

Designing for Wellbeing in the Workplace

by

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

Approved April 2020 by the  
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May 2020

## ABSTRACT

Employee wellbeing is a top concern for many organizations as its been linked to job performance and organizational commitment (Colquit, LePine, & Wesson, 2019). Research suggests that overall wellbeing is important to employees as well. Organizations are significantly investing into upgrading workplace environments, and there is a need for a clear understanding of how those improvements truly impact employee wellbeing. Current workplace research reveals that the open-office floorplan accounts for more than 70% of office layouts in the United States and is most commonly used for the benefits of collaboration and efficiency (Gallup, 2017). However, the open office layout ranks poorly in current employee wellbeing studies with a number of office environment stressors such as noise, distractions, and privacy concerns noted to impact employee wellbeing (C. Bodin-Danielsson, 2016; Haynes, Suckley, & Nunnington, 2017). The knowledge work performed in office environments require high amounts of cognitive tasks and when combined with filtering distractions in the workplace it can increase strains caused by common office stressors, thereby impacting employee wellbeing (Bridger & Brasher, 2011). This study will examine common stressors from the open office environment and compare employee's perceptions of their work environment before and after renovations, as well as observations and behavioral mapping that record how the built environment influences the behaviors of the occupants. This research seeks to understand how wellbeing in the open office is affected by its different physical environmental settings, and how this environment influences employee's behaviors. The end research goal is to see if there is a significant correlation of physical work environment and workplace behaviors that are common in the open

office to help understand how the designed interior workplace impacts the wellbeing of its users.

*Keywords: employee wellbeing, open-office, workplace stressors, workplace behaviors*

## ACKNOWLEDGMENTS

I would like to express sincere gratitude to my professor Milagros Zingoni who pushed me, encouraged me, and supported me throughout this process. Your commitment to me and my success as a graduate student was unwavering even when I was in doubt. You helped me find my confidence again and showed me that being a multi-tasking mom of three was a real advantage rather than an obstacle. I'd also like to thank my committee members Lori Brunner, Maria Pijem, and Mai Trinh. Thank you for your guidance and support!

Thank you to my family for your patience, love and support while I've immersed myself into this research. You cheered me on and sacrificed time and energy along with me. To my mom, thank you for your words of wisdom and inspiring me by your example. To my three children, I love you more than you will ever know. My hope you see my efforts here as an example of perseverance and hard work. To my husband, I simply could not have accomplished this without by my side. This is all because of you and the dreaming that we do together. Thank you for encouraging me to chase those dreams and for believing in me. Thank you for the countless hours of support, from dinner and kid duties to Excel troubleshooting. You are my hero and my rock, forever and always.



## TABLE OF CONTENTS

	Page
LIST OF TABLES .....	viii
LIST OF FIGURES.....	ix
CHAPTER	
1 INTRODUCTION .....	1
1.0.0 Introduction .....	1
1.0.1 Evolution of the Open Office.....	2
1.0.2 Interior Design in the Workplace.....	5
1.0.3 Justification .....	6
1.0.4 Scope & Limitations .....	9
2 LITERATURE REVIEW .....	11
2.0.0 Introduction .....	11
2.1.0 Built Environment.....	12
2.1.1 Furniture & Layout .....	13
2.1.2 Ambient Conditions .....	14
2.1.2a Lighting.....	15
2.1.2b Indoor Air Quality .....	16
2.1.2c Noise.....	16
2.1.3 Visual Distractions .....	18
2.1.4 Privacy.....	19
2.2.0 Workplace Behaviors.....	20
2.2.1 Collaboration.....	21

CHAPTER	Page
2.2.2 Task Management .....	21
2.2.3 Environmental Modifications .....	21
2.2.4 Social Interactions .....	22
2.3.0 Workplace Wellbeing .....	23
2.3.1 Employee Wellbeing .....	24
2.3.2 Managing Stressors .....	25
2.2.4 Belonging & Autonomy .....	26
3 METHODOLOGY .....	28
3.0.0 Introduction .....	28
3.1.0 Research Topic & Questions .....	29
3.1.1 Research Question One .....	29
3.1.2 Research Question Two .....	30
3.2.0 Research Approach .....	30
3.3.0 Research Method One .....	31
3.3.1 Research Method Two .....	31
3.3.2 Research Method Three .....	32
3.4.0 Sampling Strategy .....	32
3.5.0 Data Analysis Method One .....	33
3.5.1 Data Analysis Method Two .....	33
3.5.2 Data Analysis Method Three .....	33
3.6.0 Data Collection .....	33

CHAPTER	Page
3.7.0 Internal Review Board .....	34
4 DATA ANALYSIS .....	35
4.0.0 Introduction .....	35
4.1.0 Sample: Location A.....	36
4.1.1 Survey Data Median Analysis: Location A .....	37
4.1.2 Survey Data Correlations: Location A.....	42
4.1.3 Concept Naming Data: Location A .....	45
4.1.4 Observations: Location A .....	46
4.2.0 Sample: Location B .....	46
4.2.1 Survey Data Median Analysis: Location B .....	47
4.2.2 Survey Data Correlations Location B.....	50
4.2.3 Concept Naming Data: Location B.....	54
4.2.4 Observations: Location B.....	56
5 DISCUSSIONS & CONCLUSIONS .....	58
5.0.0 Introduction .....	57
5.1.0 Research Question 1: Location A .....	57
5.1.1 Research Question 2: Location A .....	57
5.1.2 Research Question 1: Location B .....	58
5.1.3 Research Question 2: Location B .....	58
5.2.0 Research Challenges .....	59
5.3.0 Opportunities for Improvements.....	59

CHAPTER	Page
5.4.0 Design Implications .....	60
5.5.0 Future Research.....	60
REFERENCES .....	69
APPENDIX	
A. SURVEY QUESTIONS.....	69
B. IRB .....	69

## LIST OF TABLES

Table	Page
1. Location A, Correlations Q45 and Q26.....	39
2. Positive Correlations Q45 .....	42
3. Positive Correlations Q26 .....	42
4. Positive Correlations Q4 .....	43
5. Positive Correlations Q4 .....	43
6. Location B, Correlations Q45 and Q26 .....	57
7. Positive Correlations Q45 .....	59
8. Positive Correlations Q26 .....	59
9. Positive Correlations Q4 .....	60
10. Positive Correlations Q12 .....	60
11. Positive Correlations Q16 .....	61
12. Positive Correlations Q17 .....	61

## LIST OF FIGURES

FIGURE	Page
1. Bürolandschaft Layout Example.....	4
2. Vischer’s Environmental Comfort Model .....	6
3. Conceptual Framework .....	12
4. VGA Mapping of Interior Sight Lines.....	18
5. Conceptual Framework II.....	27
6. Research Design .....	28
7. Location A: Sample by Job Type.....	35
8. Location A: Sample by Age Group.....	35
9A. Location A: Survey Median Response Built Environmental Factors .....	37
9B. Location A: Survey Median Response Workplace Behaviors .....	38
9C. Location A: Survey Median Response Workplace Wellbeing .....	38
10. Location A: Concept Naming Chart, Workstation .....	44
11. Location A: Concept Naming Response Graphs, Workstation.....	45
12. Location A: Concept Naming Chart, Overall Layout.....	46
13A. Location A: Concept Naming Response, Overall Work Area .....	47
13B. Location A: Concept Naming Responses, Conference Room.....	47
13C. Location A: Concept Naming Responses, Small Conference .....	48
13D. Location A: Concept Naming Responses, Large Kitchen/Break Area .....	48
13E. Location A: Concept Naming Responses, Small Kitchenette.....	48
14A. Location A: Level 1 Observation Map .....	51

## LIST OF FIGURES

FIGURE	Page
14B. Location A: Level 2 Observation Map.....	52
15. Location B: Sample by Age Group.....	53
16. Location B: Sample by Job Type.....	53
17A. Location B: Survey Median Response Built Environmental Factors.....	55
17B. Location B: Survey Median Response Workplace Behaviors.....	56
17C. Location B: Survey Median Response Workplace Wellbeing .....	56
18. Location B: Concept Naming Chart, Workstation .....	61
19. Location B: Concept Naming Response Graphs, Workstation .....	62
20. Location B: Concept Naming Chart, Overall Layout.....	64
21A. Location B: Concept Naming Response Graphs, Overall Work Area.....	64
21B. Location B: Concept Naming Response, Overall Break Area.....	65
21C. Location B: Concept Naming Response, Conference.....	65
22A. Location B: Level 1 Observation Map.....	66
22B. Location B: Level 2 Observation Map.....	67

## CHAPTER 1

### INTRODUCTION

#### **1.0.0 Introduction**

From an evolutionary perspective, humans previously spent all their time outdoors when most jobs or tasks were survival-based. Now, as we have become a knowledge work society, we work and live 90% of our time indoors. According to the International WELL Building Institute (IWBI)(2019, para. 1) “...our physical environment impacts our health more than lifestyle, medical care and genetics.” What then are the consequences of working in an office all day and what does that do to the human psyche? This has been a subject studied by multiple disciplines, including: Interior Design, Architecture, Facilities Management, Environmental Psychology, Neuroscience, and Organizational Behavior. This study continues where other researchers have gone and seeks to understand how workplace wellbeing is affected by the physical environmental settings of the open office and how the physical work environment influences employee behaviors.

It has been well documented that open office environments can adversely affect employee wellbeing. There is evidence of common workplace stressors, like poor interior air quality, lighting issues, and problems with acoustics and noise. In the 2017 Gallup report on the American workplace, the data they collected states employees largely reported they have good lighting, comfortable temperatures, and outdoor views or windows. However, over three-fourths of those surveyed, identified noise and excessive sound as the primary challenges affecting their work environment negatively (Gallup Inc., 2017). Psychosocial stressors have also been studied, such as lack of privacy and



lack of autonomy in the work environment (Garthus-Niegel et al., 2016; Jahncke & Halin, 2012; Jarczok et al., 2013). These stressors have all been connected to productivity levels, job satisfaction, and issues with overall wellbeing. Employee wellbeing is key to organizational. This has been linked to increased productivity and “accelerating creativity and innovation” (Pearce & Hinds, 2018, para.1). Hoskins (2014) a Gensler Co-CEO highlights the value of workplace wellbeing inviting other to look into it. He explains that “If you want to build a culture of high performance, start by taking a look at your office environment” (para. 1).

### **1.0.1 Evolution of the Open Office**

As we work tasks continue to evolve, the office space where tasks are carried out also continues to evolve. Looking back at the origins of the open office layout is helpful in understanding key points through time and how it has informed the research on this subject.

Early workplace research started with Frederick Winslow Taylor who published *The Principles of Scientific Management* (1911) and based his research for workplace efficiency on his time and motion studies. “The principle object of scientific management should be to secure the maximum prosperity for the employer, coupled with the maximum prosperity for each employee” (Taylor as cited in Leadon, 2012, p. 13).

Additional workplace research from the 1920s involved the Hawthorne experiments by Mayo and Roethlisberger that were flawed in design but were one of the first looking at how the interior environmental (lighting) conditions influenced productivity (Colquitt et al., 2019).

In the early 1950s the first truly intentional space planning efforts came from the Quickborner Team, a German consulting firm, that began creating office layouts by tracking paper movement and communication routes. The space planning method was called *Bürolandschaft* in Figure 1 meaning *office landscape* was designed by the Schnelle brothers (Knobel, 1987).

*Nothing had prepared us for those curious German drawings which actually showed desks, hundreds of desks, randomly arranged in great open spaces...All at once those unforgettable layouts seemed to prove not only that offices were for people but that a superior understanding of how those people worked could lead to revolutionary changes in the shape of buildings. (Frank Duffy as cited in Knobel, 1987, p. 61)*

Elements of early open office design include Frank Lloyd Wright's Johnson Wax building which opened in 1939. This layout was pre-partitions but featured an open layout with rows of desks in an open space. With new technologies such as air conditioning and fluorescent lighting, workers no longer needed to be by windows for lighting and ventilation.

New technology continually plays a role in office space interiors, and when the Baby Boomer generation flooded the workforce in the 1960s there came an emergence of panel-based systems from the office furniture manufacturer Herman Miller with the Action Office product line. Space planning became highly cellular and there was a rise in activism for equal and positive work solutions and access to fresh air, sunlight, and privacy (Leadon, 2015).

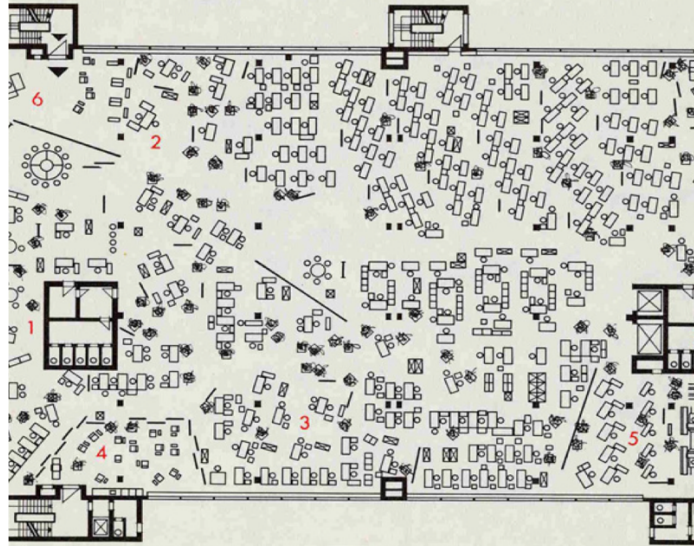


Figure 1. Bürolandschaft layout example.

In the 1970s recycling, sustainability, and ergonomic design were introduced into the workplace. This was when work truly switched from hands to head, and the previously labor-intensive workforce had evolved into primarily knowledge-based workers.

Worksurfaces and desk areas were driven by technology like typewriters and larger desk calculator or phones.

Into the 1980s the trend toward the office campus was on the rise for larger corporations, providing a larger number of amenities to employees. Workplace culture turned to the egalitarian non-territorial offices composed of vast open spaces, communal furnishings, and the latest technologies. Computers and technology continued to be improved and advanced, creating a lighter and less crowded work environment. However, the density of users in one space began to increase.

Into the 1990s to 2000s during the dot com boom, creativity and innovation were the focus of most companies and venture capital firms and startup technology companies of Silicon Valley began to lead the way in office design innovation. Competing for and

retaining talented employees fueled the work-play environments and new innovations in the open plan, which claimed to add more community and teamwork into the workspace with ping-pong tables, flexible work spaces and even slides.

Current trends in the open office involve attempts to remedy some of the reoccurring stressors with open plan workspaces. The activity-based or hybrid layout includes more private spaces as well as smaller breakout meeting areas for impromptu collaboration (Appel-Meulenbroek, Groenen, & Janssen, 2011). Deskless layouts have also been facilitated in some organizations where users have no personal desk space and work wherever they choose on a daily basis (Kim, Candido, Thomas, & de Dear, 2016). There is also a growing amount of research on what impacts the user's wellbeing within the layout, and more attention has been drawn to sustainability, exposure to the outdoors and nature, as well as incorporating nature into the design of the workspace known as biophilia.

### **1.0.2 Interior Design in the workplace**

In an empirical review of Environmental Psychology in the workplace, Vischer (2008) explains that people need more than just health and safety in their work environment, but also environmental support for the tasks they perform. Vischer's (2008) Environmental comfort model in Figure 2 shows the components of the interior environment for occupant satisfaction and wellbeing in the workplace. How the workspace is designed and utilized does not only impact the user's physical and mental wellbeing, it also can impact their commitment to their organization and their productivity via creation of new knowledge. The designed environment that an employee interfaces with daily is part of the user's experience, and the behaviors that are caused by the interior environmental

elements are also part of that experience that can influence wellbeing. For this reason, this research examines both the physical elements of the designed workspace and the behaviors of the user's in response and in active use of their workspace.

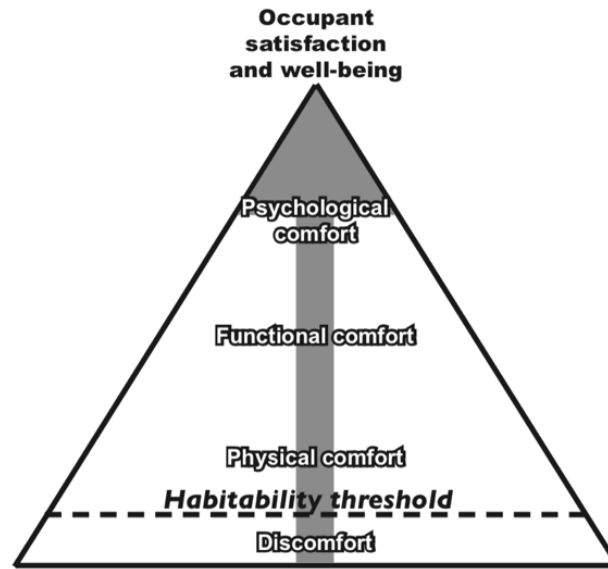


Figure 2. Vischer's Environmental comfort model.

### 1.0.0 Justification

Office environments are argued to offer space and cost savings for organizations as well as offering large amounts of flexibility in layouts and redesign as needs change (Charles & Veitch, 2002; Haynes et al., 2017; Pejtersen, Allermann, Kristensen, & Poulsen, 2006).

However, research shows that the open office layout type has adverse effects on productivity and mental health (De Been & Beijer, 2014; Rasila & Rothe, 2012; Roelofsen, 2008).

The office setting is generally recognized as a physical representation of an organization's culture. Keeping current and addressing the needs of their employees is believed to be paramount to successfully retaining and attracting talent (Gallup Inc.,

2017; Vischer, 2008). McElroy's and Morrow's (2010) study points to empirical evidence that interventions in the work environment that are intended to keep organizational culture current can indeed have the opposite effect. They argue that little research exists to prove that office design affects organizational culture change, especially under the current models where cubicle walls are being lowered and per person square footage is shrinking (McElroy & Morrow, 2010). With all the known workplace stressors that are a problem for open office environments, it is important for organizations to address these stressors to improve employee wellbeing.

Improving employee wellbeing from an organizational level, understanding the value, and implementing changes to aid in employee wellness has a major cost benefit to organizations. Companies like Google, Facebook, IBM, and Overstock have devoted millions of dollars to redesigning their workspaces. More than half of employees surveyed in a Gallup, Inc. study reported that overall wellbeing was very important to them (Gallup 2017). "When employees are fulfilled in all aspects of their wellbeing, this leads to increased employee engagement and increases individual performance" (Meister, 2018, p. 2). In a scenario where a company with a payroll budget of \$100 million, even just a 2% increase in productivity and performance could translate to a \$2 million savings (Meister 2018). Understanding wellbeing as part of the formula of overall work environment experience can only help companies leverage, engage and retain top talent while increasing monetary savings.

Interior Designers and interior architects have been studying the relationship between wellbeing and workplace for decades. For instance, The Council for Interior Design

Qualification's (CIDQ) (2019) definition of interior design describes interior designers as responsible for promoting "the health, safety, and welfare while supporting and enhancing the human experience" (para. 1). The human experience as defined by CIDQ (2019) is "influence of the moment-to-moment physical and sensory elements found within the intimate details of interior space that impact an occupant's emotions, health, and overall feeling" (para. 10). This is supported by Vischer's study (2008). It is her conclusion that occupants need more than just health and safety; they need an environment that supports their daily tasks. Interior Design is then, how the human experience is created, and the product of that experience will either successfully support the user's tasks and wellbeing or fall short of those goals.

In an effort to take some of the current research into action, many organizations decide to renovate or remodel their current areas. If budget and time allow, other organizations build new spaces entirely. There is research that suggests that updating and renovating spaces increase the overall wellbeing of its employees and the organization (McElroy & Morrow, 2010). Other studies conclude that the cost benefit ratio for open plan offices are unfavorable and should be replaced with more hybrid or activity-based layouts (Haynes et al., 2017).

Therefore, this research evaluates perspectives of occupants' workspaces and discovers if recent renovations improve wellbeing and productive behaviors. Analyzing this data should provide helpful documentation for the existing body of knowledge on workplace wellbeing and add some insight for design professionals and organizations to improve and create a successful workplace design.

### **1.1.0 Scope and Limitations**

This research took place in two separate office locations. Location A is a smaller company in rural Alabama that designs and build custom luxury motor homes. The office space houses about 45 employees and has recently renovated for the first time in over 30 years. The motivation for the renovation was both for easing communication flow and information transfer among team members, as well as updating the organization's image to recruit and maintain talent. It involved all new fixtures and furnishings in a newly designed two-story building. There are some walled offices, but the majority of the space is panel-based systems in an open office layout. Survey participants range in age from 26-55, with 7 male respondents and 6 female respondents (N=13). For the Concept Naming interviews there were 10 participants (N=10). Total participants from site Location A is (N=23).

The second location is a city planning office that was redesigned in 2018. There were two different levels observed. The lower level had more customer interaction and was updated with newer fixtures and layout changes. It housed smaller workstations and lower panel heights. The upper level was only reconfigured and consisted of higher panel heights and larger workstations. All desks on both levels were upgraded with sit-to-stand desk capabilities. Both levels also had walled offices adjacent to the open office areas. Participants range in age from 26-65. Survey respondents totaled (N=28), and the Concept Naming participants totaled (N=18). Total participants at site location B were (N=46).



One limitation of this research is the data from the surveys and interviews is self-reported information and could be subject to influence of peers or perceptions of the researcher's goals. Self-reported information is also subjective to each individual's perspective and personal life circumstances and the survey does not account for personal circumstances that may influence an occupant's wellbeing or outlook of the work environment.

Participants' wellbeing is not only influenced by work alone, so outside factors could come into play with self-reported results. Triangulating the interview and survey data with some the researcher's observations and behavioral mapping should assist in providing accurate findings.

Additionally, at the time of this research the renovations have been completed. Therefore, the researcher is not able to observe and triangulate data that is self-reported from conditions prior to the move into the new space. Survey questions will inquire about previous conditions thus the data collected in this study relies on the memory of the occupants.

## CHAPTER 2

### LITERATURE REVIEW

#### **2.0.0 Introduction**

Originally, the open-office environment concept birthed from an interest in breaking down walls and allowing for more communication and collaboration between groups and coworkers. And while the open-office layout does facilitate better information exchange and collaboration, organizations need to balance the needs of the company with the needs of the employees when it comes to layout (Gallup Inc., 2017). “Workplace design and layout provide an intelligible framework within which collective knowledge is continuously explored, represented, interpreted, and transformed in relation to ongoing projects...the structure of space supports an organizational culture and cognitive functions” (Peponis et al., 2007).

The open office environment is comprised of many different components and adding on to that the complexities of workplace behavior and wellbeing creates a larger spread of components. For the purpose of this study the researcher is using a framework that includes research components of the open office workplace in order to group the research into three main categories; the built office environment, workplace behaviors, and workplace wellbeing. Within each component is several subcategories that have been derived from current research as common pieces that play a role in the designed open office workplace. These components are visualized in the conceptual framework (Figure 3). In this chapter, existing interdisciplinary literature is explored and existing theories on workplace stressors and employee wellbeing are considered to lay the background for the research goals and understand what current workplace wellbeing research has offered.

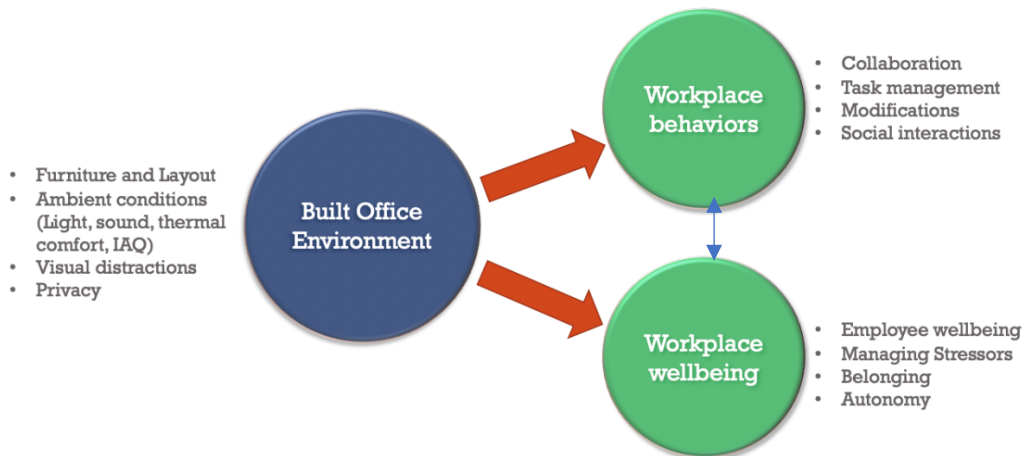


Figure 3. Conceptual Framework.

## 2.1.0 Built office environment

The open office plan is a common layout for getting more people into a large space and takes up less space than private offices. Herbig, Schneider and Nowak (2016) looked at the space occupancy numbers to see if the number of occupants in the open office had an effect on employee wellbeing. This study suggests that the higher the number of occupants in the open office space, the lower employee satisfaction and higher reported number of physical and mental wellbeing issues (Herbig, Schneider, & Nowak, 2016).

In the varied research available on workplace wellbeing and the open plan office the majority the studies focus on the negative impacts and how often the narrative from users is one of dissatisfaction.

Employees' negative reactions to open-plan offices may be due to the overstimulation theory. Overstimulation theory states that the physical environment (i.e., open space, close proximity of others, and densely populated areas) can expose

individuals to excessive stimulation. Users respond to this overstimulation behaviorally by withdrawing from or expressing dissatisfaction with the environment (Oldham, 1988).

There is also some research in regard to age and the work environment. Specifically, the work environment as a tool to draw in and retain talent (Bodin-Danielsson & Bodin, 2008). Age is a factor that effects the views and perceptions of the workplace environment (Haynes et al., 2017; Rasila & Rothe, 2012). Generational Cohort theory states that based on each generation's values, they experience space in the workplace differently and therefore may experience office stressors differently (O'Neill 2010). Age is also a factor from a physical standpoint. Many products are designed in open office use to limit or prevent injury such as carpal tunnel and musculoskeletal disorders. As we age, tissues and muscles weaken making injury more likely (Wahl et al. 2012).

### **2.1.1 Furniture and Layout**

Office furniture manufacturers invest in furniture and layout research in order to support their products. Manufacturers like Steelcase, Knoll, and Herman Miller partner with professional organizations such as American Society of Interior Designers (ASID) and International Interior Design Association (IIDA), as well as large design firms like Gensler, Smith Group and Canon Design to research, report and discuss their findings to better understand how they can best serve the office environment (Herman Miller, 2017; Leadon, 2015). A great deal of their research is also dedicated to wellbeing of the employees in the workplace.

As part of the physical environment in the open office, panel-based furniture systems are the most frequently used furnishings. In the current climate, panels heights are being specified and installed at lower heights and the potential for distractions increase. Panel heights have been studied in relation to employee preference and perceptions, and taller panels were more favorable while lower panels were only favorable based on the increased exposure to natural light (Yıldırım, Güneş, & Yılmaz, 2019). While furniture (such as panel-based systems) for the open office environment have greatly improved since its inception in the 1960's, now 63 percent of U.S. working adults said their office could better utilize its physical space with a better floorplan (Hiller, 2018)

In a quantitative study that looked at seven different types of offices, the researchers found a correlation between office type and job satisfaction and wellbeing. One of the main findings of the study found that Open office layout scored the lowest while flex offices scored the highest. Another finding of the study suggests that eliminating private offices and cubicles and replacing them with smaller team spaces for collaborative work, privacy pods for quiet space needs and adjustable adaptable furniture are all elements that are being used in some open office environments to aid in workplace wellbeing (Bodin-Danielsson & Bodin, 2008).

### **2.1.2 Ambient Conditions (Light, Sound, Thermal comfort, Indoor Air Quality)**

The components that have most commonly been researched as potential environmental stressors that are not directly related to the physical furniture and layout components are included in ambient conditions. Ambient conditions research that has been reviewed for this study are lighting, noise, and Indoor Air Quality (IAQ).

### **2.1.2a Lighting**

As early as the Hawthorne illumination study of 1924, the effects of lighting on productivity and employee wellbeing have been studied. In recent decades the industry has taken a closer look at exposure to sunlight in the workplace and studies of the brain and cognitive functions have shown an increase in productivity when employees have access to natural light (Meister, 2018).

Access to natural light and views of the outdoors are at the top of desired attributes in an employee's work environment. More than 1,600 employees actually rated sunlight as more important to them than onsite cafeterias, fitness centers, and onsite childcare (Meister, 2018). That same poll revealed that 47% of the employees surveyed reported feeling very tired from the absence of natural light, and about one third of those surveyed felt that they didn't get enough natural light during their workday (Meister, 2018).

On the contrary, there needs to be attention paid to the workstation placements in relation to the natural light access as computer screen glare and sunlight position (even taking seasons into account) have been known to have adverse effects on employee wellbeing (Kong, Utzinger, Freihoefer, & Steege, 2018). Additionally, in one Korean open office plan, the illuminance distribution was studied to see if there was adequate natural light available to most occupants. While the required (under local requirements) levels of illuminance were being met, upon observation, researchers found that occupants often manually adjusted the windows' electronic roller shades to account for glare and eye strain (Hwang & Kim, 2013).

### **2.1.2b Indoor Air Quality**

Indoor Air Quality (IAQ) is another important factor for employee wellbeing. For instance, poor indoor air quality has been directly linked to Sick Building Syndrome (Hwang & Kim, 2013). Sick Building Syndrome can exhibit symptoms such as distress and irritation, fatigue, headache and concentration difficulties (Kim & de Dear, 2013). Research has revealed over the last several decades the importance of healthy materials that don't off-gas chemicals into the air, and organizations and designers alike are more of the air quality and how indoor pollutants can cause illnesses.

In one study, the largest amount of complaints in the open office plan were perceived dry air, stuffy air, noise in the room, and thermal discomfort (Pejtersen et al., 2006). Physical symptoms listed within the open office plan were fatigue and headache as well as mucous membrane irritation and central nervous symptoms. In most cases these symptoms were 2-3 times higher in open office than in cellular offices. Largely the research findings were that there is a strong need to improve air quality, thermal comfort, and noise level in the open office (Pejtersen et al., 2006).

Another study revealed that after monitoring several indoor environmental factors for 2 years post-occupancy, the occupants reported dry air and were dissatisfied with the freshness of the air including temperature levels depending on seasonal variables (Hwang & Kim, 2013).

### **2.1.2c Noise**

Noise and office acoustics are one of the most researched conditions that can impact employee wellbeing in the open office. Current research documents different types of noise in the workplace and how those different types of noise effect the

occupants. In a building comfort survey, acoustics and acoustic privacy were among the most reported factors to impact individual satisfaction and environmental irritations (Seddigh, Berntson, Platts, & Westerlund, 2016). Even small increases in acoustical disturbances caused cognitive stress for the participants. When the acoustical standards were increased, there was lower report of health and work disturbances (Seddigh et al., 2016). The researchers' recommendations highlights the importance of sound masking and sound absorbing materials considering that eliminating open office concepts are not cost effective for corporations.

One of the more qualitative studies in air quality involved actually constructing a mockup of an open office space in a laboratory type experiment (Varjo et al., 2015). In this study, participants were given six different cognitive tasks to perform at a computer in their designated desking area, while conditions in the room involving temperature and noise levels varied. After each simulated condition, participants filled questionnaires out to assess how they felt in that particular environment while the cognitive tasks were measured via internet-based software. The conclusion of the experiment revealed that special consideration should be given when designing open plan environments as the researchers found a correlation between reduced cognitive performance and the increased noise levels, warmer office temperatures, and low ventilation (Varjo et al., 2015).

Similarly, another study was done but in an actual functioning open plan office. This research examined architectural interventions and found improvements in sound absorption using higher panel dividers in between workstations and increasing the sound absorption in the ceiling tiles (Passero & Zannin, 2012). Based on the aforementioned



research, it is reasonable to conclude that improving acoustic conditions can improve productivity (Roelofsen, 2008).

### 2.1.3 Visual Distractions

Visual distractions are one of the chief complaints among users. This is important because unwanted distractions and interruptions have been shown to decrease office productivity (Charles et al 2002, Roelofsen 2008, Haynes et al 2017). Within the most recent workplace research, visual distractions seem to be where there is the largest gap. Newer technology has begun to be used to map interior spaces and visual sight lines to better understand where visual distractions may arise. One software is Space Syntax which uses geospatial software to map out all the possible sightlines. Figure 4, is an image of a visual graph analysis (VGA) of a workplace floorplan (Torpey, 2019). The red lines are the areas with the highest concentration of sightlines and the dark blue lines have the lowest concentration.

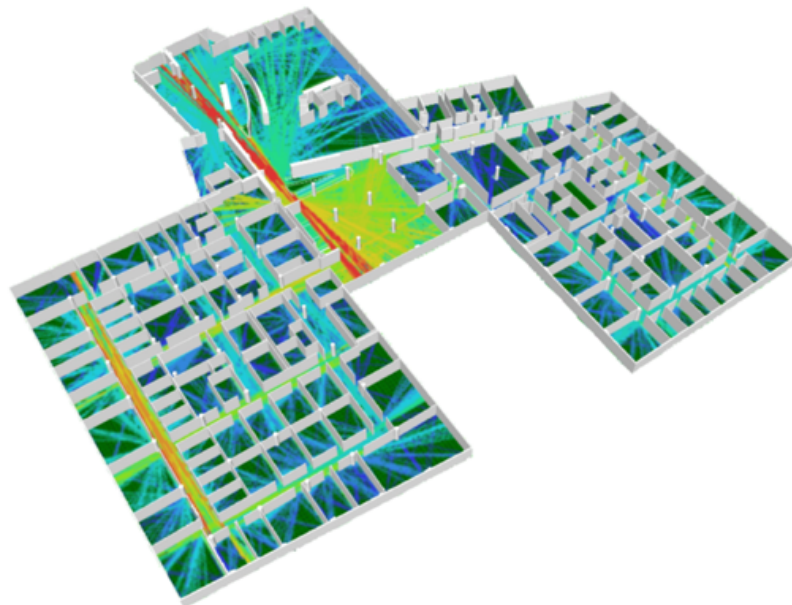


Figure 4 VGA Mapping of interior sight lines (Torpey, 2019).

Aesthetics also plays a role in the visual landscape of the office environment. Research shows that colors and materials have an effect on humans, and can have both positive and negative impacts (Appel-Meulenbroek et al., 2011). In recent years, the field of Neuroaesthetics has produced meaningful research for interior design that reveals how the brain may interpret interior aesthetics and stimuli. Agnew (2019) reveals some groundbreaking research that created a new way to measure the human response to the interior environment. This was an exhibit installation that created several different interior atmospheres with varying lighting, textures, art and furnishings. Each visitor wore a wristband that recorded certain physiological responses in each space. The results showed that the subconscious revealed possible hidden anxieties based on upbringing or culture that may also affect the impact of environmental aesthetics.

#### **2.1.4 Privacy**

Privacy concerns are among the common stressors researched in the open office environment and have been linked in several studies to employee well-being and job satisfaction (Haynes et al., 2017; Herbig et al., 2016; Leadon, 2015; Oldham, 1988; Samani, Rasid, & Sofian, 2017). Over time, privacy issues require excess self-monitoring and control that can lead to decreased attention to cognitive tasks (Bridger, Brasher 2011).

Most privacy research separates the categories into visual and acoustic privacy. A lack of visual privacy can involve others being able to constantly view the occupant of the workstation, leaving the occupant feeling constantly observed by peers or supervisors

which can cause the user the inability to relax or have any down-time needed to recover from other work or social stress (Charles & Veitch, 2002; Vischer, 2008). Some research shows that increasing panel heights or panel height materials can assist with increased visual privacy concerns, but can also have adverse effects on productivity and collaboration (Roelofsen, 2008).

Acoustic privacy issues may arise when irrelevant speech in the open office is more audible (Varjo et al., 2015). Filtering the personal or work-related conversations of additional occupants can increase stress and decrease productivity in the workplace (Bridger & Brasher, 2011; Varjo et al., 2015). Interventions like sound masking and increasing acoustic absorbing materials have shown evidence to improve acoustic privacy, but are not always valued by organizations for what they can offer to increasing employee wellbeing and satisfaction with the office environment (Hongisto, Haapakangas, Varjo, Helenius, & Koskela, 2016; Varjo et al., 2015).

### **2.2.0 Workplace Behaviors**

For the purposes of this research, workplace behaviors are defined as employee behaviors that are a product of the office environment or in reaction to the environment. Collaboration and Social interactions are a product of the work environment. The hypothesis is that if an open office layout is designed well, collaboration will happen in both planned and spontaneous ways through the workplace. Social interactions in a space are often driven by layout and tend to form in common areas like kitchens or break areas (Vischer, 2008). Task management and environmental modifications are both reactions to the open office environment. Task management refers to how an employee uses the

environment and interacts with the environment in order to complete their job tasks.

Environmental modifications are anything from headphones to ergonomic tools to even tarps over workstations (Vischer, 2008; Wyatt, 2017).

### **2.2.1 Collaboration**

Collaboration is critical to organizational growth and advancement, and greater collaboration is a goal for organizations as it has been linked to innovation and ingenuity (Gallup Inc., 2017; Lee, 2014). When there are walls that divide those who need to work and collaborate, it can hinder progress and productivity (Gallup Inc., 2017). Two recent studies concluded that the design of an office environment should provide physical spaces that facilitate collaborative and individual work. And that these spaces should provide flexibility and support for the variety of tasks employees participate in and perform daily (Leadon, 2015; Vischer, 2008).

### **2.2.2 Task Management**

Task management refers to how an employee uses the environment and interacts with the environment in order to complete their job tasks (Vischer, 2008). The stress response to managing tasks along with managing the other workplace stressors is evident in employee behaviors such as lack of motivation, challenges in task completion, and decreased productivity (Vischer, 2008). Productivity is key for organizational health, and many activities that the office's design facilitates are linked to productivity and collaboration (Haynes et al., 2017).

### **2.2.3 Environmental modifications**

Environmental modifications can be a variety of methods in which employees may modify their conditions or environment to cope with the environmental stressors. Post

Occupancy Evaluations (POE) often find that users create workarounds for stressors such as wearing headphones to drown out ambient noise, or rearranging hardware or storage set-ups, or the addition of ergonomic solutions like keyboard trays, adjustable height desks, or additional task lighting (Pejtersen et al., 2006; Wyatt, 2017). One of the benefits of the open office's modular layout is the ability to customize workstations according to needs of the user (Vischer, 2008). This also ties in with autonomy; when employees can control and create the environment they feel most productive and creative they benefit both personal and organizational wellbeing (Herman Miller, 2017).

#### **2.2.4 Social Interactions**

Social interactions in the open office workplace can have both a positive impact and a negative impact. It depends not only on the individual but also the organizational culture and dynamics of relationships. Biologically imbedded in the human brain is the need for social interaction derived from early nurturing of mothers to infants and then further developed on the needs of survival (Lieberman & Eisenberger, 2009). Working in groups was seen as good because it was advantageous for survival while being an outcast was dangerous and life threatening; even now the brain reads being socially ostracized in the same way (Lieberman & Eisenberger, 2009).

According to a study done by Herman Miller (2007), when designed effectively, the open office workplace can facilitate social interactions that serve as down time and a mental break during the workday. Common areas, such as kitchens, break rooms, and small casual break out areas can all facilitate social interactions. One study shows that these collective social interactions and breaks can be a positive impact on wellbeing.

For instance, Haynes (2017) researched the impact on perceived workplace productivity based on age and gender. He found that the lack of variety of physical layouts, autonomy with the interaction and the “downtime” offered by social interaction points to be the biggest challenge to productivity in the workplace, and that men and younger generations considered these factors as having a negative impact on their productivity more so than women and older participants (Haynes et al., 2017).

### **2.3.0 Workplace Wellbeing**

There is significant research across multiple disciplines about wellbeing and wellbeing in the workplace. It is important to understand what wellbeing is and how it can be measured effectively. Wellbeing is comprised of both physical and mental human factors. The field of neuroscience has had several research analyses and applies methods such as fMRI and other monitors of neural and biological data to the workplace design experience and in particular managing stressors.

Workplace stress is defined as “the degree to which users have to compensate and expend their own energy performing activities in adverse environmental conditions” (Lieberman & Eisenberger, 2009). According to McEwen, “stress is a state of mind with both brain and body as well as their interactions; it differs among individuals and reflects not only major life events but also the conflicts and pressures of daily life events that alter physiological systems to produce a chronic stress burden that, in turn, is a factor in the expression of disease” (McEwen, 2012).

When measuring happiness (wellbeing), we need to consider objective and subjective factors, because when we study environmental conditions that impact the end-user it is important to note the difference between causes of happiness and indicators of

happiness (Wright, 2014). Wright also documents a theory that a happier employee equals a more motivated employee and therefore more productive employee (Wright 2014).

One of the industry responses to wellbeing has been the International WELL Building Institute (IWBI). IWBI began in 2014 after several years of comprising scientific research from the medical and environmental fields, with the goal of creating industry standard for healthy buildings. Wellbeing in the office environment can be measured through several factors including stimuli management, privacy, space management, and workplace sleep support. IWBI's philosophy on office spaces is that they should mitigate stress and optimize productivity with multiple options for working, resting, and task execution. An appropriate balance will help facilitate a healthy environment and be beneficial to employee wellbeing ("International WELL Building Institute," 2019).

In J. Vischer's review of existing research on environmental psychology of the workspace, she suggests the environmental comfort model as a measure of occupant satisfaction and wellbeing (Figure 2). This model shows physical comfort, functional comfort, and psychological comfort constitute occupant satisfaction and wellbeing.

### **2.3.1 Employee Wellbeing**

In some of the empirical research, wellbeing in the workplace is often measured with job satisfaction. Job satisfaction is defined as "a pleasurable or positive emotional state, resulting from the appraisal of one's job experiences" and job satisfaction can play a key role in employee wellbeing (Bodin-Danielsson & Bodin, 2008).

Also worth noting is the Oldham (1988) study found a correlation between employee desk density and job satisfaction (Oldham, 1988).

In a study done by Gutenberg Health (2016) in Germany, the researchers looked at both work and private life conditions to understand the work-life balance component of wellbeing. They found that women in particular and those with depression and additional stress from work-life balance challenges increased reporting of their dissatisfaction with the office environment (Garthus-Niegel et al., 2016).

Another study that looked at office type and its effect on wellbeing, looked at sick leave rates, perceived managerial style, and job satisfaction to try to understand employee health and wellbeing in the office environment (C. Bodin-Danielsson, 2016).

### **2.3.2 Managing Stressors**

A common theme in research referencing managing workplace stressors is the that with the knowledge work of the office environment there is typically a high demand of self-regulation that creates stress in addition to already present work stresses of tasks demands, social demands, and physical demands. According to Bridger and Brasher (2011), mental well-being is more strongly related to the work environment than physical well-being. There is data that suggests though, that the psychological stress that accompanies long term stress management leads to cardiovascular disease and hypertension in men and women across all age groups (Bridger & Brasher, 2011; Jarczok et al., 2013). High stress can result in burnout and fatigue, which can eventually lead to other illnesses like depression, headaches and weakened immune systems (De Been & Beijer, 2014).



### **2.3.3 Belonging and Autonomy**

A key component in employee wellbeing is autonomy in the workplace, when employees have more control of when, where, and how they work it can increase individual productivity (Meister 2018). Autonomy has also been linked to an improvement in how employees collaborate and that translates to more innovation and production for the employers (Lee, 2014). The loss of autonomy and privacy can negatively affect job performance and overall satisfaction of employees (Herbig et al., 2016). In a 2014 article for the Harvard Business Review, D. Hoskins reports a workplace survey that points to choice and autonomy to drive employee happiness, motivation and performance (Hoskins, 2014).

In organizational behavior research and recent workplace research, a sense of belonging is a primary human need. Belonging is closely related to territoriality, which can cause employees to feel a sense of ownership of their place in the organization (Vischer, 2008). Place identity is another way of referring to belonging, and a Harvard Business Review article reveals that a higher place identity leads to more engagement with coworkers and work, as well as a strong commitment to their organization (Pearce & Hinds, 2018).

In a field experiment that was conducted in conjunction with an open plan office renovation/refurbishment where occupants were surveyed before and after the changes, the researchers found that including the employees as part of the change management was a large part of increased employee satisfaction post-renovation (Hongisto et al., 2016).

With increasing technology and collaboration needs, investigating the connection between personal control over their work area and its effects on group cohesion is

important. A happier more in control employee may be more motivated to work well in their collaborative environment. Part of employee well-being is the personal control over their office environment, as a result of this there is an improvement in how employees collaborate and that translates to more innovation and production for the employers. (Lee et. al 2005).

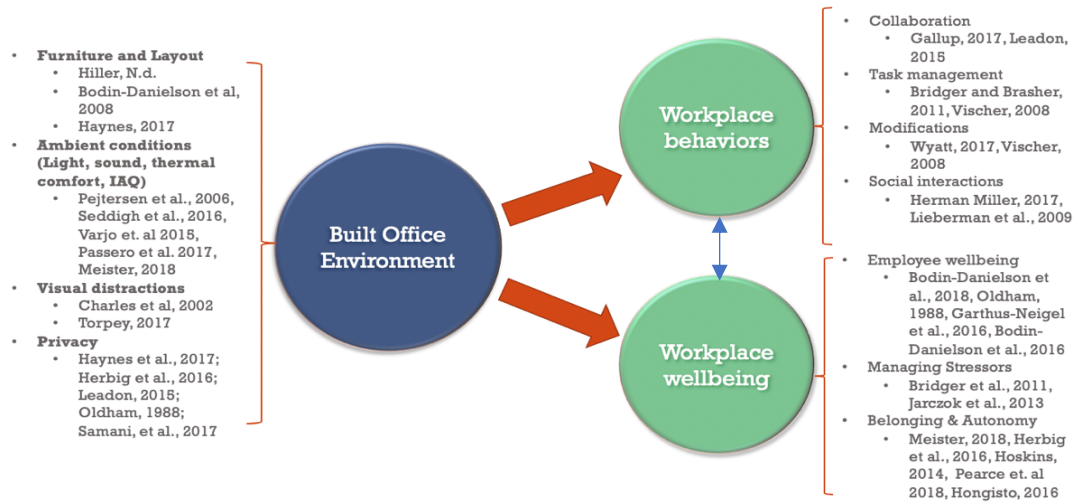


Figure 5. Conceptual Framework II

CHAPTER 3  
METHODOLOGY

**3.0.0 Introduction**

There are many factors in employee wellbeing as noted in chapter two. Much of the current research has looked into each of these factors both individually and collectively. This study differs in that it will look at the recently renovated or updated workplace to see if this interior environmental change expose current relevant data on the true impact of the designed workplace interior. The end research goal is to see if there is significant correlation of the physical work environment and workplace behaviors that are common in the redesigned open office to help understand how the designed interior workplace impacts the wellbeing of its users. This will add to the existing body of knowledge on workplace wellbeing and offer some additional perspective and education for designers, architects, company executives, facility planners, and researchers to understand how they can improve employee wellbeing in their workplace. The following chapter outlines the research methods and methodology, the research topic and questions, and the rationale for this research design.

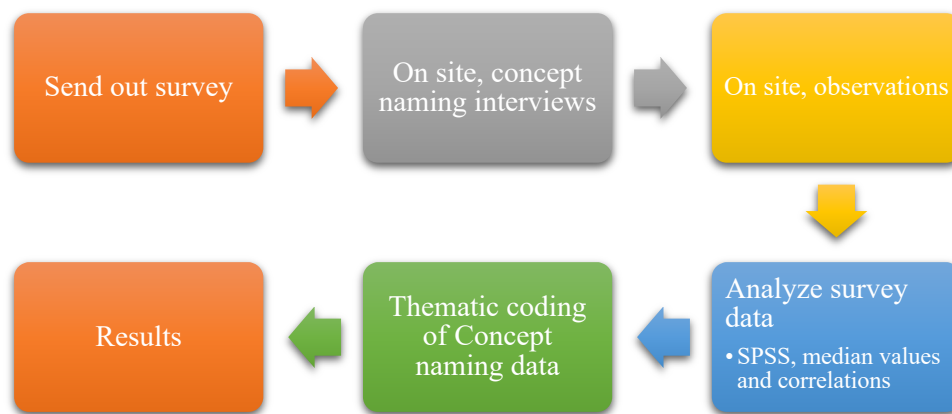


Figure 6. Research Design.

### **3.1.0 Research Topics and Questions**

*Topic: The topic of this research is understanding how the workplace wellbeing in the open office is affected by the type of physical environmental settings of the open office, and how that environment influences employee behaviors.*

Space is considered an organizational resource and research shows that employee wellbeing is a key factor in overall organizational wellness (C. B. Bodin-Danielsson & Bodin, 2008). Organizations factor in workplace quality into the cost of workplace design (Vischer, 2008). The workspace is no longer just a backdrop or setting, and needs to be designed to facilitate and support the work tasks of the occupants (C. Bodin-Danielsson, 2016; Vischer, 2008). "...where workers' have to struggle to perform their tasks because the built environment is problematic, their situation is characterized as stressful" (Vischer, 2008).

#### **3.1.1 Research Question 1**

*How does the designed (or redesigned) built environment influence employee behavior in the open office workplace?*

- 1) What are employees' perceptions of how the open plan office impacts their wellbeing?
  - a. What are the perceived benefits of their work environment?
  - b. What are the stressors of their work environment?

#### **3.1.2 Research Question 2**

*How does the design elements within the built work environment impact employee wellbeing?*

- a. What objects in the user workspace have the most benefit to wellbeing?

- b. What objects are a source of stressors?
- c. What spaces in the overall workspace appear to have the most benefit to employee wellbeing?
- d. What spaces in the overall workspace seem to have a negative impact on employee wellbeing?

**3.2.0 Research Approach-** A mixed methods approach (O’Leary, 2010) will be used for this research as it includes both qualitative and quantitative methods. This research involves studying both human behaviors and their interactions with the environments as well as their perceptions and satisfaction levels within the office environment.

- Qualitative measures
  - Observation/Behavioral Mapping (Sommer, 2002)
  - Concept Naming (Takamura, 2010)
- Quantitative measures
  - Electronic Survey (O’Leary, 2010)

### **3.3.0 Research Method One**

Observation/Behavioral Mapping (Sommer, 2002)

The researcher casually observed the user’s interactions in the workspace to document any non-verbal cues as indicators of satisfaction level as well as possible indicators of positive or negative use of space (i.e. spontaneous collaboration, unused space, impromptu meetings). The researcher also built a map of the space and noted areas not used, not used as designed or intended, congested areas, particularly noisy areas, as well as note positive use of space and positive interactions with the space. Behavioral

mapping is a proven method for studying human behavior and will be useful in triangulating self-reported data from the survey results.

### **3.3.1 Research Method Two**

Concept Naming (Takamura, 2010)

Concept naming is a unique approach to understanding characteristics of objects that we interact with and was originally designed and used for research in brand development. As the interior office environment is essentially the culture and branding of a company, it will allow the researchers to get another view into how the designed interior elements impact the users. Each participant will be given a pen and sticky notes and asked to evaluate both their workstations and the overall workplace, and assign “personality traits” to the objects or spaces they interact with on a daily basis.

### **3.3.2 Research Method Three**

Electronic Survey (O’Leary, 2010; Sommer, 2002)

One way to assess the success of designed space is with a Post Occupancy Evaluation (POE). POE’s are given to occupants 6 months to a year after they occupy a newly renovated or created space to find occupants likes and dislikes of the space and understand if the design was successful or not. In this way, the survey was designed with questions similar to that of POE to best understand from the user’s perspective what they may like or not like about the space in which they work (Vischer, 2008). “...processes of environmental knowing and assessing are linked not only to observable physical features, but also to the attitudes individuals have towards a particular space” (Vischer, 2008).

Surveys will be given electronically to participants via email and internet link. The survey should take about 10 minutes to complete and will be using a Likert scale ranging from Strongly Agree to Strongly Disagree on a numeric scale of one to five to answer questions based on the level of satisfaction with the interior environment.

#### **3.4.0 Sampling Strategy**

Participants will be from an open office environment working in a normal 8-5 workday, all participants will be over the age of 18 and able to consent in participation. The pool of participants will be selected based on the location in the workspace matching with the criteria of the research, (open office, newly renovated) and then randomly selected based on availability and willingness to participate.

#### **3.5.0 Data Analysis Method One**

Casual observations will be recorded in field notes and behavioral mapping data will be formed into a density map showing areas of congestion or heavy traffic, as well as potential unused “dead space” and other noted hot spots for foot traffic and informal/impromptu meetings.

#### **3.5.1 Analysis Method Two**

The Concept naming data was compiled into a list of words that each respondent used to describe their workstations and a separate list for their descriptions of the overall workplace. The words will then be sorted with thematic coding separating the them into positive and negative attributes. These results will then be graphed to see commonalities and if there are more positive than negatives or vice versa.

### **3.5.2 Analysis Method Three**

The survey was created in the online software, Qualtrics. Some data was analyzed with the survey software and some was analyzed with SPSS computer-based software. The survey responses were coded 1-5, 5 being Strongly Agree, 4 for Agree, 3 for Neither Agree or Disagree, 2 for Disagree, and 1 for Strongly Disagree. Data was analyzed for correlations between the survey questions by typologies, as well median analysis of the responses to the survey questions.

### **3.6.0 Data Collection**

The data was collected at Location A over 2 weeks in February 2020, with 10 hours of onsite time collecting observations and interviews. Location B was collected over 2 weeks in March 2020, with 12 hours of onsite time for observations and interviews. All interviewed participants signed a consent form in accordance with IRB protocol when photographs were required.

### **3.7.0 Institutional Review Board**

Approval was received 02/11/2020 with Exempt Status.



## CHAPTER 4

### DATA ANALYSIS

#### **4.0.0 Introduction**

Chapter 4 discusses the findings from each of the research methods. The findings are presented by location in a case study format. Within the location the results are divided by the relationship to the components laid out in the conceptual framework; Building Environmental Factors (BEF), Workplace Behaviors (WB), and Workplace Wellbeing (WW). The data is also separated by typology within the research method in which it was collected. Any significance to the research questions and objectives are drawn in each case study as appropriate. The survey questions are abbreviated with “Q” in front of the question number, and a full list of the survey questions are included in Appendix A.

The survey data presents a broader perspective of employee satisfactions with their environment, while the concept naming semi-structures interviews present a more in-depth perspective from the users. In the concept naming interviews, the participants were approached by the researcher in a one-on-one interview session in their workstation. The participants were asked to describe different elements in their workstations with a personality trait or descriptive word.

### 4.1.0 Sample Location A

This location is a municipal planning office for a larger city in central Arizona, United States. It was remodeled in 2018. There were 40 employees that work in the open office area at this location, and the survey was sent via email link to the point of contact for the site, the Product Engineering Manager, who then distributed the link for the survey to the 40 employees (N=40). The response rate to the survey was 33%, and the respondents were comprised of 55% male and 45% female (Figure 7). These participants came from a diverse group of job types with majority being Engineers and Designers (Figure 8). For the concept naming interviews at this location, 10 total participants were interviewed (N=10). No additional demographic information was collected from the interview participants.

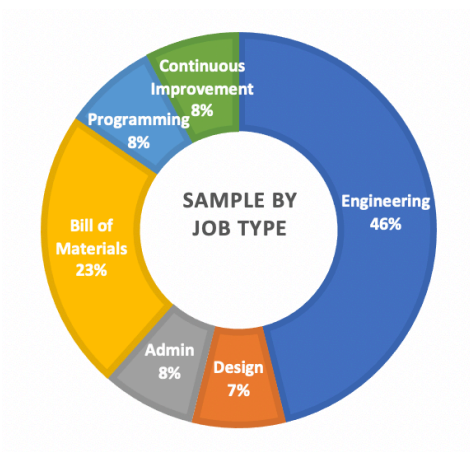


Figure 7. Sample by Job Type

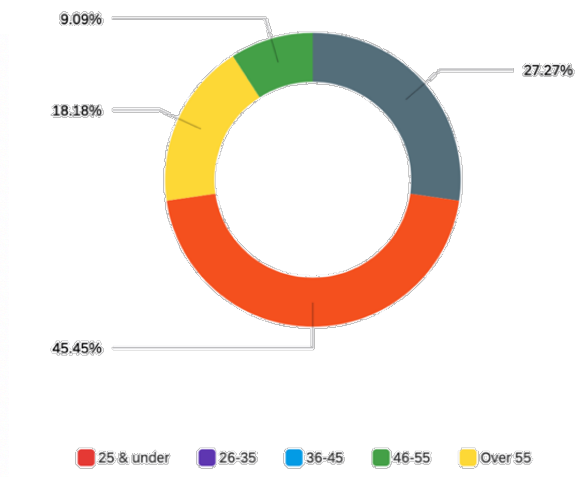
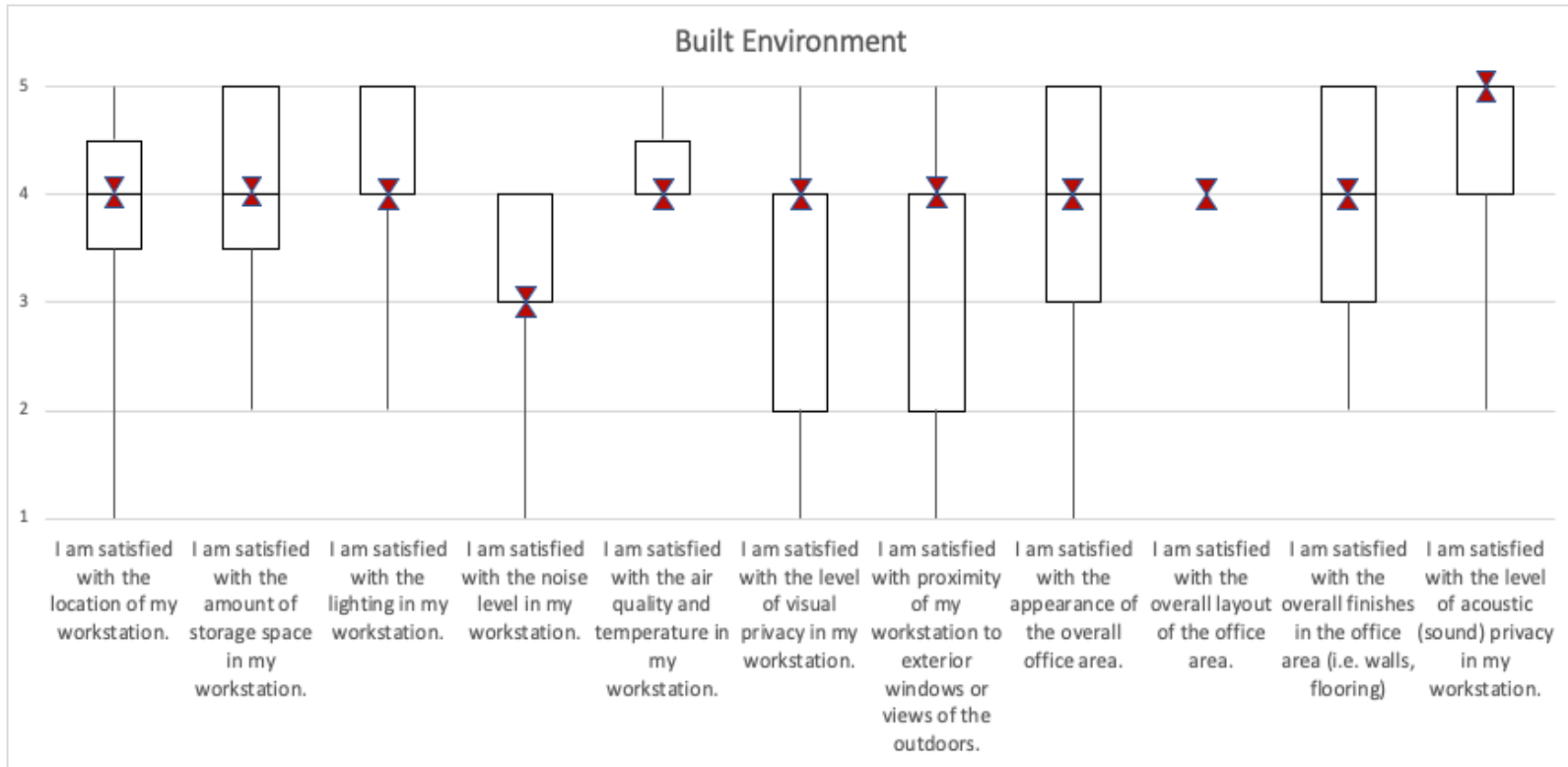


Figure 8. Sample by Age Group

#### **4.2.0 Survey Data Median Analysis: Location A**

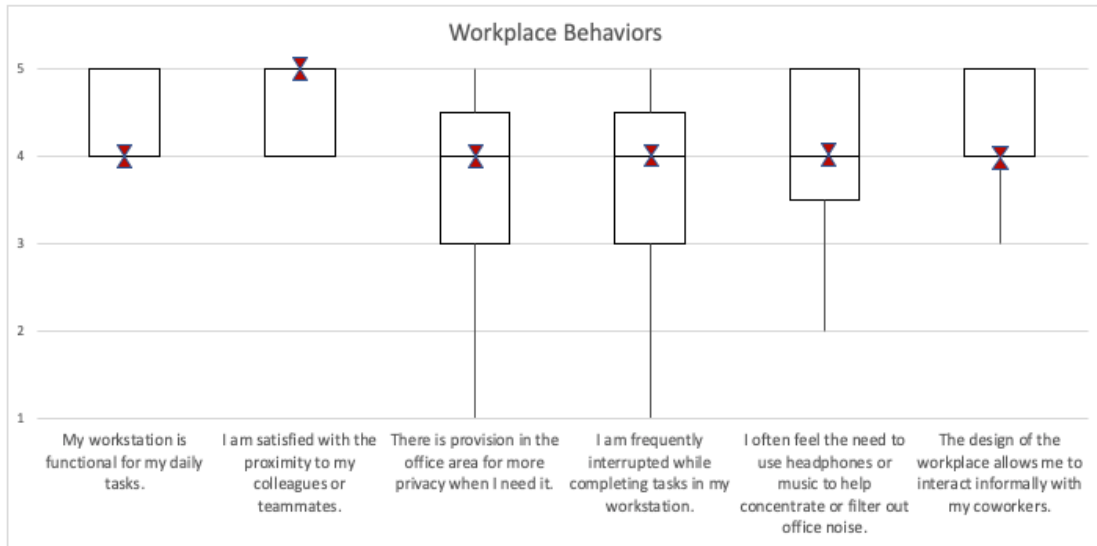
Looking at the survey data, the median data was analyzed to find the midpoint of the responses. This data is shown by typology in figures 9A, 9B, 9C. Figure 9A shows the survey questions in reference to the BEF. In this research site, the median level of satisfaction was lowest (Mdn = 3) with Q21, Q22, and Q6. The highest median satisfaction levels were (Mdn = 5) on Q12 and Q42. The boxplot in Figure 9B shows the survey questions in reference to the WB where the lowest median levels were questions all Mdn = 4 and Q12 satisfaction with proximity to colleagues had highest median satisfaction Mdn = 5. Figure 9C shows the median values for WW were all Mdn = 4 with the exception of Q21, "I am happier in the newly renovated workstation compared to my previous workstation," and Q22 overall wellbeing is important to my organization gathered neutral scores around Mdn = 3.

Figure 9A. Location A: Survey Median Response, Built Environmental Factors



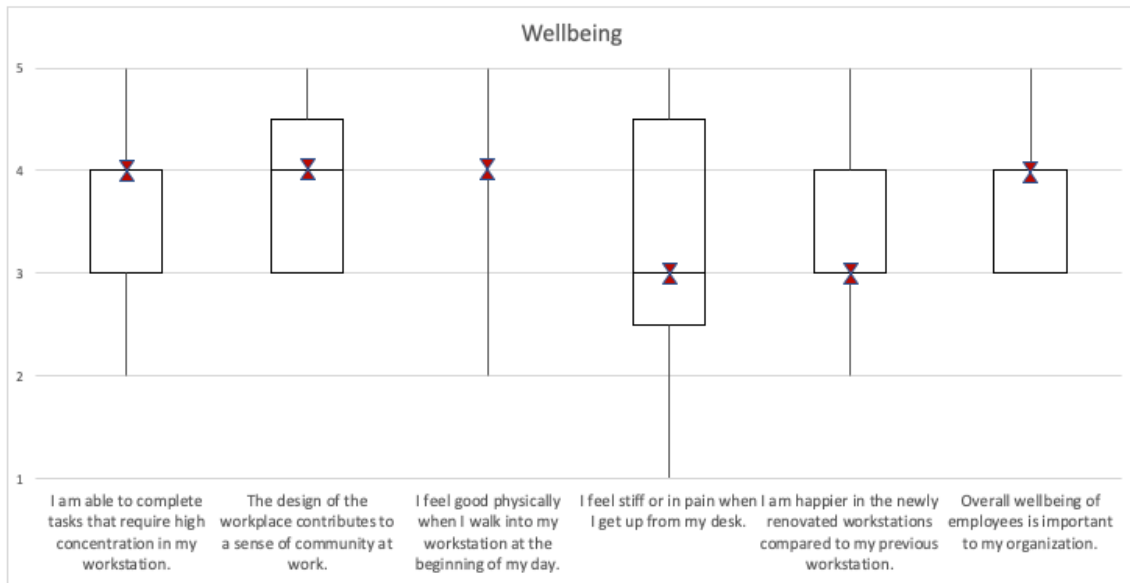
The box parameter represents the 25<sup>th</sup> and 75<sup>th</sup> percentile of the total responses. The red marker represents the median response level for each question. The questions were rated 1-5 on a Likert scale, 1- Strongly Disagree, 2-Disagree, 3-Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree.

Figure 9B. Location A: Survey Median Response, Workplace Behaviors



The box parameter represents the 25<sup>th</sup> and 75<sup>th</sup> percentile of the total responses. The red marker represents the median response level for each question. The questions were rated 1-5 on a Likert scale, 1- Strongly Disagree, 2-Disagree, 3- Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree.

Figure 9C. Location A: Survey Median Response, Workplace Wellbeing



The box parameter represents the 25<sup>th</sup> and 75<sup>th</sup> percentile of the total responses. The red marker represents the median response level for each question. The questions were rated 1-5 on a Likert scale, 1- Strongly Disagree, 2-Disagree, 3- Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree.

#### 4.2.1 Survey Data Correlations: Location A

Table 1 is the correlation data retrieved from SPSS for Location A. Questions 45, ‘Overall I am satisfied with my workplace’ and Question 26, ‘The newly renovated layout improves my overall wellbeing’ were correlated with the other survey questions which related to the research typologies. The data correlation was significant at  $p < 0.10$  level, see Table 1 for  $p$  values. The Pearson Correlation looks at the strength of the correlations between two ordinal variables in this research, and has been used in previous workplace research (Frontczak et al., 2012). The Sig. (2-tailed) value shows if there is a significant correlation, and if that value is greater the .10 in this case it is a significant correlation. In this study, if the Pearson correlation was +/- .70 to .90 is a high correlation, and +/- .50 to .70 is a moderate correlation.

<b>TABLE 1 Location A correlations Q45 and Q26</b>		<b>Q45</b>	<b>Q26</b>
<b>Q1 My workstation is functional for my daily tasks</b>	Pearson Correlation	0.600*	0.275
	Sig. (2-tailed)	0.051	0.413
<b>Q2 I am satisfied with the location of my workstation</b>	Pearson Correlation	0.726*	0.158
	Sig. (2-tailed)	0.011	0.642
<b>Q3 I am satisfied with the amount of storage space in my workstation.</b>	Pearson Correlation	0.614*	.764**
	Sig. (2-tailed)	0.044	0.006
<b>Q4 I am able to complete tasks that require high concentration in my workstation.</b>	Pearson Correlation	0.760*	0.447
	Sig. (2-tailed)	0.007	0.169
<b>Q5 I am satisfied with the lighting in my workstation.</b>	Pearson Correlation	0.730*	0.464
	Sig. (2-tailed)	0.011	0.150
<b>Q6 I am satisfied with the noise level in my workstation.</b>	Pearson Correlation	0.398	0.037
	Sig. (2-tailed)	0.226	0.915
<b>Q7- I am satisfied with the air quality and temperature in my workstation.</b>	Pearson Correlation	0.130	0.223
	Sig. (2-tailed)	0.704	0.510

<b>Q8 I am satisfied with the level of visual privacy in my workstation.</b>	Pearson Correlation	0.564	0.303
	Sig. (2-tailed)	0.071	0.366
<b>Q42 I am satisfied with the level of acoustic (sound) privacy in my workstation.</b>	Pearson Correlation	0.801*	0.516
	Sig. (2-tailed)	0.003	0.104
<b>Q9 I am satisfied with proximity of my workstation to exterior windows or views of the outdoors.</b>	Pearson Correlation	0.844*	0.394
	Sig. (2-tailed)	0.001	0.230
<b>Q10 I am satisfied with the appearance of the overall office area.</b>	Pearson Correlation	0.487	.642*
	Sig. (2-tailed)	0.129	0.033
<b>Q11 I am satisfied with the overall layout of the office area.</b>	Pearson Correlation	0.844*	.660*
	Sig. (2-tailed)	0.001	0.027
<b>Q12 I am satisfied with the proximity to my colleagues or teammates.</b>	Pearson Correlation	0.487	.642*
	Sig. (2-tailed)	0.129	0.033
<b>Q13 I feel comfortable with openness of the layout in our office area.</b>	Pearson Correlation	0.645*	0.262
	Sig. (2-tailed)	0.032	0.437
<b>Q14 I am satisfied with the overall finishes in the office area (i.e. walls, flooring)</b>	Pearson Correlation	0.324	.607*
	Sig. (2-tailed)	0.331	0.048
<b>Q15 There is provision in the office area for more privacy when I need it.</b>	Pearson Correlation	.697*	0.288
	Sig. (2-tailed)	0.017	0.391
<b>Q16 I am frequently interrupted while completing tasks in my workstation.</b>	Pearson Correlation	-0.516*	-0.569
	Sig. (2-tailed)	0.104	0.068
<b>Q17 I often feel the need to use headphones or music to help concentrate or filter out office noise.</b>	Pearson Correlation	-0.266	-0.382
	Sig. (2-tailed)	0.428	0.247
<b>Q18 The design of the workplace contributes to a sense of community at work.</b>	Pearson Correlation	.670*	.876**
	Sig. (2-tailed)	0.024	0.000
<b>Q19 I feel good physically when I walk into my workstation at the beginning of my day.</b>	Pearson Correlation	.688*	0.164
	Sig. (2-tailed)	0.019	0.629
<b>Q20 I feel stiff or in pain when I get up from my desk.</b>	Pearson Correlation	-.756*	-.739**
	Sig. (2-tailed)	0.007	0.009
	Pearson Correlation	.843*	.767**

<b>Q21 I am happier in the newly renovated workstations compared to my previous workstation</b>	Sig. (2-tailed)	0.001	0.006
<b>Q22 Overall wellbeing of employees is important to my organization.</b>	Pearson Correlation	.774*	.755**
	Sig. (2-tailed)	0.005	0.007
<b>Q34 The design of the workplace allows me to interact informally with my coworkers.</b>	Pearson Correlation	0.251	0.583
	Sig. (2-tailed)	0.456	0.060
<b>Q45 Overall I am satisfied with my workplace.</b>	Pearson Correlation	1.000	0.601
	Sig. (2-tailed)		0.051
<b>Q23 I am satisfied with moving into the newly remodeled space.</b>	Pearson Correlation	.772*	.807**
	Sig. (2-tailed)	0.005	0.003
<b>Q24 The newly renovated workstations improve wellbeing of employees.</b>	Pearson Correlation	.670*	.723*
	Sig. (2-tailed)	0.024	0.012
<b>Q25 The newly renovated workstations improve functionality and efficiency.</b>	Pearson Correlation	0.554*	.807**
	Sig. (2-tailed)	0.077	0.003
<b>Q26 The newly renovated layout improves my overall wellbeing.</b>	Pearson Correlation	0.601*	1
	Sig. (2-tailed)	0.051	
<b>Q35 My previous (before the renovation) workstation was functional and efficient.</b>	Pearson Correlation	-0.067	0.307
	Sig. (2-tailed)	0.845	0.359
<b>Q36 I was satisfied with the noise level and privacy in my previous workstation.</b>	Pearson Correlation	-0.165	-0.135
	Sig. (2-tailed)	0.628	0.692
<b>Q37 I feel I was productive in my previous workstation.</b>	Pearson Correlation	0.596*	0.284
	Sig. (2-tailed)	0.053	0.397
<b>Q38 The layout of the previous work area made me feel comfortable.</b>	Pearson Correlation	0.210*	-0.143
	Sig. (2-tailed)	0.536	0.675
<b>Q46 I was satisfied with my overall workplace before the renovations.</b>	Pearson Correlation	-.585*	-.779*
	Sig. (2-tailed)	0.059	0.005

\* Correlation is significant at the 0.10 level (2-tailed).

There is a high-positive correlation between Q45, overall workplace satisfaction, and location of workstation and overall layout (Table 2). Question 45 also recorded a high-



positive correlation with lighting (Q5), acoustic privacy (Q42), and proximity to windows (Q9)(see table 2). Although these all had a high median response, this correlation lines up with other research (D’Oca, Chen, Hong, & Belafi, 2017; Frontczak et al., 2012). For question 26, the newly renovated layout improves my overall wellbeing, had a high-positive correlation with satisfaction with storage (Q3) and happier in the new workstations versus the previous ones (Q21) (see Table 3).

The research for correlations between BEF and WB reveals that Q4 ‘the satisfaction level with the ability to complete tasks requiring high concentration’, has a high-positive correlation with Q42 ‘the satisfaction level of acoustical privacy in the workstation’ (see Table 4, Q42 & Q4). The median satisfaction level for Q42 was Mdn=5, indicating that the average satisfaction level with acoustical privacy was high. The median response level for Q4 was Mdn=4, indicating that most respondents agree that they can complete tasks of high concentration at a satisfactory level. The BEF represented in Q42, acoustical privacy impacts the WB-task management with a positive outcome. BEF of Q11 (Mdn=4) and Q13 (Mdn=4) relate to satisfaction level with the overall layout and openness of the layout. Q11 and Q13 showed a high-positive correlation with completing tasks that require concentration (Table 5).

<b>High-Positive Correlation with Overall workplace Satisfaction (Q45)</b>	Question		Median
		Q2	Location of workstation
	Q4	Able to complete tasks that require a high concentration level	4
	Q5	Lighting	4
	Q42	Acoustic Privacy	5
	Q9	Proximity to windows	4

	Q11	Overall Layout	4
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<b>Table 3</b>			
<b>High-Positive Correlation with the newly renovated layout improves my overall wellbeing (Q26)</b>	Question		Median
	Q3	Storage space	4
	Q21	Happier with the new workstations over previous	3

<b>Table 4</b>			
<b>High-positive correlation Ability to complete tasks that require high concentration (Q4)</b>	Question		Median
	Q42	Acoustic Privacy	4

<b>Table 5</b>			
<b>High-positive correlation: Ability to complete tasks that require high concentration (Q4)</b>	Question		Median
	Q11	Satisfied with overall layout	4
	Q13	Satisfied with openness of layout	4

#### 4.2.2 Concept Naming Data: Location A

The concept naming data from the interview responses were categorized by common words and summed to a total number. Then identified words were coded thematically by positive, neutral, and negative words. Figure 10 shows some of the factors that the participants identified with the descriptive words and are viewed in the scale based on the “weight” of positive, negative or neutral terms. Figure 11 is the amount of times that word was recorded. The red bars are negative responses, green bars are neutral responses, and blue bars are positive responses. These give a visual representation of the “personality traits” that make up the perceptions of the physical items in the users’ workstations.

Figure 10. Location A: Concept naming chart, Workstation

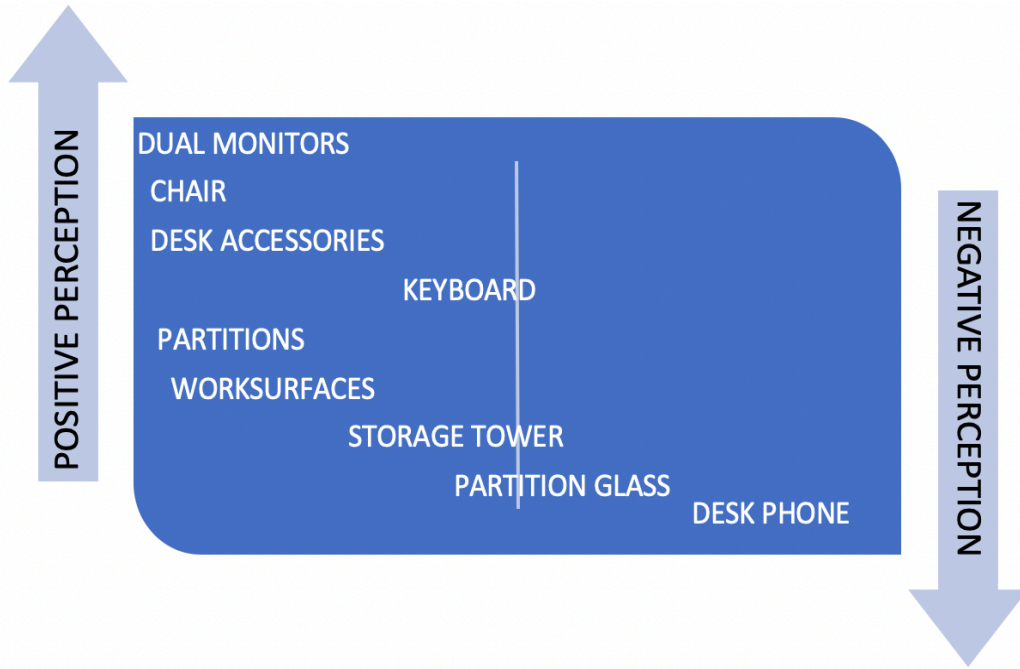
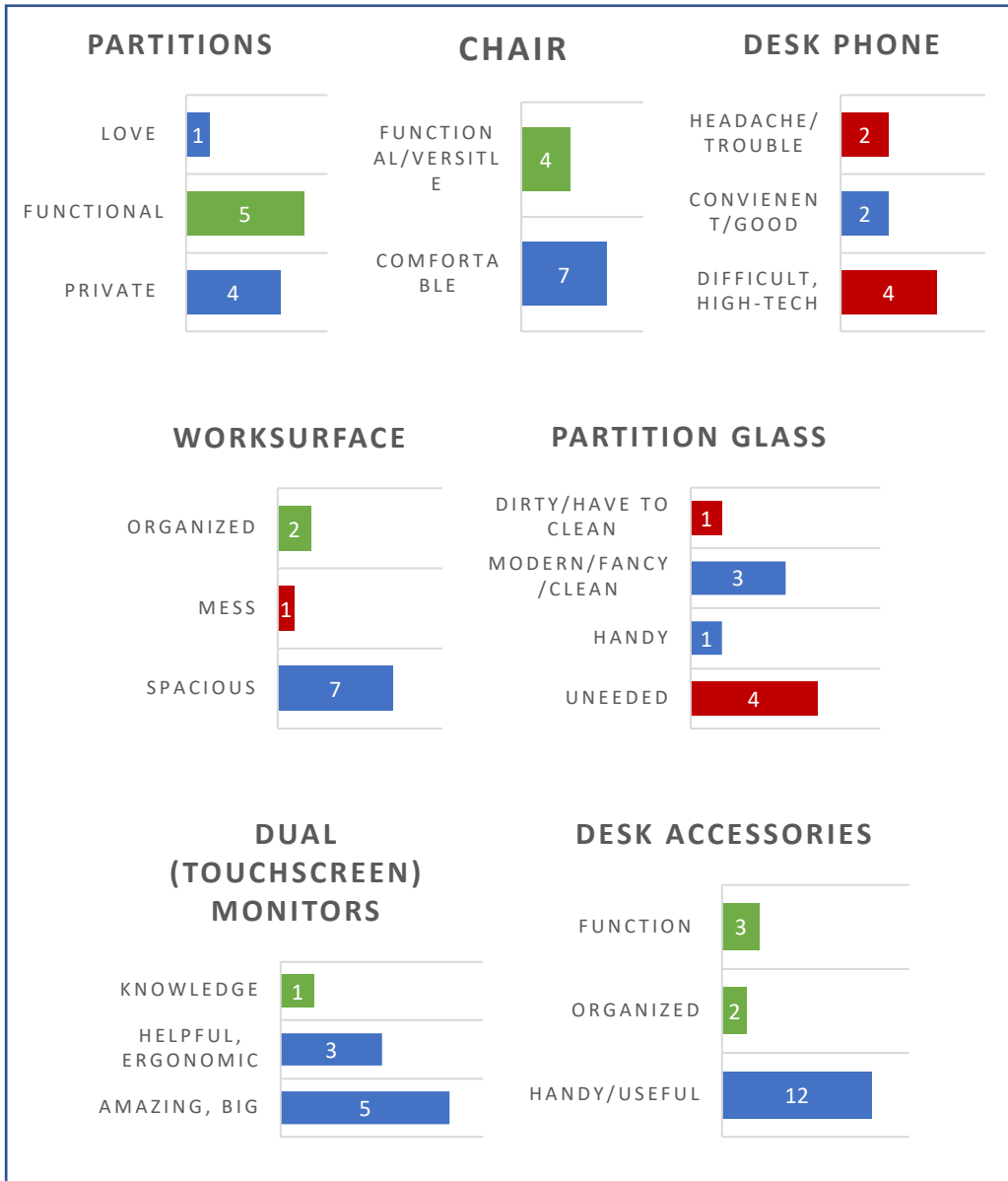


Figure 11. Location A: Concept Naming Responses, Workstations.



Concept naming was also done in an abbreviated fashion to the overall layout of the workplace. The graph in Figure 12 shows the perceptions of the overall layout based on the data collected. Figures 13A-13E show the individual responses and the perceptions are coded again with red as negative response, blue is a positive response and the yellow is a neutral response. The participants were asked again to assign personality traits or descriptive words to some of the major areas/zones of the workplace. The overall work area seems to be represented by mostly positive descriptions with only two negative comments documented. The most negatively described area was the facility's large kitchen break room, as it was viewed as "too much" and "excessive."

Figure 12. Location A: Concept Naming Chart, Overall Layout



Figure 13A. Location A: Concept Naming Responses, Overall Work Area

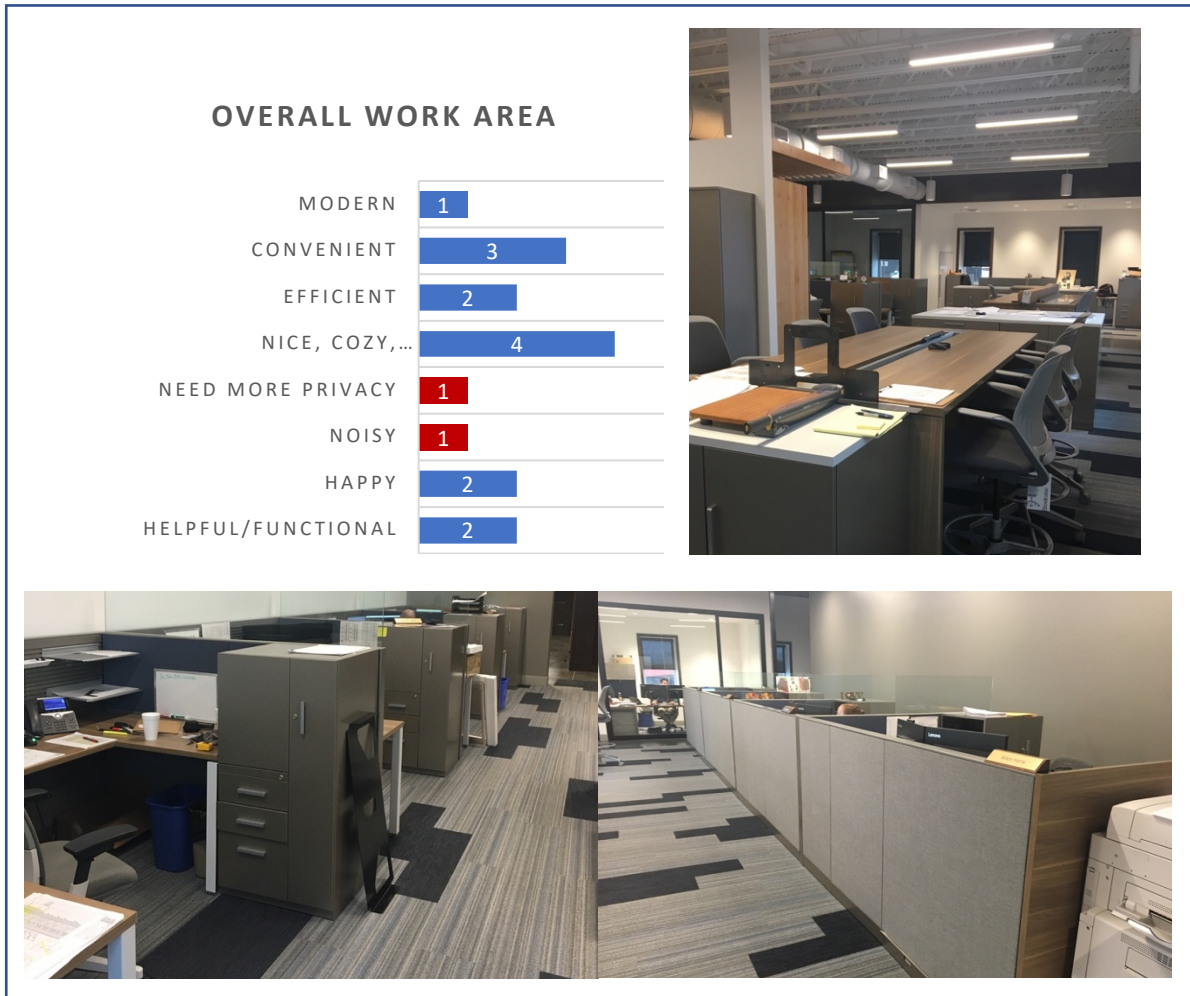


Figure 13B. Locations A: Concept Naming Responses, Conference room

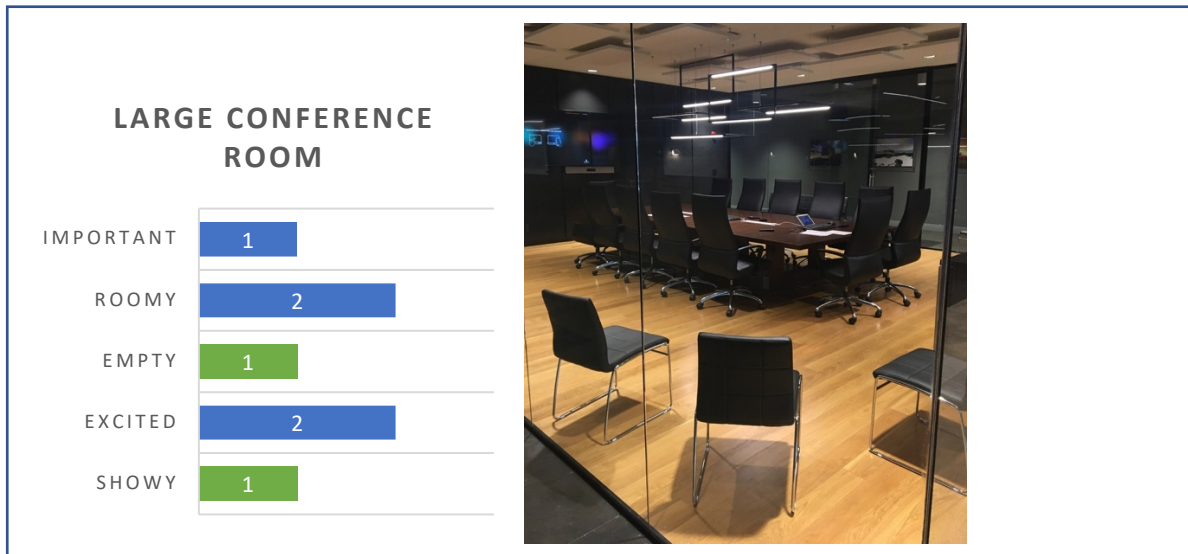


Figure 13C. Location A: Concept Naming Responses, Small Conference Room

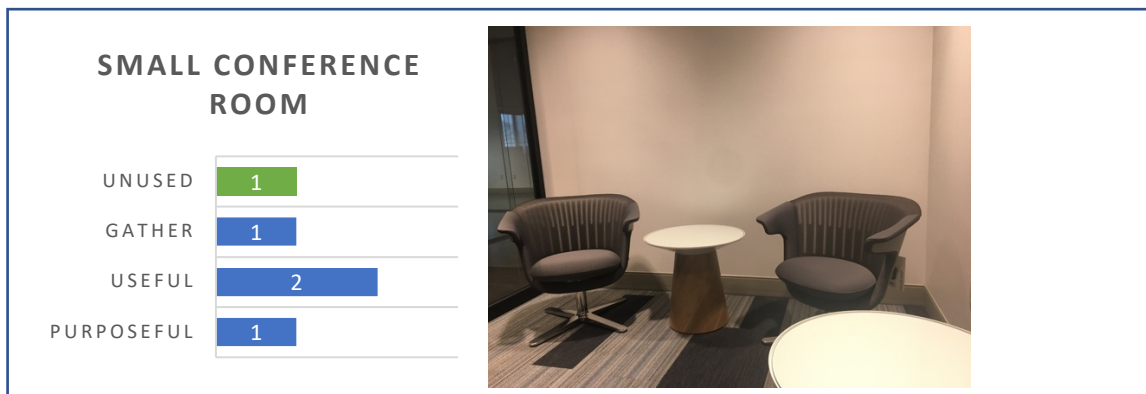


Figure 13D. Location A: Concept Naming Responses, Large Kitchen/Break Area

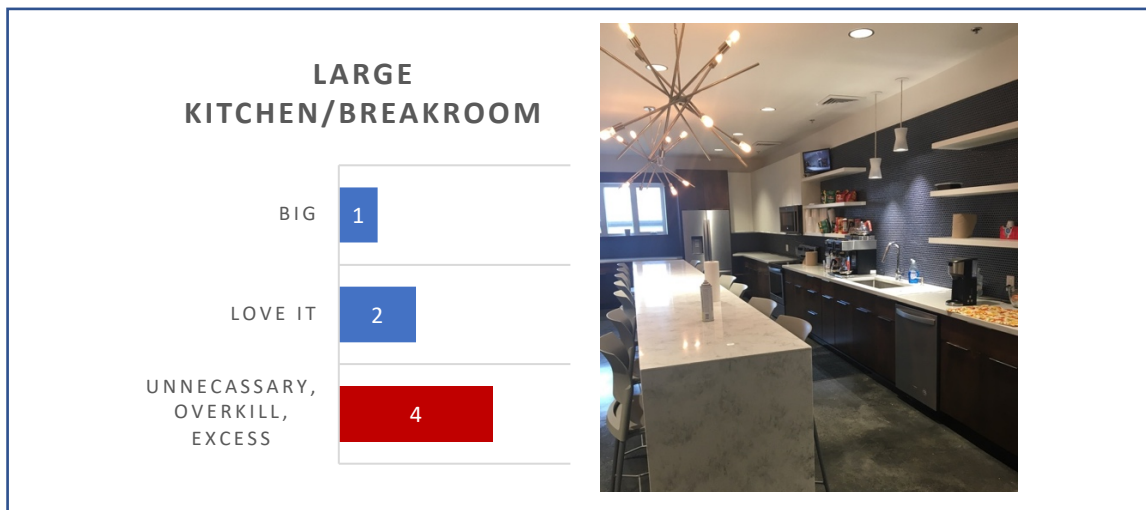
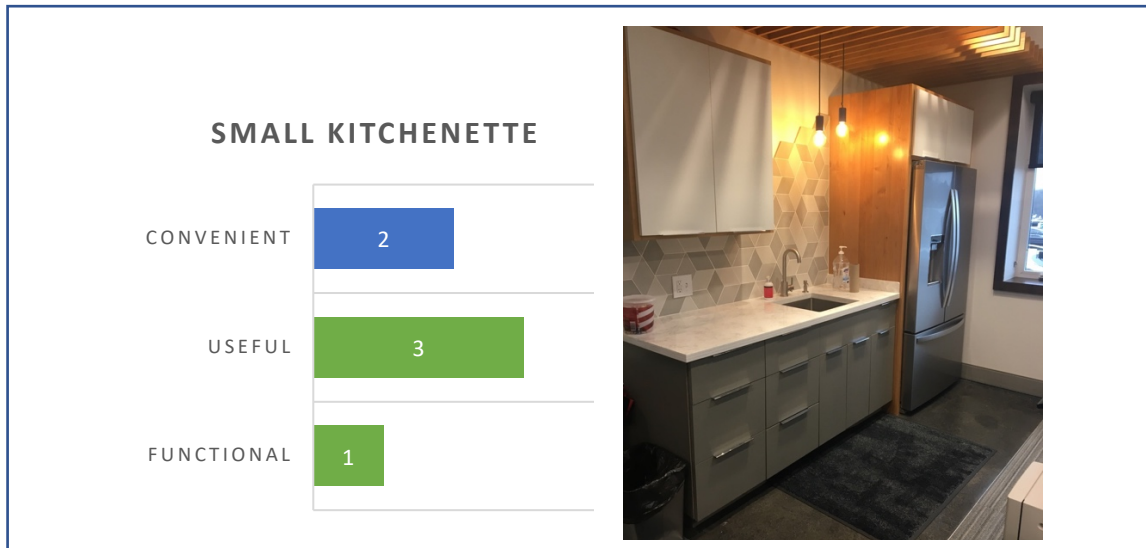


Figure 13E. Location A: Concept Naming Responses, Small Kitchenette



#### 4.1.4 Observations: Location A

Observations were conducted four times each day on two separated days for a total of 2 hours of observations. Collaboration was witnessed via meetings in formal conference areas as well as impromptu meetings and around workstations. From these observations the researcher observed that the panel height allowed for employees to converse informally over workstations. The researcher also observed that for coworkers that came from other areas, the panel height was such that employees could rest their arms on the top and have informal interactions with colleagues.

Another aspect unveiled by the observations was the quantity of headphone users. For this research study, headphone use is a modification used to manage office stressors. As such, the headphone usage was noted in use by 8 employees on day 1 and 7 employees on day 2 over both levels.

The researcher observed that employees managing tasks without issues. Tasks observed were primarily at the workstation involving both computers, phone calls, and paper



charts. There were no apparent barriers to achieving tasks. However, some workstation locations contained extra furniture or unused office equipment that individual users may have to walk around but did not seem to cause any apparent stress. In one workstation it was observed that a printer that was broken down and not in use was adjacent to a workstation entrance. As explained by the user of that workstation, it was not a bother because it assisted with more privacy.

Informal common area conference spaces were often a place for gathering. These tables in most cases were adjacent to exterior windows, and there was a common area similar in each departmental area on both levels. These common areas were also directly adjacent to the workstations with similar aesthetics. More employees gathered at these common area tables over lunch than in the kitchen area. It appears this fosters a sense of community within the different departments. The behavioral map in Figure 14A and B show the social interactions “hot zones”, headphone use, and unused spaces. The social interaction “hot zones” were where the researcher observed social gatherings happening informally and noted with red circles on the maps in Figures 14A and 14B. Smaller circles represent where 2 employees gathered, and larger circles represent where 3 or more employees gathered. It is also important to note that this location was built with expansion in mind so there were several unused areas and workstation

Figure 14A. Location A, Level 1, Observation Map



Figure 14B. Location A, Level 2, Observation Map

52



### 4.2.0 Sample: Location B

Location B is a city government office in Mesa, Arizona. A total of 35 employees work in the researched open office environment. An email link for the survey was emailed to management to distribute to those employees (N=35). The response rate to the survey was 80% (N=28), and the respondents were comprised of 62% were male and 38% were female. These participants came from a diverse group of job types with majority being Engineers and Planners (Figure 15). Eighteen employees (N=18) voluntarily participated in the concept naming interviews at this location to understand the employees' perceptions of their workstations and the overall layout. No additional demographic information was collected from the interview participants.

Figure 15. Location B: Sample by age group type

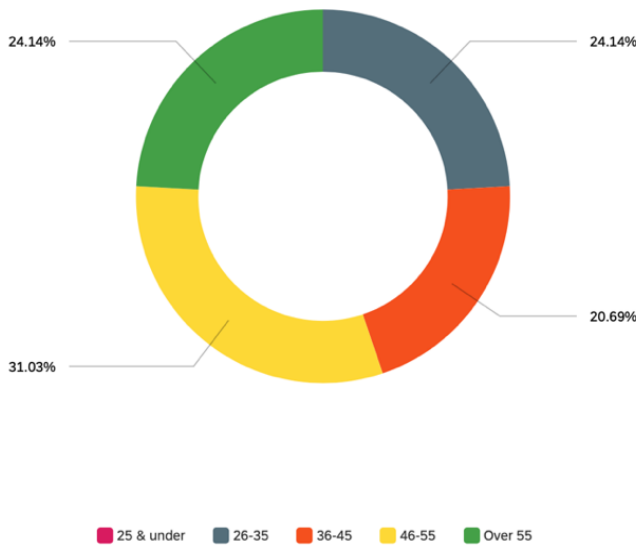
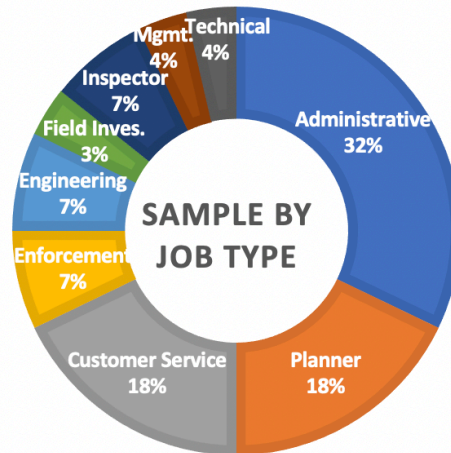


Figure 16. Location B: Sample by job type



#### **4.2.1 Survey Data Median Analysis: Location B**

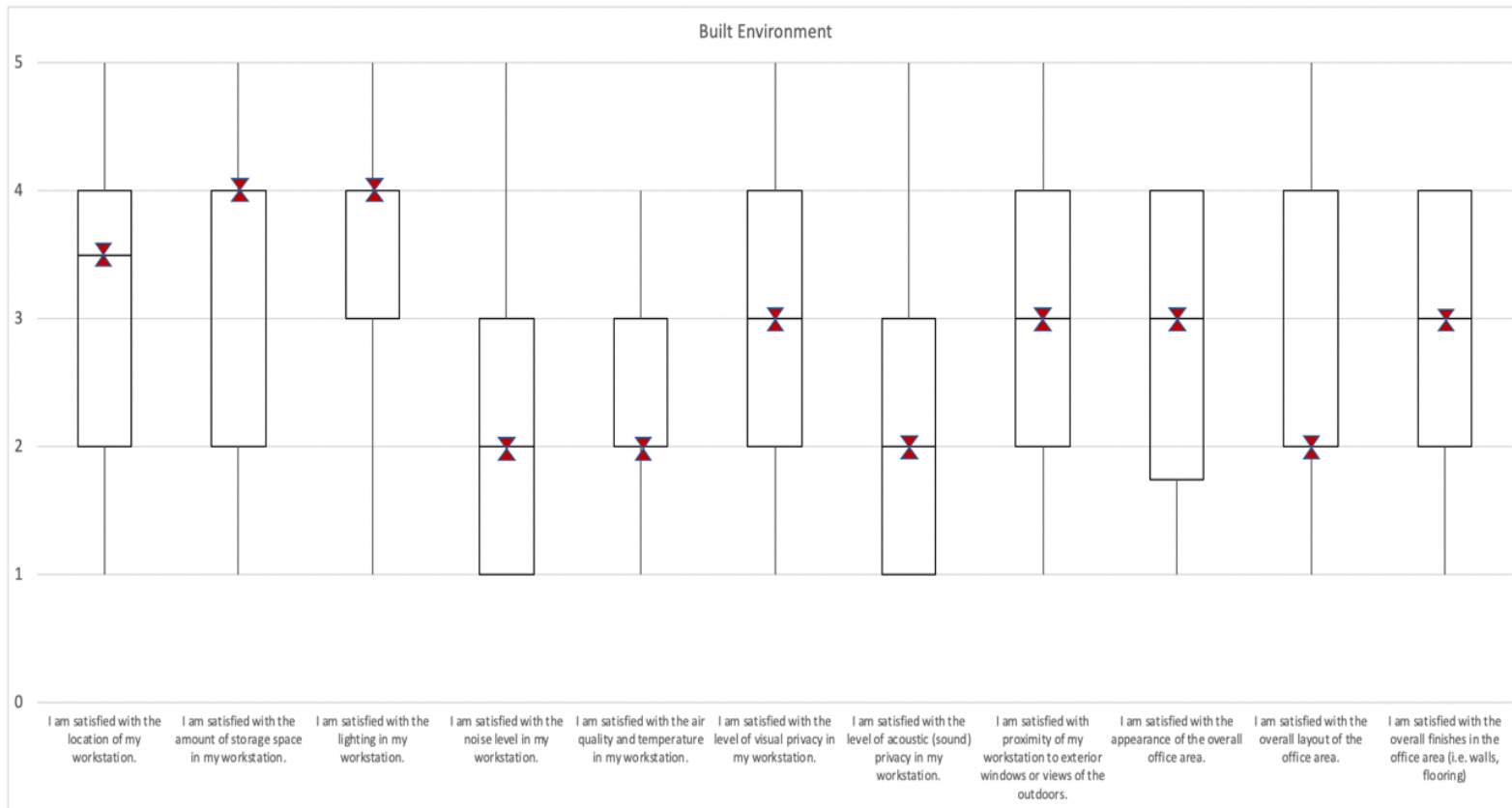
The boxplot in Figure 17A shows the survey questions that reference built environmental factors such as furniture, layout, ambient conditions, and visual/acoustic privacy. In this research site, it appears that the median level of satisfaction is lowest with noise level in the workstation, air quality & temperature in the workstation, acoustic privacy, and overall layout of the office area. The highest median satisfaction levels were with location of workstation, amount of storage in workstation, and lighting in the workstation.

The survey questions that related to workplace behaviors such as collaboration, task management, modifications, and social interactions are shown in the boxplot graph in Figures 17B. Median level of satisfaction for ‘there is provision in the office for more privacy is available when I need it’ was ranked lowest Mdn=2, indicating the majority of participants did not think this was satisfactory to the current layout. Also noted is that the median response for the question ‘I am frequently interrupted while completing tasks in my workstation’ and ‘I often feel the need to use headphones or music to help me concentrate or filter office noise’ were high in the agree and strongly agree range. This data also shows that the median response indicates that satisfaction level is high for workstation function, proximity to colleagues, and workplace allows informal interactions with coworkers.

The boxplot for questions involving workplace wellbeing can be seen in Figure 17C. The median results for this section seem to fall largely in the middle range, with the exception

of the perception that wellbeing is important to their employer. This median was highest at 4, indicating that participants felt their employer cares about employee wellbeing.

Figure 17A. Location B: Survey Response Median Date, Built Environmental Factors.

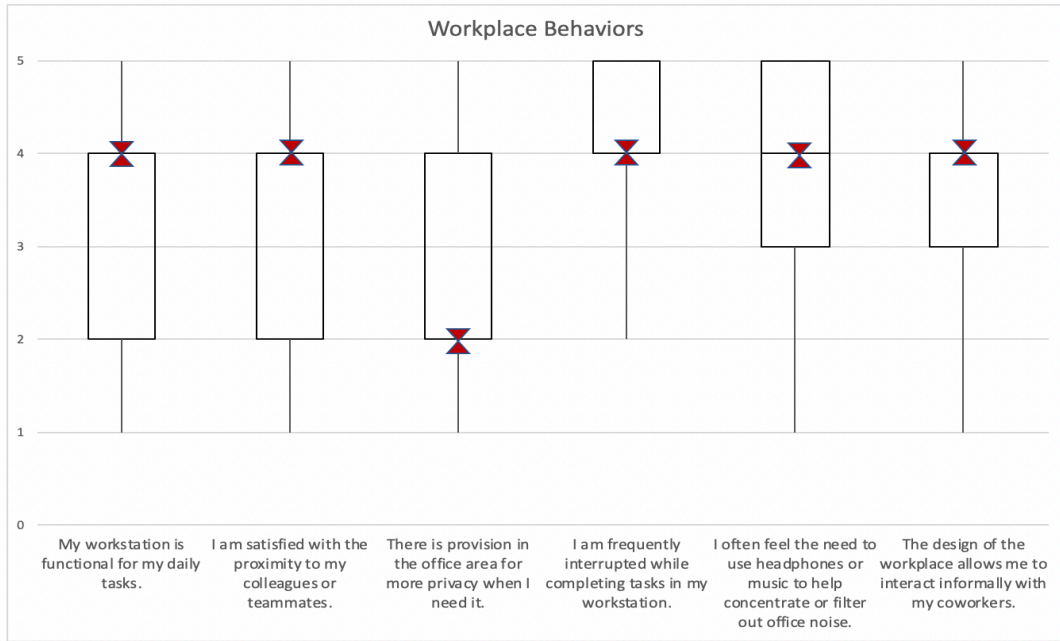


56

The box parameter represents the 25<sup>th</sup> and 75<sup>th</sup> percentile of the total responses. The red marker represents the median response level for each question. The questions were rated 1-5 on a Likert scale, 1- Strongly Disagree, 2-Disagree, 3-Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree.

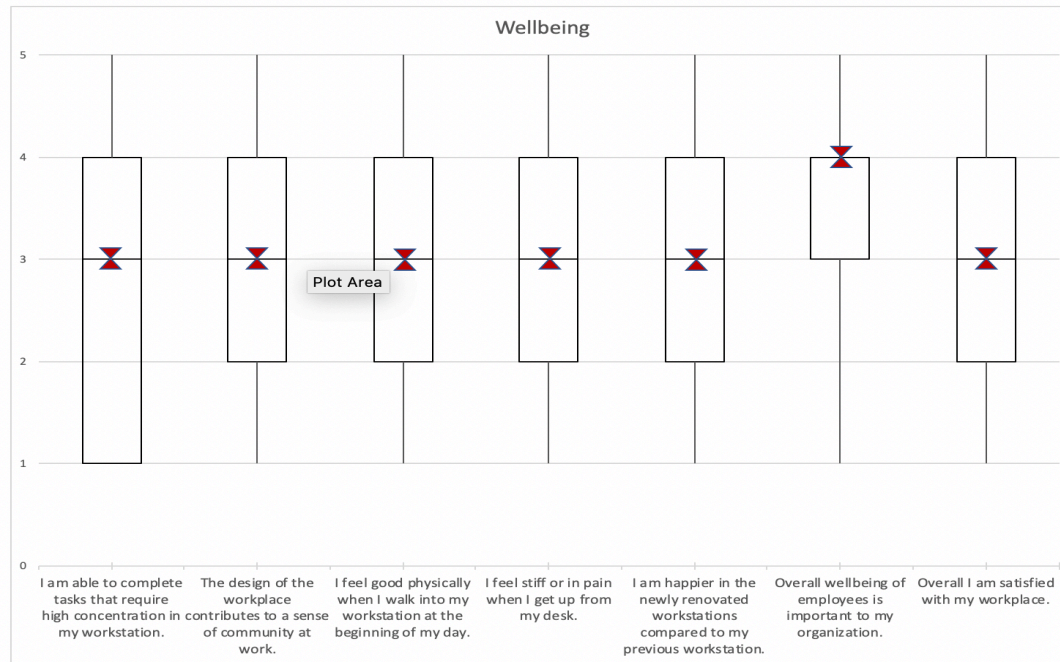


Figure 17B. Location B: Survey Response Median Date, Workplace Behaviors.



The box parameter represents the 25<sup>th</sup> and 75<sup>th</sup> percentile of the total responses. The red marker represents the median response level for each question. The questions were rated 1-5 on a Likert scale, 1- Strongly Disagree, 2-Disagree, 3- Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree.

Figure 17C. Location B: Survey Response Median Date, Workplace Wellbeing.



The box parameter represents the 25<sup>th</sup> and 75<sup>th</sup> percentile of the total responses. The red marker represents the median response level for each question. The questions were rated 1-5 on a Likert scale, 1- Strongly Disagree, 2-Disagree, 3- Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree.



## 4.2.2 Survey Data Correlations: Location B

The researcher analyzed the survey data with the correlation method within SPSS-24 software. Two questions were correlated against the survey questions relating to the built office environment, workplace behaviors, and workplace wellbeing. Questions 45, ‘Overall I am satisfied with my workplace’ and Question 26, ‘The newly renovated layout improves my overall wellbeing’ were correlated with the other survey questions which related to the research typologies. The data correlation was significant at  $p < 0.10$  level, see Table 1 for  $p$  values.

<b>Table 6. Location B Correlations Q45 and Q26</b>		<b>Q45</b>	<b>Q26</b>
<b>Q1 My workstation is functional for my daily tasks</b>	Pearson Correlation	.778**	.644*
	Sig. (2-tailed)	0.00	0.00
<b>Q2 I am satisfied with the location of my workstation</b>	Pearson Correlation	.546**	.622*
	Sig. (2-tailed)	0.01	0.00
<b>Q3 I am satisfied with the amount of storage space in my workstation.</b>	Pearson Correlation	.613**	-0.429*
	Sig. (2-tailed)	0.00	0.04
<b>Q4 I am able to complete tasks that require high concentration in my workstation.</b>	Pearson Correlation	.514**	0.38
	Sig. (2-tailed)	0.01	0.07
<b>Q5 I am satisfied with the lighting in my workstation.</b>	Pearson Correlation	.422*	0.534*
	Sig. (2-tailed)	0.04	0.01
<b>Q6 I am satisfied with the noise level in my workstation.</b>	Pearson Correlation	.673**	0.462*
	Sig. (2-tailed)	0.00	0.02
<b>Q7 I am satisfied with the air quality and temperature in my workstation.</b>	Pearson Correlation	.438*	0.26
	Sig. (2-tailed)	0.03	0.23
<b>Q8 I am satisfied with the level of visual privacy in my workstation.</b>	Pearson Correlation	.518**	0.468*
	Sig. (2-tailed)	0.01	0.02
<b>Q42 I am satisfied with the level of acoustic (sound) privacy in my workstation.</b>	Pearson Correlation	.641**	.490*
	Sig. (2-tailed)	0.00	0.02
	Pearson Correlation	-0.02	0.01

<b>Q9 I am satisfied with proximity of my workstation to exterior windows or views of the outdoors.</b>	Sig. (2-tailed)	0.92	0.95
<b>Q11 I am satisfied with the overall layout of the office area.</b>	Pearson Correlation	.479*	.502*
	Sig. (2-tailed)	0.02	0.01
<b>Q12 I am satisfied with the proximity to my colleagues or teammates.</b>	Pearson Correlation	.580**	0.34
	Sig. (2-tailed)	0.00	0.10
<b>Q14 I am satisfied with the overall finishes in the office area (i.e. walls, flooring)</b>	Pearson Correlation	0.36	0.34
	Sig. (2-tailed)	0.08	0.11
<b>Q15 There is provision in the office area for more privacy when I need it.</b>	Pearson Correlation	.514**	0.564*
	Sig. (2-tailed)	0.01	0.00
<b>Q16 I am frequently interrupted while completing tasks in my workstation.</b>	Pearson Correlation	-.437*	-.495*
	Sig. (2-tailed)	0.03	0.01
<b>Q17 I often feel the need to use headphones or music to help concentrate or filter out office noise.</b>	Pearson Correlation	-.484*	-0.40
	Sig. (2-tailed)	0.01	0.06
<b>Q18 The design of the workplace contributes to a sense of community at work.</b>	Pearson Correlation	.649**	.593*
	Sig. (2-tailed)	0.00	0.00
<b>Q19 I feel good physically when I walk into my workstation at the beginning of my day.</b>	Pearson Correlation	.874**	.662*
	Sig. (2-tailed)	0.00	0.00
<b>Q20 I feel stiff or in pain when I get up from my desk.</b>	Pearson Correlation	-.434*	-.437*
	Sig. (2-tailed)	0.03	0.03
<b>Q21 I am happier in the newly renovated workstations compared to my previous workstation</b>	Pearson Correlation	.601**	.687*
	Sig. (2-tailed)	0.00	0.00
<b>Q22 Overall wellbeing of employees is important to my organization.</b>	Pearson Correlation	.724**	.557*
	Sig. (2-tailed)	0.00	0.01
<b>Q34 The design of the workplace allows me to interact informally with my coworkers.</b>	Pearson Correlation	.436*	.729*
	Sig. (2-tailed)	0.03	0.00
<b>Q23 I am satisfied with moving into the newly remodeled space.</b>	Pearson Correlation	.598**	0.679*
	Sig. (2-tailed)	0.00	0.00
<b>Q24 The newly renovated workstations improve wellbeing of employees.</b>	Pearson Correlation	.678**	.631*
	Sig. (2-tailed)	0.00	0.00
	Pearson Correlation	.578**	.702*

<b>Q25 The newly renovated workstations improve functionality and efficiency.</b>	Sig. (2-tailed)	0.00	0.00
<b>Q26 The newly renovated layout improves my overall wellbeing.</b>	Pearson Correlation	.579**	1.00
	Sig. (2-tailed)	0.00	
<b>Q35 My previous (before the renovation) workstation was functional and efficient.</b>	Pearson Correlation	0.07	-0.20
	Sig. (2-tailed)	0.74	0.34
<b>Q36 I was satisfied with the noise level and privacy in my previous workstation.</b>	Pearson Correlation	0.12	0.12
	Sig. (2-tailed)	0.56	0.58
<b>Q37 I feel I was productive in my previous workstation.</b>	Pearson Correlation	-0.09	-0.27
	Sig. (2-tailed)	0.68	0.20
<b>Q46 I was satisfied with my overall workplace before the renovations.</b>	Pearson Correlation	-0.14	-0.30
	Sig. (2-tailed)	0.50	0.16
<b>Q45 Overall, I am satisfied with my workplace.</b>	Pearson Correlation	1.00	.579*
	Sig. (2-tailed)		0.003

\* Correlation is significant at the 0.10 level (2-tailed).

Table 7 reveals that Q45, overall satisfaction with the workplace, had a high correlation with proximity to colleagues, feeling good physically in workstations, wellbeing in important to their employer, and satisfactions with the most recent changes. Table 8 reveals that Q26, overall wellbeing is improved by the recent changes, has a high-positive correlation with feeling good physically when walking into workstation and layout allows for interacting informally with coworkers.

<b>Table 7. High-Positive Correlation with Overall workplace Satisfaction (Q45)</b>	<b>Question</b>	
	Q12	Proximity to colleagues
	Q19	Feel good physically walk into workstation
	Q22	Wellbeing important to organization
	Q23	Satisfied with most recent changes

<b>Table 8. High-Positive Correlation newly renovated layout improves overall wellbeing(Q26)</b>	<b>Question</b>	
	Q19	Feel good physically walk into workstation
	Q34	Interact informally with co-workers

After analyzing the data for correlations between the BEF and WB, the researcher recorded the significant findings in Table 9, Table 10, table 11, and Table 12. The ability to complete tasks that require high concentration and acoustic privacy had a high-positive correlation, and a moderate-positive correlation with noise level and storage satisfaction levels. Noise level and acoustic privacy both has a low median satisfaction level (Mdn.=2) which suggests that noise level and acoustic privacy directly impact concentration-based tasks.

Table 9. High-Positive Correlation with Ability to complete tasks with high concentration (Q4)	Question		
	Q42	Acoustic privacy	
Moderate-Positive Correlation (Q4)	Q3	Storage	
	Q6	Noise Level	

Table 10 reveals that there was a moderate positive correlation between satisfaction with the proximity to colleagues and the noise level and being happier with the renovation changes. This suggests that proximity to colleagues contributes to the noise level but also impacts the satisfaction with the changes, possibly due to ease of access to colleagues. Workstation location and frequent interruptions had a moderate positive correlation which may imply that depending on the location of the workstation within the layout, some may have more interruptions than others (Table 11). Also, one more workplace behavior of wearing headphones was shown to have a high-negative correlation with noise level and acoustic privacy, as well as workstation location (Table 12).

Table 10. Moderate-Positive Correlation with Proximity to Colleagues (Q12)	Question	
	Q6	Noise Level
Q21	Happier with renovation changes	

<b>Table 11.</b> <b>Moderate-Negative Correlation with Frequent Interruptions (Q16)</b>	<b>Question</b>	
	Q2	Workstation location

<b>Table 12.</b> <b>High-Negative Correlation with feel the need for headphones or modifications (Q17)</b>	<b>Question</b>	
	Q6	Noise level
	Q42	Acoustic Privacy
<b>Moderate-Negative Correlation with feel the need for headphones or modifications (Q17)</b>	Q2	Workstation location
	Q21	Happier with renovation changes

### 4.3.3 Concept Naming Data: Location B

The responses that were collected from the participants were categorized by common words and summed to a total number. Then the words were coded by positive, neutral, and negative words. Figure 18 shows that some of the factors that the participants identified with the descriptive words, and they are place in the graph based on the “weight” of positive, negative or neutral terms. The following graphs show the collective data from some the identified element that had the most recorded words. The number was the amount of times that word was recorded, and the red bars = negative responses, green bars are neutral responses, and blue bars are positive responses. These give a visual representation of the “personality traits” that make up the perceptions of the physical items in the users’ workstations (Figure 19).

Figure 18. Location B: Concept Naming Chart, Workstations

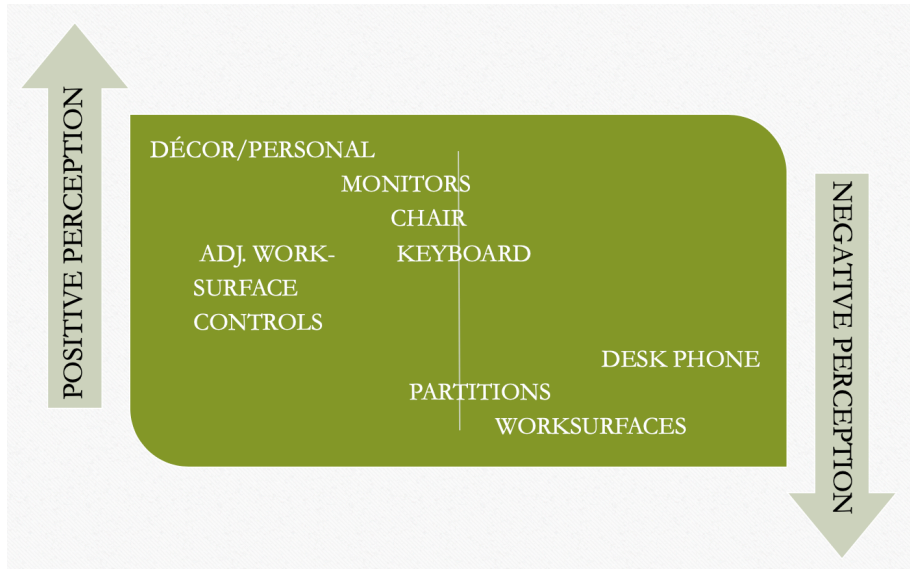


Figure 19. Location B: Concept Naming Data, Workstations

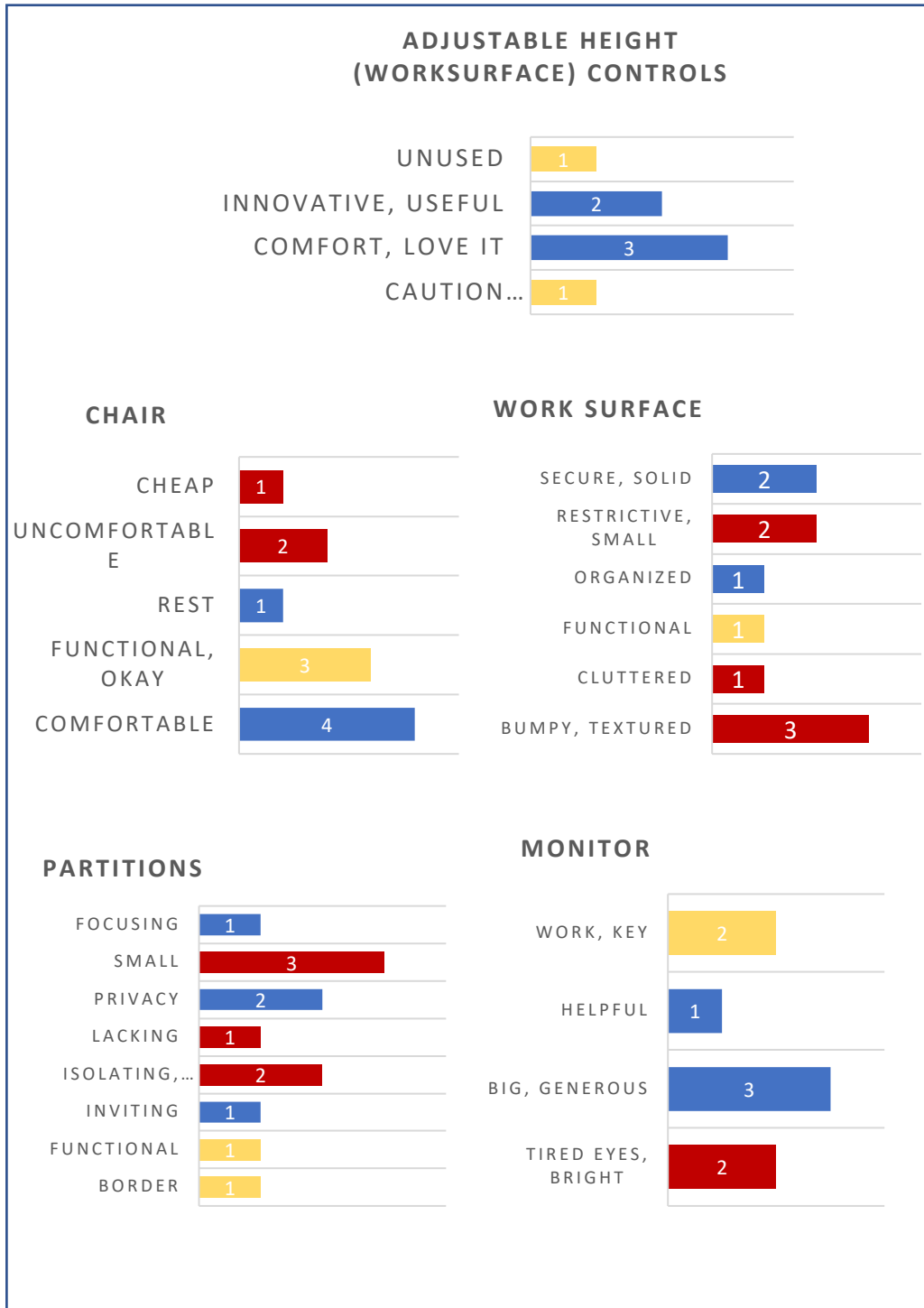
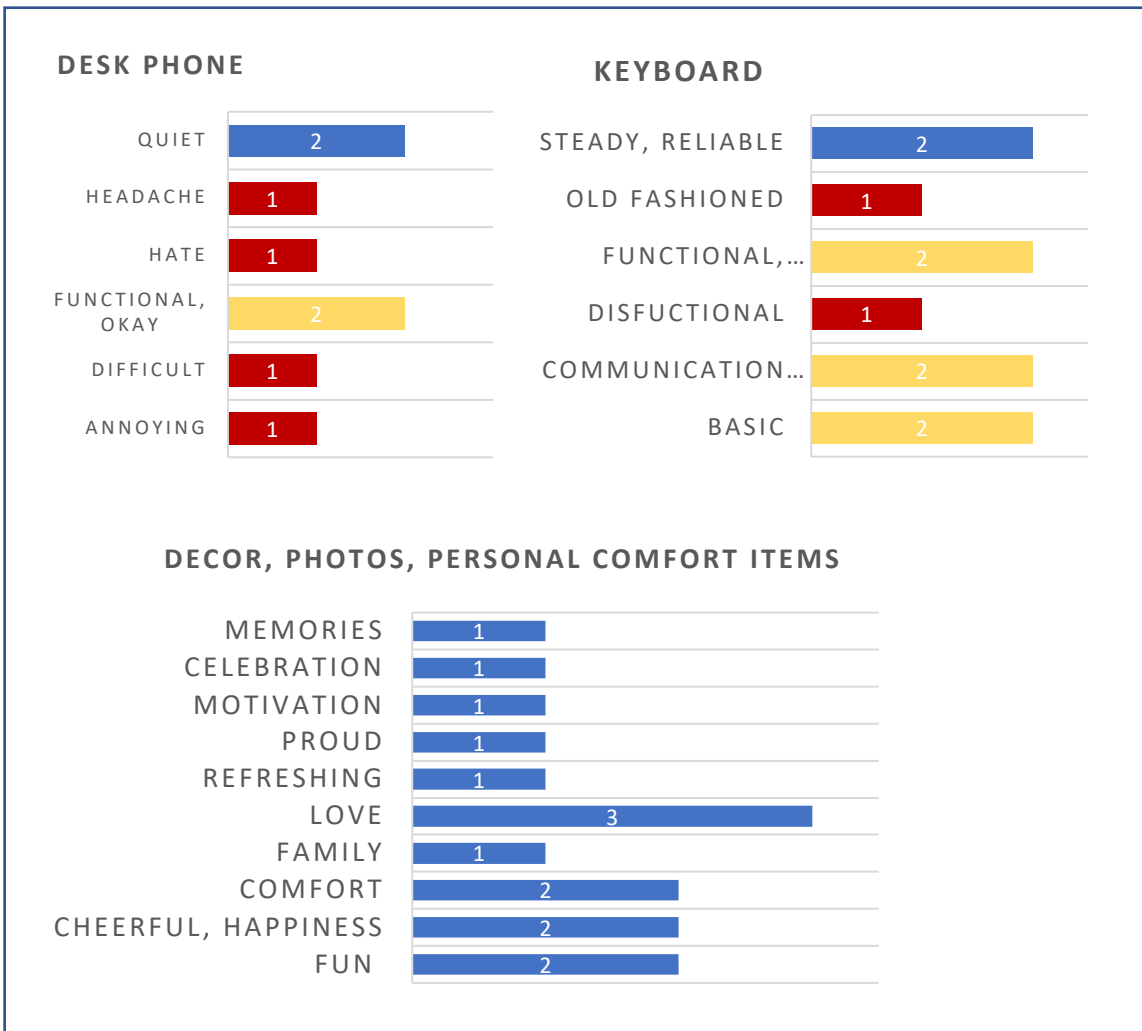


Figure 19. Workstation Concept Naming Data (Cont.)





In the concept naming exercise for the overall space for location B, the data is shown in Figures 20, and 21A-C.

Figure 20. Concept Naming Chart, Overall Layout

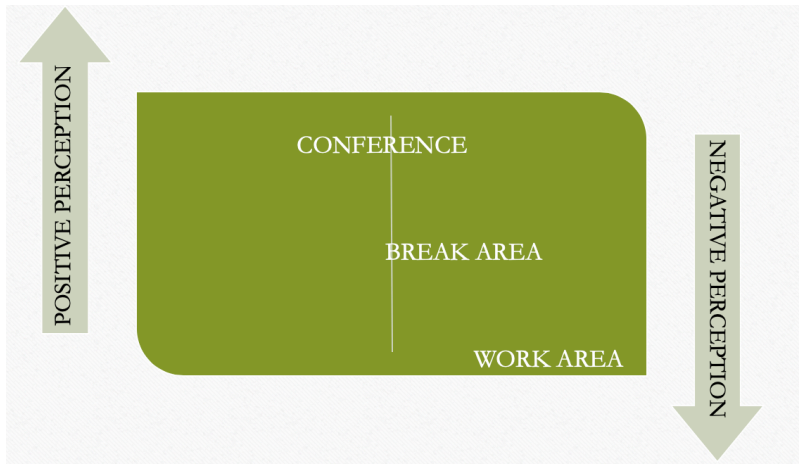


Figure 21A. Overall Work Area Responses

### OVERALL WORK AREA

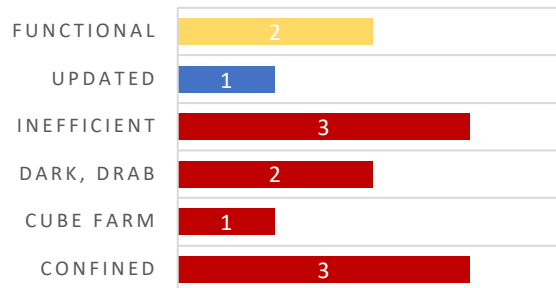


Figure 21B. Break Room Responses

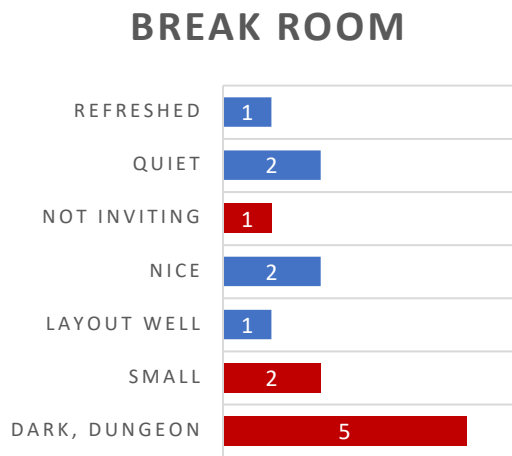
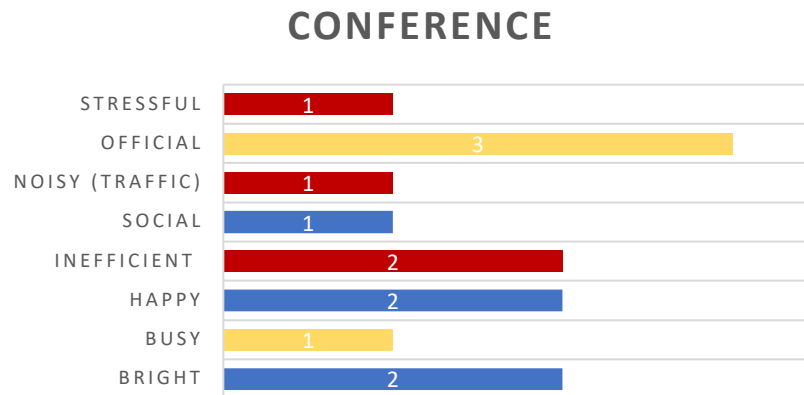


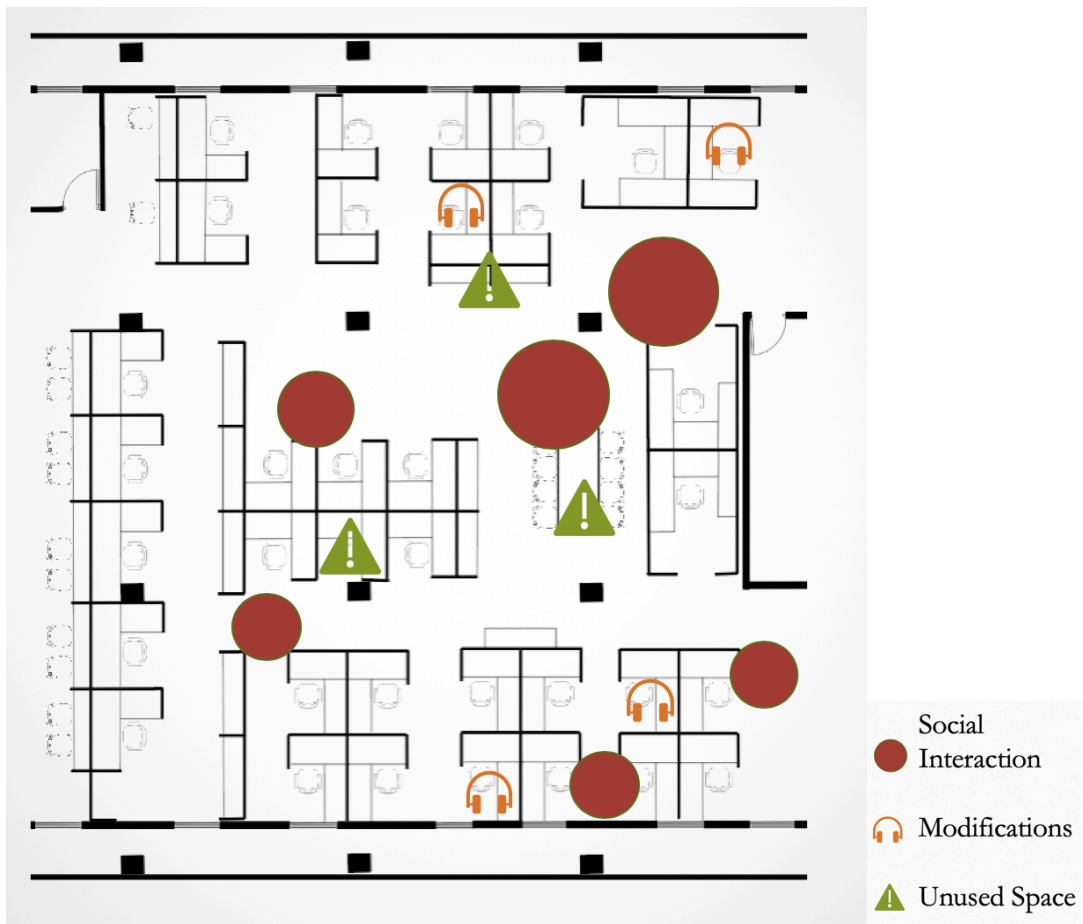
Figure 21C. Conference Room Responses



#### 4.3.4 Observations: Location B

The researcher observed the overall conditions on the lower level to be well lit, and clean and presented fairly organized. Since this location is a municipal service location, this open office area has some limited visibility to the public. The researcher excluded the customer interaction workstations as to not interfere with daily tasks serving the public. The observations were performed 4 times a day over 2 days and totaled 2 hours of observation time. In that time workplace behaviors were noted in casual observation field notes as well as some mapping of the floorplan (Figure 21a,b).

Figure 22A. Location B: Level 1 Observation Map





## CHAPTER 5

### DISCUSSIONS & CONCLUSIONS

#### **5.0.0 Introduction**

The following chapter reports the findings from the data analysis and integrates it with the posed research questions. The subsequent sections will discuss both locations separately, followed by challenges and opportunities for improvements recognized within the research. Also discussed are the design implications of the findings and future research goals prompted by this study.

#### **5.1.0 Research Question 1: Location A**

In this case study, some of the workplace behaviors that were positively impacted by the design of the office area were evident across the various research methods. The relatively high satisfaction level with acoustic privacy had a high correlation with the high satisfaction level with task completions that required high concentration, showing that the workplace behavior of task management was positively impacted in this environment.

Task management was also positively impacted by the overall layout satisfaction.

From the observations, the research surmised that headphones were worn by about 20% of the employees that worked in the open office areas. Other behaviors observed included social interactions at and outside of the cubicles, in hallways, and break areas.

Interestingly there was a beautiful new large kitchen area which did not appear to be used for eating in; most employees left to eat elsewhere after preparing food. It was more likely that employees would gather and eat at an informal conference table in their departmental area. The overall perceptions of the work environment were generally very

positive. The noise level and lack of acoustic privacy were the only variables that occurred as possible stressors, but only on a low-positive correlation.

### **5.1.1 Research Question 2: Location A**

The design element that most impacted wellbeing were layout and proximity to colleagues, supporting the observations and anecdotal information gathered from employees that this layout and design facilitates a sense of community and the newly designed space has had a positive impact on employees.

The elements in the design that seem to be stressors were desk phones (because they are complicated technologically or just bring trouble or additional tasks when they ring), the partition glass (due to having to clean often), and the size of the work surface was so large in some cases it became cluttered. The overall work area where the workstations reside seem to have the most positive impact on employee wellbeing, while the larger kitchen/breakroom seem to have to most negative perceptions.

### **5.1.2 Research Question 1: Location B**

In this case study the WB that were impacted by the BEF included privacy, noise, and indoor air quality/temperature. The benefits of BEF are the proximity to colleagues and the lighting and storage. The stressors fit the model of a lot of previous research with acoustic privacy and noise levels correlating highly with overall satisfaction with the workspace.

### **5.1.3 Research Question 2: Location B**

The concept naming data showed that the BEF that impact WW the most were the worksurfaces, the partitions, the chairs, and the desk phones. Worksurfaces were reported

to have a bumpy texture that made writing on them challenging. The partitions were remarked negatively as small and isolating, and chairs had a mix of comfort and discomfort words. The desk phones again here had a mixed bag of responses, but between technical challenges and call contents it gained a negative rating as stressors. Having the autonomy to decorate and personalize workstations seem to be rated the highest with all positive remarks describing their décor, photos and mementos of home, fun, and values. The overall space that was rated most poorly was the break rooms, for being dark and uninviting.

### **5.2.0 Research Challenges**

This research has some challenges that primarily revolved around time limitations, the research sites, and locations. Firstly, due to the nature of the study being that of researching workplace wellbeing, employers were often apprehensive to participate. Additionally, due to the time constraints it was challenging to find a location that met the research requirements and were willing to participate. When these sites that were used for this study were procured, the timing was such that the researcher did not have time to vet them before arriving on location. The demographics, location, and company culture and values seem to have a large impact on the responses from participants. With site A being a rural small town in northern Alabama, you have a culture of folks who are naturally positive and had only been in the new space about 6 months. Whereas the site B was a municipal government office which may also skew responses.



### **5.3.0 Opportunities for Improvement**

There were several opportunities for improvement when reflecting back on the research process. It would've been beneficial to spend more time at both sites which could have increased the sample size as well as build relationships and trust with the employees. In some cases, having to sign a consent form made potential participants apprehensive to participate. Since both research sites were not local to the researcher, the time available was limited. I think for this particular project one location with a larger population would have been more feasible. Additionally, having multiple sites was challenging within the time constraints.

The research methods could have also been improved. In the concept naming exercise, flooring, ceiling and lighting should have been included in the analysis to get a better overall picture of the space. More time in observations would have also been advisable for both sites, as it would've made it possible to gather more data. Location A was designed and built with expansion in mind, so foot traffic for observations needed to be studied over a longer period of time to get a more thorough map of behaviors.

### **5.4.0 Design Implications**

When comparing both research sites, it is evident that Location A with all brand-new furnishings and design yielded more satisfaction from the users than Location B.

Location B being having older furnishings yielded more negative results about satisfaction level in all the components. One conclusion could be that wellbeing is improved in when the open office layout is applied a Location A has accomplished.



Understanding how the interior environmental settings impacts users is paramount to healthy and happy employees. The results of this study can be used to better inform the design community on the implications our designs have on employee wellbeing in the workplace.

The use of the Concept Naming (Takamura, 2010) method as applied in the study could be a great advantage to researchers looking to understand employees perceptions of their work areas ad organizations and should be used on a larger scale in the future.

### **5.5.0 Future Research**

What is the next step in the evolution of the open office design? The complexity of office design needs to balance both organizational requirements and the diversity in employee personalities and daily tasks and their work needs. Hybrid activity-based layouts show in current research that employees can work in a space based on their task needs rather than a one-size-fits all plan would be best (Appel-Meulenbroek et al., 2011; Vischer, 2008).

As designers, architects, researchers, and industry partners work to design facilities that meet these diverse needs, more research should be done to show the benefits of designing for holistic wellbeing of both the organization and the employees. Future research should be done to develop an organizational work-type personality profile based on the work being done and the employee personalities and job types to provide a framework for designers to apply appropriate layouts that would be most effective for employees. Future research should be conducted with the concept naming method, but on a larger scale. The sample size with this study was small so a larger sample would provide a better perception of the users.

Additional key components to consider in future research is geographical location, and corporate culture of the research site. Having an understanding of the values, beliefs and culture of the geographical location and the impact it would have on survey and interview responses is important. Rather than developing the design plan for an organization's layout based on the organization's opinion of the perceived needs alone, researchers could develop a framework for choosing a layout and design based on scientific evidence of the work being performed and both corporate and cultural values. Perhaps it is best said in this final quote, "A single best physical or digital workspace architecture will never be found. That's because more interaction is not necessarily better, nor is less. The goal should be to get the right people interacting with the right richness at the right times" (Bernstein & Waber, 2019).

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APPENDIX A  
[SURVEY QUESTIONS]



- Q1 My workstation is functional for my daily tasks.
- Q2 I am satisfied with the location of my workstation.
- Q3 I am satisfied with the amount of storage space in my workstation.
- Q4 I am able to complete tasks that require high concentration in my workstation.
- Q5 I am satisfied with the lighting in my workstation
- Q6 I am satisfied with the noise level in my workstation.
- Q7 I am satisfied with the air quality and temperature in my workstation.
- Q8 I am satisfied with the level of visual privacy in my workstation.
- Q42 I am satisfied with the level of acoustic (sound) privacy in my workstation.
- Q9 I am satisfied with proximity of my workstation to exterior windows or views of the outdoors.
- Q10 I am satisfied with the appearance of the overall office area.
- Q11 I am satisfied with the overall layout of the office area.
- Q12 I am satisfied with the proximity to my colleagues or teammates.
- Q13 I feel comfortable with openness of the layout in our office area.
- Q14 I am satisfied with the overall finishes in the office area (i.e. walls, flooring)
- Q15 There is provision in the office area for more privacy when I need it.
- Q16 I am frequently interrupted while completing tasks in my workstation.
- Q17 I often feel the need to use headphones or music to help concentrate or filter out office noise.
- Q18 The design of the workplace contributes to a sense of community at work.
- Q19 I feel good physically when I walk into my workstation at the beginning of my day.
- Q44 Where is your favorite location in your workplace to feel productive? (i.e. your workstation, conference room, kitchen)
- Q20 I feel stiff or in pain when I get up from my desk.
- Q21 I am happier in the newly renovated workstations compared to my previous workstation.
- Q22 Overall wellbeing of employees is important to my organization.
- Q34 The design of the workplace allows me to interact informally with my coworkers.
- Q45 Overall, I am satisfied with my workplace.
- Q47 Base on your answer above, please briefly explain why that is your favorite place to be productive.
- Q23 I am satisfied with moving into the newly remodeled space.
- Q24 The newly renovated workstations improve wellbeing of employees.
- Q25 The newly renovated workstations improve functionality and efficiency.
- Q26 The newly renovated layout improves my overall wellbeing.
- Q35 My previous (before the renovation) workstation was functional and efficient.
- Q36 I was satisfied with the noise level and privacy in my previous workstation.
- Q37 I feel I was productive in my previous workstation.
- Q38 The layout of the previous work area made me feel comfortable.
- Q46 I was satisfied with my overall workplace before the renovations.

APPENDIX B

[IRB EXEMPTION]



EXEMPTION GRANTED

[Milagros Zingoni Phielipp](#)  
[HIDA: The Design School](#)  
 480/727-0267  
[MilagrosZingoni@asu.edu](mailto:MilagrosZingoni@asu.edu)

Dear [Milagros Zingoni Phielipp](#):

On 2/11/2020 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Designing for Wellbeing in the Workplace: How does the built environment influence behavior in the open office workplace?
Investigator:	<a href="#">Milagros Zingoni Phielipp</a>
IRB ID:	STUDY00010953
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> <li>• Combined Recruitment/Consent (Duplicate also in Consent Forms), Category: Recruitment Materials;</li> <li>• Consent/Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);</li> <li>• Interview Q's, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);</li> <li>• PI Exempt Wizard, Category: Other;</li> <li>• Protocol, Category: IRB Protocol;</li> <li>• Recruitment/Consent , Category: Consent Form;</li> <li>• Site permission/Tippin, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc);</li> <li>• Survey Consent, Category: Consent Form;</li> </ul>

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 on 2/11/2020.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Laura Frederick  
Laura Frederick