertical surface pattern results also had high standard deviation due to the exclusion of advanced interactive technological tools. As the Gensler Phoenix office has no internal stairways, the results were negative regarding the wide stairways pattern. It is suggested that facilities with internal staircase be surveyed to assess its importance for future research.

This study adds to the existing body of knowledge pertaining to the usefulness of a pattern language for designing collaborative work environments. The insights obtained from this study will provide designers, architects, and facility managers with a new design tool to aid in creating effective collaborative spaces in a work environment. By developing and broadening this tool across various workplace typologies, pattern language for collaborative environments could be used as an effective and valuable design tool.

## REFERENCES

- Adewumi, S. (2010, November 1). Neocon 2010: the future of new workplace design. *Workspace Design*. Retrieved November 30, 2010, from <http://workspacedesignmagazine.com/index.php/category/issues/2010-11/>
- Alexander, C., Ishikawa, S., & Silverstein, M. (1977). *A Pattern Language*. New York: NY: Oxford University Press.
- Allen, T. J. (1971). Communications networks in R & D laboratories. *R&D Management*, 1(1), 14-21.
- Anthony, L. (2001). *Pattern Language as a design and evaluation tool for teaming environments*. Master's thesis, Virginia Polytechnic Institute and State University-Virginia. Retrieved September 13, 2010 from <http://scholar.lib.vt.edu/theses/available/etd-05122001-093653/unrestricted/etd.pdf>
- Arnold, T. (2002). From the Buerolandschaft to the cityscape in the office. In R.Hascher, S.Jeska & B. Klauck (Eds.), *A Design Manual: Office buildings*, Birkhaeuser:Germany.
- Backhouse, A. & Drew, P. (1992). The design implications of social interaction in a workplace setting. *Environment and Planning B: Planning and Design*, 19, 573-584.
- Becker, F. (2004). *Offices at work*. San Francisco: Jossey-Bass.
- Berte, E. (2011). Apple unveils thinner, faster iPad 2: Steve Jobs Appears. *FOX Business*. Retrieved March 2, 2011 from <http://www.foxbusiness.com/technology/2011/03/02/apple-unveils-newly-designed-ipad-2-steve-jobs-shows/>
- Blixt, J. (2000, September). 25 products that rocked design. *ASID ICON*, 21.
- Brand, J. (2008) Office ergonomics: pertinent research and recent developments. In C.M. Carswell (Ed.), *Reviews of human factors and ergonomics*, 4, 245-281. Santa Monica, CA: Human Factors and Ergonomics Society
- Brand, J.L, Augustin, S. (2009). Impact of physical environment on knowledge worker performance, *Haworth -Collaboration white paper*. Retrieved December 23, 2010 from <http://www.haworth.com/en-us/Knowledge/Workplace-Library/Pages/AllDocuments.aspx>
- Brand, J.L. (2009), Physical space and social interaction, *Haworth-Collaboration white paper*. Retrieved December 24, 2010 from <http://www.haworth.com/en-us/Knowledge/Workplace-Library/Pages/AllDocuments.aspx>
- Brill, M. (1998, August). *New officing strategies*. Workshop presented at the Alternative Office Convention, San Jose, CA.

Brill, M., Weidemann, S., and the BOSTI Associates (2001), *Disproving widespread myths about workplace design*, published and distributed by Kimball International, Jasper. Retrieved December 9, 2010 from <http://www.bosti.com/public.htm>

Butler, C. (1999). Seriously silly. *Business Week*, 3646, 14.

Coplien, J.O. & Schmidt, D.C. (Eds.). (1995). *Pattern language of Program Design*. Boston: Addison-Wesley publication.

Duffy, F. (1992). *The Changing workplace*. London, UK: Phaidon Press Limited.

Duffy, F. & K. Powell (1997). *The New Office*. UK: Conran Octopus.

Earle, H.A. (December, 2003). Building a workplace of choice: Using the work environment to attract and retain top talent. *Journal of Facility Management*, 244.

Evans, J. & Mathur, A., (2005). The value of online surveys. *Internet Research*, 15(2), 195-219. Retrieved October 30, 2010, from [www.emeraldinsight.com/1066-2243.htm](http://www.emeraldinsight.com/1066-2243.htm)

Ford, C., McLaughlin, F., & Newstrom, J. (2003). Questions and answers about fun at work. *Human Resource Planning*, 26(4), 18-33.

Gensler. (2011). Retrieved January 23, 2011, from <http://www.gensler.com/>

Gibson, V. (2003). Flexible working needs flexible spaces? *Journal of Property Investment & Finance*, 21(1), 12-22.

Groves, K. (2010). *I wish I worked there! A look inside the most creative spaces in business*. United Kingdom: John Wiley & Sons Ltd.

Harmon-Vaughan, B. (2009). Creating More Efficient Workspaces Can Increase Productivity and Reduce Costs. Retrieved January, 20, 2011, from <http://aznow.biz/workforce/efficient-workspaces-increase-productivity-reduce-costs>

Harrison, A., Wheeler, P. & Whitehead, C. (Eds.) (2004). *The distributed workplace*. Spon Press: London, UK.

Hassanain, M.A., (2006), Factors affecting the development of flexible workplace facilities, *Journal of Corporate Real Estate*, 8(4), 213-220.

Haynes, B.P., & Price, I. (2004). Quantifying the complex adaptive workplace, *Facilities*, 22(1), 8-18.

Heerwagen, J.H., Kampschroer, K., Powell, K.M., & Loftness, V. (2004). Collaborative knowledge work environments. *Building Research and Information*, 32(6), 510-528.

- Herman Miller Inc. (2008). Making room for Collaboration. Herman Miller workplace research [Online]. Retrieved November 23, 2010 from [www.hermanmiller.com](http://www.hermanmiller.com)
- Ilozor, B. D., Lover, P. E. D. & Treloar, G. (2002). The impact of work settings on organizational performance measures in built facilities. *Facilities*, 20(1/2), 61-68.
- Issacs, EA., Tang, JC. (1993). What video can and can't do for collaboration: A case study. *Proceedings of Multimedia*, 199-206
- Jeska, S. (2002). The effects of information technology on corporate structures. In Arnold, T., Hascher, R., Jeska, S., & Klauck, B. *A design manual Office building*.(p. 25-28). Germany: Birkhauser- Publishers for Architecture.
- Johansson, M., Frost, P., Brandt, E., Binder, T. & Messeter, J., (2002). New challenges for workplace design, *Proceedings of the Participatory Design Conference*, Malmo, Sweden.
- Kaplan, S. (1995). The restorative effects of nature: toward an integrative perspective, *Journal of Environmental Psychology*, 15, 169-182.
- Kaplan, S. (2001). Meditation, restoration, and the management of mental fatigue. *Environment and Behavior*, 33(4), 480-506.
- Khambaty,L.(2001, Spring). A Pattern Language for Designing Interiors for Alzheimer's Patients. *Journal of Design Communication*, Issue 3. Retrieved November 20, 2009, from <http://scholar.lib.vt.edu/ejournals/JDC/Spring-2001/>
- Klauck, B. (2002). Communication as the focus of office planning. In Arnold, T., Hascher, R., Jeska, S., & Klauck, B. *A design manual Office building*.(p. 25-28). Germany: Birkhauser- Publishers for Architecture.
- Kosslyn, S., The world question center 2007, *The Edge*. Retrieved April 19, 2010 from [http://www.edge.org/q2007/q07\\_4.html](http://www.edge.org/q2007/q07_4.html).
- Koh, E. (2010). Conferencing room for telepresence with remote participants. *Proceedings of the 16<sup>th</sup> International ACM conference*. Florida, USA, 309-310.
- Kraut, R.E., Egidio, C. & Galegher, J. (1990). Patterns of contact and communication in scientific research collaboration, In J. Galagher, R.E., Kraut and C. Egidio (Eds.): *Intellectual teamwork*. Hillsdale, NJ: L. Erlbaum Associates.
- Laing, A., DEGW North America (2006). New patterns of work: The design of office. In J.Worthington DEGW (Ed.), *Reinventing the Workplace*, Second Edition (pp29-49). Burlington, MA : Architectural Press.

Langhoff, J., (2007, May). Does place still matter? The role of the workplace in a distributed world. *Haworth-The New Ways of Working*. Retrieved 25 June, 2009 from <http://www.haworth.com/en-us/Knowledge/Workplace-Library/Pages/AllDocuments.aspx>

Lawler, E. (2001). *Organizing for High Performance: Employee Involvement, TQM, Re-engineering and Knowledge Management in the Fortune 1000*. New York, NY: Jossey-Bass.

Loftness, V., Vischer, J., & Tanis, J. (2008). The interior environment. In Grech, C. & Walters, D. (Eds.), *Future office: Design, practice and applied research*. (p. 19-24). London & New York: Routledge.

Mariotti, J. (1999). A company that plays together stays together. *Industry Week*, 248(6), 63.

Marnot, A. & Eley, J. (2000). *Office space planning: Designing for Tomorrow's workplace*. New York, NY: McGraw-Hill.

McGhee, P. (2000). The key to stress management , retention, & profitability? More workplace fun. *HR Focus*, 77(9), 5-6.

McLain-Kark, J. (2001). Notes on pattern languages for the Millennium. *Journal of Design Communication*. 3. Retrieved August 9, 2010 from <http://scholar.lib.vt.edu/ejournals/JDC/Spring-2001/patlang.html>

Meyer, H. (1999). Fun for everyone. *Journal of Business Strategy*, 20(2), 13-17.

Mudgett, John C. (2000, July 24). *Office space-who needs it?* Retrieved April 20, 2010 from <http://www.cuh2a.com>.

Nadler, D., Tushman, M. & Nadler, M. B. (1997). *Competing by Design: The Power of Organizational Architecture*. UK: Oxford University Press.

Nie, N., Hillygus, S. & Erbring, L. (2002). Internet use, interpersonal relations and sociability: Findings from a detailed time diary study. In B.Wellman (Ed.), *The Internet in Everyday Life* (p. 215–243). London : Blackwell Publishers.

Oseland, N. (1999). *Environmental factors affecting office worker performance: A review of evidence*. London, UK: Technical Memoranda TM24 CIBSE.

Penn, A., Desyllas, J. & Vaughan, I. (1999). The space of innovation, *Environment and Planning: Planning and Design*, 26, 193-218.

Pile, J. (1978). *Open office planning: A handbook for interior designers and architects*. New York, NY: Whitney library of design.

Piotrowski, C.M., (2007). *Professional Practice for Interior Designers* (4<sup>th</sup> ed.). New York: John Wiley & Sons.

- Rashid, M., Kampschroer, K., Wineman, J. & Zimring, C. (2004). *Face-to-face interaction in office setting: What you know about it may not be always true*. Technical Report. Atlanta, GA: Georgia Institute of Technology, College of Architecture,
- Reder, S. & Schwab, R.G. (1990). The temporal structure of cooperative activity, in *CSCW'90 Proceedings*, 303-320. New York, ACM Press.
- Rice, J. & Mitchell-Ketzes, S. (2002). Success stories from the new workplace. *Building operating management*, August 2002.
- Schrum, L. & Benson, L., (2002). The evolution of workplace tolls for group communications and collaboration. *Advances in developing human resources*. 4(4), 479-492. Retrieved on January 3 2010, from <http://adh.sagepub.com/content/4/4/479>.
- Sellen, A. (1995). Remote conversation: The effects of Mediating talk with technology. *Human Computer Interaction*, 10,401-444.
- Serrato, M.G. (2002). Building based communication research. Retrieved 30 October, 2009 from <http://www.tradelineinc.com>.
- Shuman, D. & Scott, K. (2002, February), Workplace design can improve productivity: Five elements for a changing workplace, *Seattle Daily Journal of Commerce*, p. 28.
- Sims, W. (2000). Team space: Planning and managing environments to support team work, *International Journal of Facilities Management*, 1(1), 21-33.
- Sogawa, D., Nitana, S., Shiokawa, K., Horiguchi, M., Nakada, Y., Ichikawa, Y., Adachi, K., Ochiai, T. and Hagino, H. (2002). *Universal design and the workplace: guidelines on how universal design contributes to asset value and facility function*. Paper presented at the International Conference for Universal Design, Yokohama, Nov/ Dec, 1023, p1023
- Steelcase (2008, August), There is no 'I' in teamwork – But there is plenty in future [Online]. Retrieved 19 September, 2009 from [http:// www.steelcase.com](http://www.steelcase.com)
- Steelcase. (June, 2008). *Workspace for work-anywhere in the world*. Steelcase-360. Retrieved June 10,2010 from <http://www.steelcase.com/en/resources/research/360/pages/main.aspx>
- Steelcase. (2009). *Attracting and Engaging Today's Workders*. Steelcase-360. Retrieved April 24, 2010 from <http://360.steelcase.com/articles/attracting-and-engaging-todays-workers-2/>
- Steelcase. (February, 2010). *Work with me here*. Steelcase -360. Retrieved March 23, 2010 from <http://www.steelcase.com/en/resources/research/360/pages/main.aspx>



Stegmeier, D. (2008). *Innovations in office design: The critical influence approach to effective work environments*. New Jersey: John Wiley & Sons, Inc.

Szigeti, T., McMenemy, K., Saville, R., & Glowacki, A. (2009). *Cisco TelePresence Fundamentals*. Indianapolis, USA: Cisco Press.

Thorp, I., & Darling, M. (2009). *Designing for collaborative learning*. Haworth- Changing Nature of Work and Trends White Paper. Retrieved October 25, 2010 from <http://www.hermanmiller.com/Research>

Van Aken, E.M. (2000). Theory of Organization. Unpublished lecture material.

Vischer, J.C., (2005). *Space meets status*. London and New York: Routledge Taylor & Francis Group.

Wineman, J., & Serrato, M. (1998). *Facility design for high performance teams*. In E. Sundstrom & C. Crocker (Eds.), *Supporting work team effectiveness: Best management practices for fostering high performance* (p. 271 - 297). San Francisco: Jossey-Bass.

Worthington, John. (2005). *Reinventing the Workplace*. Great Britain: Elsevier. Retrieved 4 February 2011, from <http://lib.myilibrary.com?ID=64200>

Workspace. (2002). Retrieved on October 17, 2010 from [http://www.workspaceinc.net/asp/about\\_us\\_news/news\\_details.asp?newsid=168](http://www.workspaceinc.net/asp/about_us_news/news_details.asp?newsid=168)

APPENDIX A  
PILOT STUDY – EMAIL LETTER

Dear Participants,

I am a graduate student pursuing my Master in Interior Design at Arizona State University. As a part of my research, I have developed a website and a survey questionnaire.

My research is based on Christopher Alexander's pattern language methodology. Based on current trends and research this thesis is built upon a masters thesis by [Anthony](#) in 2001. This study attempts to make a web-based tool that could be easily accessible by the designers to create effective collaborative work environments.

The process is very simple. It is explained in details as below:

**Step 1:** Open the pattern language website <http://www.public.asu.edu/~dmshah6/>

**Step 2:** Open the online survey

form <https://spreadsheets.google.com/viewform?hl=en&formkey=dHYtOHJpeFJRb3NaYWpZaEJCWkdIcFE6MA#gid=0>

**Step 3:** Start the survey

**Step 4:** Simultaneously answer the survey questions corresponding to each pattern language using the links along the left margin of the pattern language website. It's easiest to have both the websites displayed side by side.

**Step 5:** Submit the survey when done.

The survey is very simple and self explanatory. It takes approximately 20 minutes to complete the entire survey. Please complete one survey per person. I would appreciate you completing the survey by 24th December 2010. In case of any questions/concerns email me at [dmshah6@asu.edu](mailto:dmshah6@asu.edu).

I appreciate your time and feedback,

Deepika Sangoi

MSD Interior Design

Arizona State University

APPENDIX B  
PILOT STUDY - SURVEY

## Pattern language : Design tool for collaborative work environments

Dear Participants,

I am a graduate student under the direction of Professor Diane Bender in the Herberger Institute for Design and the arts at Arizona State University.

I am conducting a research study to create an information tool for designing effective team environments. In 1977, Christopher Alexander and his associates developed pattern language as a series of inter-related physical elements combined to create a framework of design solutions. Based on Christopher Alexander's methodology, I have re-created a web-based pattern language for team environments in the workplace. I am inviting your participation, which will involve browsing through the website and filling the online survey based on it.

The responses to the survey may not benefit you on a personal level, but may help in forming guidelines for designing team environments.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. The age range of participants enrolling for the study must be between 18 to 85 yrs old.

Your responses will remain anonymous. They will be destroyed on the completion of the research study. The results of the study may be used in reports, presentations or publications but your name will not be known. There are no foreseeable risks or discomforts to your participation.

If you have any questions concerning the research study, please contact the research team at: Diane Bender(PI) – (480)-965-4367 or [diane.bender@asu.edu](mailto:diane.bender@asu.edu) or Deepika Sangoi(co-investigator) – (480)-297-7173 or [dmshah6@asu.edu](mailto:dmshah6@asu.edu). If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By clicking the Continue button, you agree to the above statements and your submission of the survey will be considered as your consent to participate.

Continue »

Powered by [Google Docs](#) [Report Abuse](#) - [Terms of Service](#) - [Additional Terms](#)

## Pattern language : Design tool for collaborative work environments

\* Required

### Demographics

Age \*one must between 18-85yrs old to participate

- 18-25
- 26-40
- 41-60
- 61-85

Gender \*

- Male
- Female

Major \*

### Pattern Language

Consider your work environment and rate the below 15 patterns based on their importance in the teaming work environments. The descriptions of each pattern is explained in the website.

### Community connections

1 2 3 4 5  
least important      most important

Welcoming entry

1 2 3 4 5

least important      most important

Public spaces that tell a story

1 2 3 4 5

least important      most important

Main street thoroughfare

1 2 3 4 5

least important      most important

Social hub

1 2 3 4 5

least important      most important

Town halls

1 2 3 4 5

least important      most important

Team huddle space

1 2 3 4 5

least important      most important

Heads down space

1 2 3 4 5

least important      most important

Work areas on wheels

1 2 3 4 5

least important      most important

Technology access

1 2 3 4 5

least important      most important

Let there be light

1 2 3 4 5

least important      most important

Vertical surfaces

1 2 3 4 5

least important      most important

Comfortable workplace

1 2 3 4 5

least important      most important



Wide stairways

1 2 3 4 5

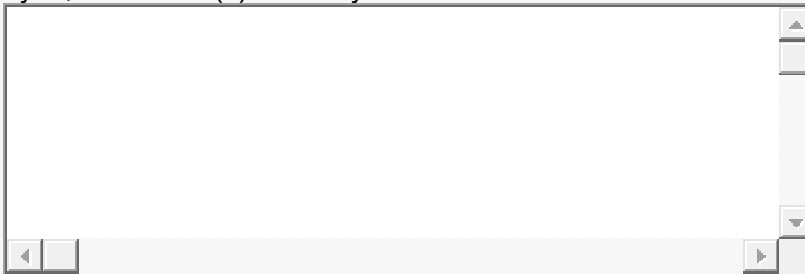
least important      most important

Stay close

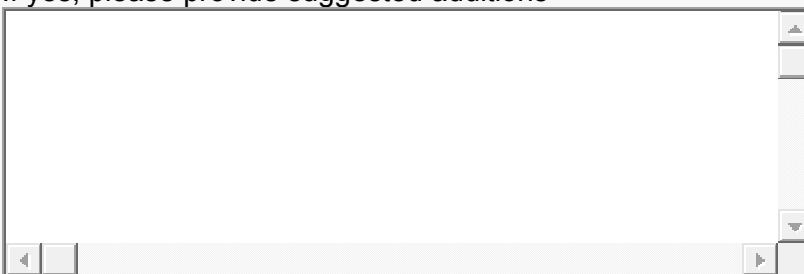
1 2 3 4 5

least important      most important

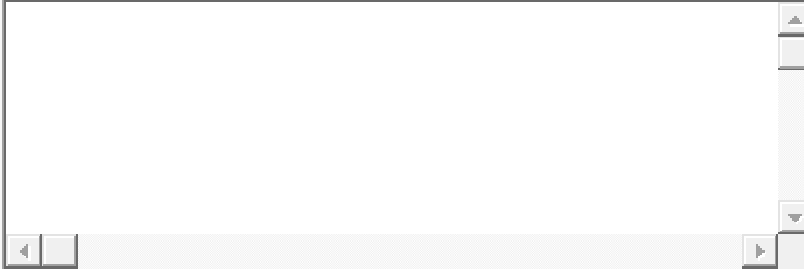
Would you remove any of the 15 patterns to this language?  
If yes, which one(s) and why?



Would you add any pattern to this language?  
If yes, please provide suggested additions



Would you revise any of the existing patterns to this language?  
If yes, please provide suggested revisions

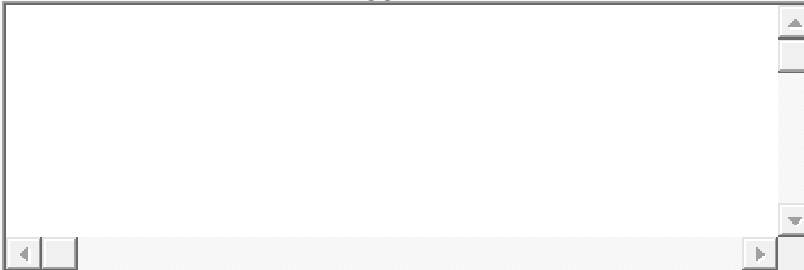
A large, empty rectangular text area with a thin border. It has a vertical scrollbar on the right side and horizontal scrollbars at the bottom, indicating it is a scrollable input field for text.

Do you believe that this pattern language could be a useful tool for designing team environments?

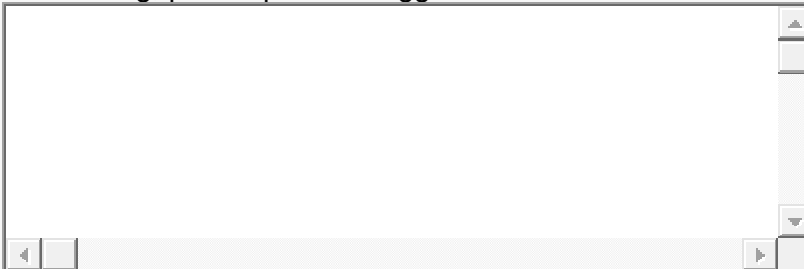
1 2 3 4 5

Disagree      Agree

Access to the website  
If difficult, please provide suggestions

A large, empty rectangular text area with a thin border. It has a vertical scrollbar on the right side and horizontal scrollbars at the bottom, indicating it is a scrollable input field for text.

Pattern language  
If confusing, please provide suggestions

A large, empty rectangular text area with a thin border. It has a vertical scrollbar on the right side and horizontal scrollbars at the bottom, indicating it is a scrollable input field for text.

Survey

If it is difficult to understand, please provide suggestions

Powered by [Google Docs](#) [Report Abuse](#) - [Terms of Service](#) - [Additional Terms](#)

## Pattern language : Design tool for collaborative work environments

### Thank you

Thank you for participating in this survey. I greatly appreciate your time and feedback. If you have any questions please email me at [dmsah6@asu.edu](mailto:dmsah6@asu.edu)

Time taken to complete the survey

[« Back](#)

[Submit](#)

Powered by [Google Docs](#) [Report Abuse](#) - [Terms of Service](#) - [Additional Terms](#)

APPENDIX C  
PILOT STUDY - FOLLOW-UP EMAIL

Hi,

I need your help! Last week I e-mailed a survey for my masters thesis pertaining to pattern language for collaborative work environment. To date, my response rate has been very low. Your insight as a designer is greatly needed and a valuable part for my study. I implore you to please take 20 minutes to complete and return my survey. The deadline for filling this survey is Dec 24th (Friday).

I am truly grateful for your valuable insight. If I can be of assistance please do not hesitate to ask.

(If you have already responded, please accept my thanks!)

Thank you,  
Deepika Sangoi  
(Previous e-mail w/survey & website link)

APPENDIX D  
PATTERN LANGUAGE WEBSITE

# Pattern Language

A design tool for collaborative work environment

## Home

[Community connections](#)

[Welcoming entry](#)

[Public spaces](#)

[Main street thoroughfare](#)

[Social hub](#)

[Townhalls](#)

[Team huddle space](#)

[Heads-down space](#)

[Work areas on wheels](#)

[Technology access](#)

[Let there be light](#)

[Vertical surfaces](#)

[Comfortable work](#)

[Wide stairways](#)

[Stay close](#)

[Summary](#)

[References](#)

[Survey](#)

### Introduction

This website is created to illustrate the interrelated components involved in designing flexible collaborative work environments using Pattern Language methodology.

### Pattern Language

In 1977 Christopher Alexander, Sara Ishikawa and Murray Silverstone published "A Pattern Language" book, which is a unique design methodology to solve common problems faced by any community or individual creating livable structure such as a town or a house. Named as one of the "25 Products that Rocked Design" by American Society of Interior Design ([Blixt, 2000](#)), their language is comprised of intrinsically interrelated patterns that focus on the relationships of spaces to inhabitants and surrounding environments. A pattern is a practical guide to resolve any problem that occurs over and over, such as a welcoming entry or townhalls.

### Collaborative Work Environment

Many organizations have implemented working in teams to increase efficiency and productivity. Collaboration is not a new concept, yet within the past few years it has become a work method that has influenced many corporate restructuring plans. Teams are created to solve problems, manage employees, improve processes, and develop new products. Companies are re-organizing their work environment to respond to the needs of teams.

### Description of the website

Based on current trends and research this thesis is built upon a masters thesis by [Anthony](#) in 2001. Each of the 15 patterns is organized to include a title, a picture representing a physical example of the pattern, a short description about the pattern and a justification section which links to the sources. 15 patterns for collaborative work environment are highlighted in blue and listed on the left side of this web page. Link to the survey is also highlighted in bold blue on the left side of this web page.

### Conclusion

The culmination of their patterns forms a 'language' that enables designers and architects to create thoughtful and successful design solutions.

I appreciate your time to browse through the website and answer the survey questions. This should take approximately 20 minutes.



# Pattern Language

A design tool for collaborative work environment

Home > Community connections

## Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Community connections

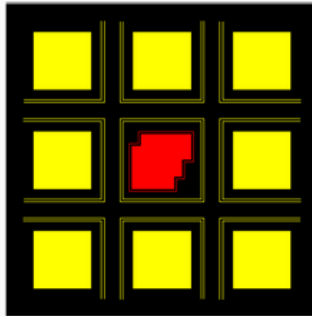


Image 1

### Description

For flexibility in a work environment, offices must be convenient to customers, shops, parking, airports, schools, restaurants and other modern amenities.

### Justification

Today's worker rarely works an eight-hour day in one place. Striving to find a balance between home and work has been an influential factor in the evolution of alternatives like working from home and telecommuting ([Gibson, 2003](#)). As workdays are longer, those who spend the majority of their time in the office are forced to run errands and manage personal affairs during lunch and break times. Convenient access to amenities allows the worker to accomplish these tasks in a timely and efficient manner.

# Pattern Language

A design tool for collaborative work environment

Home > Welcoming entry

Community connections

**Welcoming entry**

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Welcoming entry



Image 2

### Description

The entry to an office or building is the transitional element that invites or welcomes an employee to work.

### Justification

A unique and well-designed entry communicates an inviting welcome to employees and visitors. Based on an independent research by American Society of Interior designer (ASID), physical workplace ranked in the top three when examining the factors that contribute to job satisfaction ([Earle, 2003](#)). These entries should be reflective of the image a company wishes to portray and be distinctive in their use of materials and architecture.

# Pattern Language

A design tool for collaborative work environment

Home > Public spaces

Community connections

Welcoming entry

**Public spaces**

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Public spaces that tell a story



Image 3

### Description

The public spaces within an office should communicate the company story. These areas are visited by clients and guests and should reflect the corporate philosophies and goals by being an extension of the overall image portrayed by the company.

### Justification

Having a space to display who we are and how we work represents organizational identity (2008, [Steelcase](#)). The public spaces within an office environment should communicate these philosophies and goals by clearly defining the company in terms of how the organization functions. These spaces should be integral elements in the overall design concept and be reflective of the company's structure and organization.

# Pattern Language

A design tool for collaborative work environment

Home > Main Street thoroughfare

Community connections

Welcoming entry

Public spaces

**Main street thoroughfare**

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Main street thoroughfare



Image 4

### Description

The Main Street thoroughfare is the centralized major artery connecting public spaces within the office environment. This thoroughfare should be an integral part of the design concept and provide workers with impromptu places to communicate and share information.

### Justification

With the demand placed on the workplace to provide environments that respond to flexible work, these main corridors become more than simply paths of travel. [Heerwagen et alia](#) identify the benefits to the knowledge worker of ad hoc brief interactions with colleagues. According to [Heerwagen et alia](#) brief interactions can be both intentional and unintentional, and can occur in many locations, i.e. at people's desks, in the corridor and near central services. The location of the brief interaction can be considered an "information exchange" ([Heerwagen et alia, 2004](#)). The researchers conclude that designing space to maximize visibility will also maximize the number of interactions among coworkers ([Herman Miller](#)).

# Pattern Language

A design tool for collaborative work environment

Home > Social hub

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

**Social hub**

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Social hub



Image 5

### Description

During the day, the path to the coffee machine is well traveled. Providing cafe locations a central position in the office equipped with comfortable seating and necessary communication tools gives employees a place to interact informally.

### Justification

Leverage social networks and break down silos by offering a centrally located casual space, such as a cafe or coffee bar. Food and beverages are a draw, but a collaborative tools make the space more effective. Settings where people can work in the open makes them accessible to others. A social hub often becomes the psychological center of the workplace ([Feb 2010, 360-Steelcase](#)).

# Pattern Language

A design tool for collaborative work environment

Home > Town halls

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

**Townhalls**

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Town halls



Image 6

### Description

Town halls are informal multi-functional congregational places. These areas are used for large or small meetings and are typically available to all company employees.

### Justification

Group areas may even need more attention paid to social "channeling" and other symbolic details than personal work areas, since 60 percent of what people learn occurs informally, and much of this happens within teams ([Brand, 2009](#)). Not all meetings need to be formal and enclosed within four walls. Open and re-configurable congregational areas provide space for impromptu gatherings as well as company meetings. Having meeting spaces of various sizes helps to accommodate diverse team requirements ([Stegmeier, 2008](#)).



# Pattern Language

A design tool for collaborative work environment

Home > Team huddle space

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

**Team huddle space**

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Team huddle space



Image 7

### Description

A place conveniently located to all members within a team to support meetings, brainstorming, and problem solving activities.

### Justification

Group work is not "open" work and should be supported with designated team areas for interactive communication and brainstorming ([Brill, 1998](#)). There is increasing demand for dedicated team collaboration spaces that restrict access to the rest of the employees and allow work in progress to remain in place for days, weeks, and months at a time ([Stegmeier, 2008](#), p.25). As [Wineman and Serrato](#) state (1998, p. 282): Working groups of any type should have easily accessible space available for the group to meet (face-to-face). Such spaces encourage collaboration across boundaries within the organization. Available, easily reserved, and well-equipped meeting spaces facilitate impromptu meetings. The rate of participation in meetings seemed higher in the team area than in the conference rooms ([Brand & Augustin 2009](#)).

# Pattern Language

A design tool for collaborative work environment

Home > Heads-down spaces

[Community connections](#)

[Welcoming entry](#)

[Public spaces](#)

[Main street thoroughfare](#)

[Social hub](#)

[Townhalls](#)

[Team huddle space](#)

**[Heads-down space](#)**

[Work areas on wheels](#)

[Technology access](#)

[Let there be light](#)

[Vertical surfaces](#)

[Comfortable work](#)

[Wide stairways](#)

[Stay close](#)

[Summary](#)

[References](#)

[Survey](#)

## Heads-down spaces



Image 8

### Description

A sense of personal space provides employees with the opportunity to balance privacy with interaction. Sometimes one needs a place where one can focus on a task, have a private conversation or phone call, or just distance oneself from interruptions.

### Justification

It is important in a dynamic teaming environment to provide personal work areas or zones for employees who seek privacy ([Mudgett, 2000](#)). Since, office work can be considered as both individual and collaborative in nature, then office environments must aim to achieve maximum interaction while at the same time not affecting concentrated individual work ([Haynes and Price, 2004](#)). [Haynes and Price](#) compare this to the concept of "caves and commons".



# Pattern Language

A design tool for collaborative work environment

Home > Work areas on wheels

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

**Work areas on wheels**

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Work areas on wheels



Image 9

### Description

Team members respond to varying demands and tasks that require mobility and flexibility in their physical surroundings. Furniture and equipment should respond to the user needs.

### Justification

Furniture within the team space should be versatile and easy to reconfigure ([Facilities Programs, 1993](#)). Mobile tables, drawer pedestals, storage units, white boards, and chairs provide the opportunity for team members to reconfigure their physical environment based on activity requirements. Moreover, teams keep varying and shuffling based on the projects. Provide flexible tools to support the creation and sharing of knowledge. This means everything from interior walls to digital devices to furniture, accessories, and supplies ([Thorp & Darling, 2009](#)).

# Pattern Language

A design tool for collaborative work environment

Home > Technology access

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

**Technology access**

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Technology access



Image 10

### Description

Providing access to technology in all formal and informal team spaces helps employee to connect with colleagues and clients across the globe.

### Justification

These days work happens around the globe. Access to technology at all formal and informal team spaces helps to collaborate with far-flung colleagues ([Feb 2010, 360-Steelcase](#)). It also helps to share digital information instantly and with everyone in the group ([Feb 2010, 360, Steelcase](#)). Collaborative spaces with access to power, wi-fi and projection, where everyone can see the information and interact with it, are more effective for collaboration.

# Pattern Language

A design tool for collaborative work environment

Home > Let there be light

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

**Let there be light**

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Let there be light



Image 11

### Justification

Whether windows enhance task efficiency for a room's occupants remains controversial, although moods and emotional tone can be improved by natural light ([Brand, 2009](#)). The nature of the task is important when considering windows. Typically, if the room is well lit (ideally with natural light), a high (or sloped) ceiling encourages social interaction ([Brand, 2009](#)).

### Description

Having windows (as opposed to no windows) in a room increases its social desirability; the bigger they are (between ceiling and floor) the better.

# Pattern Language

A design tool for collaborative work environment

Home > Vertical surfaces

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

**Vertical surfaces**

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## Vertical surfaces



Image 12

### Description

Vertical surfaces such as whiteboards, projection screens, and chalkboards help to share and discuss ideas. The design and location of visual displays and artifacts also influence the effectiveness of knowledge transfer and the coordination of efforts among group members.

### Justification

As knowledge work is a largely cognitive activity, its processes are mostly invisible. Tacking surfaces, white boards, and technological tools such as projection and large video displays allow people to illustrate ideas and post thinking-in-process to make the work visually accessible to the group, aiding memory and the organization of tasks and materials. Users feel that the display areas available make it easier to analyze data for trends, patterns, and comparisons. The display of team thinking in the team rooms makes the creators feel proud of their work ([Brand & Augustin, 2009](#)). Placement that allows ready viewing and evaluation by people as they sit at work or move along a routinely traveled corridor can heighten shared awareness ([Heerwagen](#)).

# Pattern Language

A design tool for collaborative work environment

Home > Comfortable work

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

**Comfortable work**

Wide stairways

Stay close

Summary

References

Survey

## Comfortable work



Image 13

### Justification

To maximize social exchange, furniture should provide no cues to relative status within the group (Brand, 2009). Improving ergonomics in the work environment primarily creates a safer and more healthful workplace. The organization may experience as well other benefits such as increased productivity, work quality, and morale.

### Description

Ergonomics becomes an important factor if the task requires lengthy conversations.

# Pattern Language

A design tool for collaborative work environment

Home > Wide stairways

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

**Wide stairways**

Stay close

Summary

References

Survey

## Wide stairways

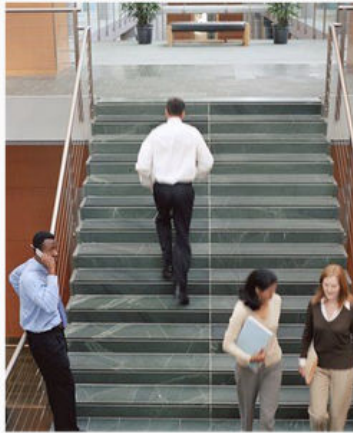


Image 14

### Description

Stairways are interaction nodes. Having wide stairways enhances impromptu interactions among employees.

### Justification

To optimize interaction and communication, one workplace strategy calls for no building in work complex to be more than five stories high. Wide staircases increases the opportunity of colleagues coming in contact with one another on a regular basis ([Stegmeier, 2008](#)).

# Pattern Language

A design tool for collaborative work environment

Home > Stay close

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

**Stay close**

Summary

References

Survey

## Stay close

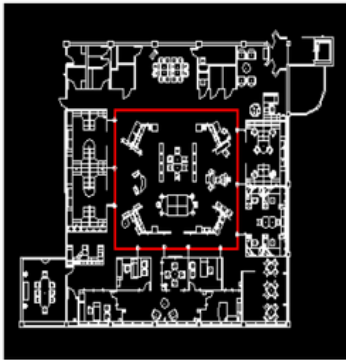


Image 15

### Justification

They want to see and be seen. Easy eye contact between people, and between people and information, make idea sharing more likely. Hearing others allows for mentoring through "eavesdropping" and sharing information informally throughout the day. And keep things close: beyond 50 feet, spaces doesn't get used, whether it's a meeting room or cafe (Stealcase 2010)

### Description

People collaborate more when they're in proximity to others.



# Pattern Language

A design tool for collaborative work environment

[Home](#) > [Summary](#)

[Community connections](#)

[Welcoming entry](#)

[Public spaces](#)

[Main street thoroughfare](#)

[Social hub](#)

[Townhalls](#)

[Team huddle space](#)

[Heads-down space](#)

[Work areas on wheels](#)

[Technology access](#)

[Let there be light](#)

[Vertical surfaces](#)

[Comfortable work](#)

[Wide stairways](#)

[Stay close](#)

**[Summary](#)**

[References](#)

[Survey](#)

## Summary

In this website you have read 15 patterns that pertain to a collaborative work environment. The patterns are organized by scale, considering for example, the broad connections to the community down to something as specific as vertical surface. The patterns are arranged in the sequence of spaces that a worker might experience on a daily basis such as community connections, welcoming entry, public spaces, team spaces, individual spaces and overall planning aspects of the space. Each pattern consists of a title, picture/illustration representing the pattern, description of the pattern, and the justification section. This makes it easier to understand each pattern without conscious effort. Each pattern is independent and makes sense as a stand-alone method. The culmination of all these patterns form a language that can be useful to designers.

Future researchers might apply these same patterns to evaluate a similar workspace, or a different work typology, by adding a focus group and modifying the survey questions.

Thank you for browsing through the website and responding to the survey.

If you have any questions/concerns please email me at [dmsah6ATasuDOTedu](mailto:dmsah6ATasuDOTedu)



# Pattern Language

A design tool for collaborative work environment

Home > Citation

Community connections

Welcoming entry

Public spaces

Main street thoroughfare

Social hub

Townhalls

Team huddle space

Heads-down space

Work areas on wheels

Technology access

Let there be light

Vertical surfaces

Comfortable work

Wide stairways

Stay close

Summary

References

Survey

## References

- Anthony, L. (2001). *Pattern Language as a design and evaluation tool for teaming environments*. (Master's thesis). Virginia Polytechnic Institute and State University-Virginia. Retrieved September 13, 2010 from <http://scholar.lib.vt.edu/theses/available/etd-05122001-093653/unrestricted/etd.pdf>
- Alexander, C., Ishikawa, S., Silverstein, Murray., Jacobson, M., Fiksdahl-king, I., & Angel, S. (1977). *A pattern language*. New York: Oxford University Press.
- Blixt, Janet. (2000, September). 25 products that rocked design. *ASID ICON*, 21.
- Brand, J.L, Augustin, S. (2009). Impact of physical environment on knowledge worker performance, *Haworth -Collaboration white paper*.
- Brand, J.L. (2009), Physical space and social interaction, *Haworth-Collaboration white paper*.
- Brill, Michael. (1998, August). *New officing strategies*. Workshop presented at the Alternative Office Convention, San Jose, CA.
- Cheskin Research and Herman Miller. (1998). *Collaboration: Applied Exploration Report*.
- Earle. H.A. (December, 2003). Building a workplace of choice: Using the work environment to attract and retain top talent. *Journal of facility management*. pp. 244.
- Evans, G. W., & Cohen, S. (1987). Environmental stress. In D. Stokols & I. Altman (Eds.), *Handbook of environmental psychology* (vol. 1, pp. 571 - 610) New York: Wiley.
- Fischer, G-N. (1998). *Individuals and environment: A psychosocial approach to workspace*. New York: Walter de Gruyter.
- Gibson, V. (2003). Flexible working needs flexible spaces? *Journal of Property investment & finance*, 21(1), 12-22.
- Haworth. (1993). *Facilities Programs: How to increase productivity through teamwork* [Brochure].
- Hayes, B.P., Price, I. (2004). Quantifying the complex adaptive workplace, *Facilities*, Vol. 22 No.1, pp.8-18.
- Heerwagen, J.H., Kampschroer, K., Powell, K.M., Loftness, V. (2004). Collaborative knowledge work environments. *Building Research and Information*, 32(6), 510-528.
- Herman Miller. (2010). *Making room for collaboration*. Retrieved September 14,2010 from <http://www.hermanmiller.com/Research>
- Lalli, K. (1998). Creating team spaces that work. *Alternative Office Journal*, 2, Spring, 1998, pp. 22-24.
- Mudgett, John C. (2000, July 24). *Office space-who needs it?* Retrieved April 20, 2010 from [www.cuh2a.com](http://www.cuh2a.com).
- Steelcase. (June, 2008). *Workspace for work-anywhere in the world*. Steelcase-360. Retrieved June 10,2010 from <http://www.steelcase.com/en/resources/research/360/pages/main.aspx>
- Steelcase. (February, 2010). *Work with me here*. Steelcase -360. Retrieved March 23, 2010 from <http://www.steelcase.com/en/resources/research/360/pages/main.aspx>
- Stegmeier, D. (2008). *Innovations in office design: The critical influence approach to effective work environments*. New Jersey: John Wiley & Sons, Inc.
- Thorp, I., & Darling, M. (2009). *Designing for collaborative learning*. Haworth-Changing nature of work and trends White paper.Retrieved October 25, 2010 from <http://www.hermanmiller.com/Research>
- Wineman, J., & Serrato, M. (1998). *Facility design for high performance teams*. In E. Sundstrom & C. Crocker (Eds.), *Supporting work team effectiveness: Best management practices for fostering high performance* (pp. 271 - 297) San Francisco: Jossey-Bass.

#### Image references

Image 1 - Anthony,L. (2001).*Pattern language as a design and evaluation tool for teaming environments*.(Masters thesis). Virginia polytechnic institute and state university,2001). Retrieved September 13, 2010 from <http://scholar.lib.vt.edu/theses/available/etd-05122001-093653/unrestricted/etd.pdf>

Image 2 - <http://www.gensler.com/#projects/201>

Image 3 - <http://www.gensler.com/#projects/178>

Image 4 - <http://www.gettyimages.com/detail/96617332/Cultura>

Image 5 - <http://www.gensler.com/#projects/282>

Image 6 - <http://www.officesnapshots.com/wp-content/galleries/googtai/googtai29.jpg>

Image 7 - <http://www.gensler.com/#projects/256>

Image 8 - <http://www.gettyimages.com/detail/89008669/Workbook-Stock>

Image 9 - [http://punchstock.com/com/usa/en/asset\\_images/98844755](http://punchstock.com/com/usa/en/asset_images/98844755)

Image 10 - [http://punchstock.com/com/usa/en/asset\\_images/106630578](http://punchstock.com/com/usa/en/asset_images/106630578)

Image 11 - <http://www.psfk.com/2010/03/office-furniture-inspired-by-peoples-favorite-spaces.html/office-furniture-inspired-by-peoples-favorite-spaces-4>

Image 12 - [http://www.punchstock.com/com/usa/en/asset\\_images/103059505](http://www.punchstock.com/com/usa/en/asset_images/103059505)

Image 13 - <http://www.bluehen.com/izzydesign-conference-room-layout-p-441.html>

Image 14 - <http://www.bluehen.com/izzydesign-conference-room-layout-p-441.html>

Image 15 - Anthony,L. (2001).*Pattern language as a design and evaluation tool for teaming environments*.(Masters thesis). Virginia polytechnic institute and state university,2001). Retrieved September 13, 2010 from <http://scholar.lib.vt.edu/theses/available/etd-05122001-093653/unrestricted/etd.pdf>

APPENDIX E  
RESEARCH – EMAIL LETTER

Dear Beth,

Happy new year.

As spoken earlier to you regarding my data collection at Gensler, I have the below mail with links to my website and survey for you to forward it to your employees. It would be of great if you could also go through my website and fill the survey.

Kindly, email me if you have any questions/suggestions.

Thank you for all the help,

Deepika Sangoi

MSD Interior Design

Arizona State University

Hello,

I am a graduate student pursuing my master in interior design at Arizona State University. As a part of my research, I have developed a website and a survey questionnaire.

My research is based on Christopher Alexander's pattern language methodology. Based on current trends and research this thesis is built upon a masters thesis by [Anthony](#) in 2001. This study attempts to make a web-based tool that could be easily accessible by the designers to create effective collaborative work environments.

The process is very simple. It is explained in details as below:

Step 1: Open the pattern language website <http://www.public.asu.edu/~dmshah6/>

Step 2: Open the online survey

form <https://spreadsheets.google.com/viewform?formkey=dGxDSUdqTHdwN3lhYjh1UTdManVJUUEE6MQ>

Step 3: Start the survey

Step 4: Simultaneously answer the survey questions corresponding to each pattern language using the links along the left margin of the pattern language website. It's easiest to have both the websites displayed side by side.

Step 5: Submit the survey when done.

The survey is very simple and self explanatory. It takes approximately 15 minutes to complete the entire survey. Please complete one survey per person. I would appreciate you completing the survey by 18th January 2011. In case of any questions/concerns email me at [dmshah6@asu.edu](mailto:dmshah6@asu.edu).

I appreciate your time and feedback,

Deepika Sangoi

MSD Interior Design

Arizona State University

APPENDIX F  
RESEARCH - SURVEY

## Pattern language : team based work environments

Dear Participants,

I am a graduate student under the direction of Professor Diane Bender in the Herberger Institute for Design and the arts at Arizona State University.

I am conducting a research study to create an information tool for designing effective team environments. In 1977, Christopher Alexander and his associates developed pattern language as a series of inter-related physical elements combined to create a framework of design solutions. Based on Christopher Alexander's methodology, I have re-created a web-based pattern language for team environments in the workplace. I am inviting your participation, which will involve browsing through the website and filling the online survey based on it.

The responses to the survey may not benefit you on a personal level, but may help in forming guidelines for Gensler in designing team environments.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. The age range of participants enrolling for the study must be between 18 to 85 yrs old.

Your responses will remain anonymous. They will be destroyed on the completion of the research study. The results of the study may be used in reports, presentations or publications but your name will not be known. There are no foreseeable risks or discomforts to your participation.

If you have any questions concerning the research study, please contact the research team at: Diane Bender(PI) – (480)-965-4367 or [diane.bender@asu.edu](mailto:diane.bender@asu.edu) or Deepika Sangoi(co-investigator) – (480)-297-7173 or [dmsah6@asu.edu](mailto:dmsah6@asu.edu). If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By clicking the Continue button, you agree to the above statements and your submission of the survey will be considered as your consent to participate.

Continue »

Powered by [Google Docs](#)[Report Abuse](#) - [Terms of Service](#) - [Additional Terms](#)

## Pattern language : team based work environments

\* Required

### Demographics

Age \*

one must between 18-85yrs old to participate

- 18-25
- 26-40
- 41-60
- 61-85

Gender \*

- Male
- Female

Job title \*

Pattern Language

Consider your work environment and rate the below 15 patterns based on their importance in the teaming work environments. The descriptions of each pattern is explained in the website.

Community connections

1 2 3 4 5

least important      most important

Welcoming entry

1 2 3 4 5

least important      most important

Public spaces that tell a story

1 2 3 4 5

least important      most important

Main street thoroughfare

1 2 3 4 5

least important      most important

Social hub

1 2 3 4 5

least important      most important

Town halls

1 2 3 4 5

least important      most important

Team huddle space

1 2 3 4 5

least important      most important

Heads down space

1 2 3 4 5

least important      most important

Work areas on wheels

1 2 3 4 5

least important      most important



Technology access

1 2 3 4 5

least important      most important

Let there be light

1 2 3 4 5

least important      most important

Vertical surfaces

1 2 3 4 5

least important      most important

Comfortable workplace

1 2 3 4 5

least important      most important

Wide stairways

1 2 3 4 5

least important      most important

Stay close

1 2 3 4 5

least important      most important

Would you remove any of the 15 patterns to this language?  
If yes, which one(s) and why?

Would you add any pattern to this language?  
If yes, please provide suggested additions

Would you revise any of the existing patterns to this language?  
If yes, please provide suggested revisions

Do you believe that this pattern language could be a useful tool for designing team environments?

1 2 3 4 5

Disagree      Agree

« Back

Continue »

Powered by [Google Docs](#) [Report Abuse](#) - [Terms of Service](#) - [Additional Terms](#)

## Pattern language : team based work environments

### **Thank you**

Thank you for participating in this survey. I greatly appreciate your time and feedback. If you have any questions please email me at [dmsah6@asu.edu](mailto:dmsah6@asu.edu)

« Back

Submit

Powered by [Google Docs](#) [Report Abuse](#) - [Terms of Service](#) - Additional Terms

APPENDIX G  
IRB APPROVAL



---

Office of Research Integrity and Assurance

---

*Ar*

**To:** Diane Bender  
CDN

**From:** Mark Roosa, Chair *sm*  
Soc Beh IRB

**Date:** 11/30/2010

**Committee Action:** Exemption Granted

**IRB Action Date:** 11/30/2010

**IRB Protocol #:** 1011005719

**Study Title:** Pattern Language: A tool for team-based work environments

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2).

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.