

NAVIGATING THE O.C.E.A.N.

AN ANALYSIS OF THE IMPACT OF PERSONALITY TRAITS ON THE PERCEPTION
OF AUDITORY AND VISUAL STIMULI IN THE WORKPLACE

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By

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ABSTRACT

The physical workplace influences how people work within their environment. Specifically, the design of an environment impacts stimuli that can be encountered in the workplace. With trends continuing towards open floor plan designs, justified by a push towards increased density and reduced real estate expenses per person, it is important to understand how the physical elements of the design impact human capital. This study, looking at varied levels of open plan design, focused on how stimuli is experienced by the knowledge workers in a workspace. Exploring the concepts of prospect and refuge within the workplace environment, the study looks at not only quantifying these metrics, but also how these elements impact the perception of auditory and visual stimuli that is experienced by individuals with varying personality characteristics.

BIOGRAPHICAL SKETCH

Emily Dunn, the author, holds a Bachelor of Science in Business Administration from the University of Arizona, Eller College of Management, awarded in 1999. With work experience in both the financial and resort/hospitality sectors, she went on to pursue her MBA. Emily was awarded a Master of Business Administration from Vanderbilt University Owen Graduate School of Management in 2005. She continued to her passion for understanding the value of human capital working in both the biotechnology and technology industries before enrolling in Cornell University in 2003. Her studies explored areas of study in both environmental psychology and real estate, with a goal of finding synergies between human capital and the built environment.

DEDICATION

I would like to dedicate this work to my family. My father and mother, who have supported every crazy career and life adventure I dared to pursue. To my brothers, who, with their own unique and amazing personalities, helped me understand the differences in people and how no one person is the same and that people should be treated as the unique and special people that they are.

To my classmates, you know who you are. Late nights in the grad lab, sharing ideas at the Big Red Barn. That is how great innovations and great friends are made. Thank you.

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Navigating the O.C.E.A.N.

An analysis of the impact of personality traits on the perception of auditory and visual stimuli in the workplace

Abstract:

The physical workplace is important, its not just an overhead expense, it influences how people work within their environment. Specifically, the design of an environment impacts stimuli that can be encountered in the workplace. With trends continuing towards open floor plan designs, justified by a push towards increased density and reduced real estate expenses per person, it is important to understand how the physical elements of the design impact human capital. This study, looking at varied levels of open plan design, focused on how stimuli is experienced by the knowledge workers in a workspace. Some of the findings can be explained using the concepts of prospect and refuge, attempting to quantify how an office design bounds a persons' field of vision, and how that impacts the perception of stimuli. Furthermore, personality characteristics are a growing area of interest and an important consideration in human capital management. Companies have already seen the value of understanding personality traits in their human capital investment and learning how individuals are motivated in different ways. Understanding how personality impacts that perception of the physical environment is another application of this same information. The final component of the study addresses the idea of task, something well understood in activity based work design, and a factor to further understand individual differences and

how the physical work environment can support or hinder the valuable human capital investment.

Research on workplace design has primarily looked at the impact of noise, or auditory stimuli in the environment and how that impacts employees' satisfaction levels, productivity and general performance on the job. There is also evidence demonstrating the benefits of an open floor plan design, primarily on the collaborative elements of work and team building within an organization. Throughout the research however, there appears to be a lack of understanding regarding the visual stimuli that a person experiences in an open floor plan design and how their field of vision impacts their perception of the environment. Personality traits also have a lot of research behind them, but few are applied to the physical work environment. That said, the study aimed to answer the following questions: Does auditory and visual stimuli impact a person's perception of the environment? Do personality traits have an impact on the perception of stimuli? And finally, does the perception change during focused based tasks?

In an attempt to answer these questions, three locations were used. All sites, part of a company called USTWO, a user interface design company, had varying levels of open floor plan designs. The population was comprised of approximately 70 individuals with a 65:35 male to female ratio. These were knowledge-based workers that had varying work responsibilities, requiring different proportions of creative thinking, conducting both collaboration and focused based tasks. Observations and measurements were taken at each of the three sites in London, UK; Malmo, Sweden and New York City, USA. These measurements, comprised of noise decibel readings

and coded observations of visual prospect and refuge, were then compared with survey responses from an adapted workplace survey. The individual perceptions gathered from the survey were supplemented by the 44-question Five Factor Model personality test to understand an individual's personality levels along a spectrum across five measured traits.

Results from this study indicated that satisfaction levels when related to stimuli were not statistically significant, likely due to the promotion of a fun and creative design studio environment. However, when looking at the perception of auditory and visual stimuli, certain personality characteristics provided statistically significant results with regards to perception of disruption. Specifically, as the percentage of noise above 60 dba increased, certain personality traits found the environmental stimuli more welcoming. For those in an environment with a reduced level of refuge, however, certain personality traits found both auditory and visual stimuli more disruptive as their refuge characteristics were reduced during a focused based task.

Introduction:

Floor plans for offices have evolved from open workspaces for administrative positions with private offices on the perimeter to hallways of offices and cubicle and now, in more recent years the open floor plan has made a resurgence. This time around, the open floor plans are being a bit more carefully considered. Looking at the impact of auditory stimuli and workplace "noise," designs have attempted to alleviate some of these potential disturbances with acoustically absorbing ceiling panels and

sound dampening materials in the space. Companies seeking real estate options to improve colleague collaboration and still support the need for focused time have looked at providing headphone allowances to give their employees individual control over the noise that might be heard in the environment.

While research is continuing to look at ways to minimize disruption in the workplace, companies continue to implement these open floor plans design without always having a clear understanding of the impact on their staff. The benefits of open floor plans and the physical connection with colleagues, has demonstrated its value in various research. Allowing for higher density, with a larger number of people per square foot (or meter), these floor plans have a lot of financial appeal to organizations as well. Noise and auditory stimuli can be addressed in several ways, but visual stimulus is a lot harder to regulate, especially on an individual level. While some research has looked at an individual's perception of complex versus more simple images (Zuber & Ekehammar, 1988), open floor plans create other levels of visual disruption that are difficult to quantify, making them harder to address and solve to address needs of staff. Understanding that individual perceive their environment differently can also be based on a variety of characteristics. Additionally, the task or responsibilities of the individual may vary as well, further impacting the potential disruption levels of their environment.

Researching these considerations with floor plan design revealed the potential role of field of vision, best defined by the prospect-refuge theory, which basically related a location preference with "the ability to see without being seen." (Appleton, 1975). This study aims to start the process of quantifying the prospect-refuge characteristics of

an office space and gain an understanding of the impact of that design on perception of stimuli in the workplace. Further understanding of individual difference and preferences, the survey used in this study incorporated the 44-question Five Factor Model (FFM) personality assessment which revealed that personality traits can impact a person's perception of their environment and that these are most evident during the time when a person is working on a focused based task.

Having a better understanding of perception of stimuli, looking at both the vantage point of the user as well as their personality type and task at hand can provide organizations and designers insights to provide better options for staff. Looking at design characteristics of prospect and refuge and providing appropriate levels of stimuli based on individual needs can result in a less disrupted employee and potentially lead to improved metrics in other areas of workplace success.

Literature Review

Existing research looks at several components of workplace design related to personality type, auditory and visual stimuli, and employee satisfaction, but few combine these concepts together. While there is research that looks at the influences of the built environment on job satisfaction, it is generally focused on the overall population and not as much on individual's unique perceptions, especially as related to personality differences.

Perceptions of workplace design

Research suggests that the concept of reduced privacy, as perceived by the individual, has an influence on job satisfaction (Duvall-Early & Benedict, 1992) Further research explores the differences in types of privacy, specifically auditory and visual privacy perceived by individual employee (Sundstrom, E., 1986). However, looking beyond the idea of privacy, how people react to noise and visual stimuli in the workplace has also been explored. The trends in open-plan designs with decreasing levels of privacy and increasing levels of stimuli have been areas of interest for researchers. Studies have demonstrated that "excessive or undesirable environmental stimulation leads to arousal, taxing information-processing capacity" (Lee & Brand, 2010). Additionally, increased density, while a cost benefit in terms of reduced real estate expenses, can also have an impact on employees as research has suggested that high occupant density may also increase cognitive workload (Lee & Brand, 2010).

While much of the research looks at the impact of workplace design over an entire population, research has looked at the individual differences in perceptions of the environment. Studies have also explored the impact of the environment, taking into account the differences in individual job types and the complexity of the tasks to be performed by individuals in the workplace (Sundstrom, et al., 1980). Taking into account job types and task complexity are important considerations, as they further support the concept of the Yerkes-Dodson law that defines the relationship between arousal and performance. Essentially, there is an inversed U-shaped curve that visually represents the relationship between optimal level of arousal and task performance (Cohen, 2011). Further defining this relationship and considering task complexity, studies support the concept that peak or optimal performance on complex tasks is reached at a lower level of arousal, while performance is optimized for simple tasks at a relatively higher level of arousal as compared to complex tasks. In other relationships, however, once the peak performance has been achieved, any increase in arousal levels shows a decrease in performance level (Teigen, 1994).

Beyond task-based performance, stimuli can have an impact on employees in other areas. The different components that measure the workplaces' impact on an employee, specifically knowledge based workers, as explored in this study, are best broken down into three categories: cognitive performance, which includes factors such as performance and efficiency; physiological impacts such as stress and overall employee health, and psychological factors such as satisfaction levels (Roper & Juneja 2008). While all three categories should be important considerations for employers and

designers of workplaces, the psychological impact that might result from an employees' exposure to a specific type of work environment is of particular interest. More specifically, looking at job satisfaction and an employees' perception of auditory and visual stimuli, as impacted by the architectural layout of the work environment remains unresolved.

Job Satisfaction

Research has proven the common understanding that job satisfaction results can have a number of different factors that influence an individuals' satisfaction with their job. Studies regarding gender differences have demonstrated that men and women working in a more balanced environment with regards to gender report higher levels of job satisfaction as compared to a more homogeneous (in terms of gender) population. (Fields & Blum, 1997) Other factors such as autonomy, performance metrics, and job security are also shown to have an impact on an individuals' satisfaction with their work (Vlosky & Aguilar, 2009). More importantly, as a component of overall job satisfaction, research has also explored the idea of environmental satisfaction. Previous studies have identified working conditions and the physical work environment as consistent components of overall job satisfaction. (Sundstrom, 1986, Sundstrom et al, 1994)

Stimuli in the work environment

Exploring the physical work environment further, research has shown that a combination of noise sources, as experienced by individuals in the workplace, has an

inverse relationship to both environmental and job satisfaction. Sources of noise, specifically people talking, were also reported to be “consistently correlated with environmental dissatisfaction.” (Sundstrom, et al 1994) Research on distractions in the workplace have also demonstrated that auditory distractions, out of all distractions in the workplace, has been reported to be one of the biggest concerns for employees in knowledge based roles. (Roper & Juneja, 2008) Specific laboratory studies looking at auditory stimuli suggest that as our brain scans acoustic input within the environment, it is processing the information to determine if there is anything relevant. This also suggests that this processing of what many define as background noise, may “involuntarily draw our attention away from (a current task)” (Schroger, Giard & Wolff, 2000). Research also suggests that the negative impacts of noise in the workplace are dependent on the task (Nurminen & Kurppa, 1989) a component that this research aimed to address as well.

Research on visual stimuli in the workplace is not as expansive as the studies done on the impact of noise in the work environment. Some studies have explored the idea of visual privacy as defined by architectural components within the workplace. For example, the presence of a door in the workplace was perceived to provide the most amount of visual privacy (Altman, 1975; Duvall-Early & Benedict, 1992), suggesting that open floorplans, with minimal doors within the interior, would reduce the amount of visual privacy perceived by the occupants. While the perception of privacy was not a primary focus of this study, the research that supports the relationship between privacy

and overall job satisfaction (Sundstrom et al, 1980) was an important consideration in the initial research.

Additional research exploring the concept of visual stimuli has looked at visual characteristics associated with arousal levels. Defining visual characteristics that appear to affect arousal based on their “complexity, novelty and color” (Zuber & Ekehammar, 1988), the research supports arousal studies that demonstrate that colors such as red and yellow, with long wavelengths were found to be more arousing than colors with short wavelength such as blue and green (Zuber & Ekehammar, 1988). Occupational surveys used in research have suggested that visual disturbances, as defined by an occupant’s ability to avoid visual disturbances in the workplace, are an important consideration in workplace design. Their research demonstrated that occupants exposed to inadequate designs with regards to both acoustic and visual characteristics do not acclimate over time. Therefore, these occupants that continue to be exposed to the same levels of auditory and visual stimuli, perceive them at the same levels (disruptive or not) every day they work in this environment (Schwede, Davies & Purdey, 2008) As this research was focused on environmental perceptions over time, it did not include a comparison between actual stimuli and perceived exposure by individuals in the workplace. Rather, this research demonstrates the importance of further understanding the impact of auditory and visual stimuli on workplace occupants. Visual and auditory stimuli are generally experienced in tandem with each other. In fact, much of the physical environment is experienced using the five senses of vision, sound, touch, smell and taste, many times using several senses simultaneously (Hong & Jeon,

2014). Research further supports that “cross-modal interactions between vision and audio were viewed as the major modalities” (Hong & Jeon, 2014; Spence & Driver, 2004).

Research looking at the combination of both auditory and visual stimuli confirms that the visual stimuli that a person experiences has a significant influence on the perception of sounds within the environment. While primarily focused on landscape and urban environments, research found that visual conditions modify the auditory perception of a participant (Carlos, Barrio & Lucio, 1999). In a workplace environment, it might then be assumed that the ability to visualize the source of auditory stimuli has an impact on a person’s perception of the environmental stimuli.

Prospect & Refuge

Exploring the idea further, understanding a person’s field of vision, what they can see, and their exposure, what can see them, may also influence how environmental stimuli is perceived. Appleton (1975) first explored these concepts and identified them as “prospect,” which essentially defined the human’s preference for vistas, or an open space that allows a person to see what’s coming towards them and “refuge,” being a place to hide or be protected, summing up ideal habitats as ones that provide “the ability to see without being seen.” While these concepts were initially explored for the benefit of landscape architecture, further research has looking into the application of these concepts for the architecture in buildings. Frank Lloyd Wright’s home in Bear Run, Pennsylvania is described as incorporating the concepts of prospect and refuge both

with the structural design of the house, as well as the location with respect to the surrounding landscape (Hildebrand, 1982).

Research has also examined the preference for a space that is a result of a particular combination of prospect and refuge. A study using photographs of natural scenes as prospect with man-made refuge suggests that in terms of safety, a view of an open natural scene (higher prospect) was perceived as safer than a closed view (Naser et al, 1983). The interesting part of Naser's study, however had to do with the difference in preference of vantage point between males and females. Males had a higher preference for an open view from a open vantage point (lower refuge), while females had a preference for a more protected view (higher refuge level). This difference further suggests that prospect and refuge do have a combined effect on setting preference and that individual difference, such as gender can significantly impact these preferences.

Personality

Stimuli and perception have a unique relationship. Individual differences and experiences can have an impact on how people perceive their environment. While taking into account the many different variables that could impact a person's perception would be ideal, this study is primarily focused on individual differences based on personality components. Recent media attention has drawn focus on the difference between introverts and extroverts. Beyond news articles and other social media account, Susan Cain (2013) researched the difference between introverts and extroverts. In her literary research, Cain suggests that introverts are more sensitive to

stimuli than extroverts and that “introverts and extroverts often need very different levels of stimulation to function at their best” (Cain, 2013). Her work is supported by research demonstrating that when selecting optimal decibel levels for the similar types of auditory stimuli, extroverts, on average selected a level of 72 dba, while introverts, on average, selected an optimal level at 55 dba. The research further demonstrated that when exposed to higher dba levels than the optimal dba level, introverts were over-aroused and underperformed on a given task. Extroverts, conversely, when exposed to lower sound levels than the optimal decibel level, were under-aroused and possibly disengaged (Cain, 2013, Geen, 1984).

Exploring different measurements of personality, there are many options available both within the research community as well as less reliable methods available in social media. With the options of personality tests such as the Myers-Briggs Type Indicator (MBTI) being commonly used by educators, as well as by companies looking to put together strong team dynamics, there is additional research looking at the most valid forms of personality measurement. The MBTI is based primarily on the research of C.G. Jung, and there are correlations between the 8 measures of the MBTI and the five factors of The Five-Factor Model (Costa Jr. & McCrae, 1992). The Five-Factor Model (FFM) popularly known by its acronym OCEAN, represents the “five major trait dimensions” (Openness to experience, Conscientiousness, Extraversion, Agreeableness, Neuroticism) used to describe the core personality differences” (Fruyt & Van Leeuwen, 2014). The research conducted on the FFM has shown that it is “useful from childhood to old age, retrievable from both self- and observer reports, and...(is)

valid across cultures” (Fruyt & Van Leeuwen, 2014). While the MBTI is a very common form of measurement for personality assessment, using the FFM as a form of personality assessment was considered the most relevant for this research, as the study crosses through three different countries, a variety of ages of employees and contains a multi-cultural population within all three, research sites.

Workplace design as its own concept remains a consistent area of interest for research as it is impactful for so many people across different cultures and countries. The balance between providing an environment to support open communication and collaboration with the disruption caused by background noise is generally in constant fluctuation. (Banbury & Berry, 2005)

Purpose

As research has suggested, individual differences, specifically those related to a person's personality traits, can have an impact on how people perceive the world around them. The workplace is an environment that many are exposed for a large percentage of time during their working years. The importance of having supportive environment should be an important consideration for both employers and employees alike.

Stimuli, specifically auditory and visual based may be experienced differently by knowledge based workers in their workplace environment. The goals of this study are to determine if and how and stimuli impacts a person's satisfaction with their physical work environment. Furthermore, the aim is to better understand if and how personality traits and a particular work function can further impact that relationship a person has with their work environment and the stimuli that is experienced within. It is therefore hypothesized that:

Hypothesis 1:

Auditory and visual stimuli impacts environmental satisfaction within the workplace.

Hypothesis 2:

Personality traits impact a person's perception of auditory and visual stimuli in the workplace.

Hypothesis 3.1:

Task type (focus based) impacts a person's perception of auditory and visual stimuli in the workplace.

Hypothesis 3.2

Personality traits moderate impact of task type (focus based) on perception of auditory and visual stimuli in the workplace.

Methodology

Comparing perceptions of environmental stimuli requires that observational data be compared to survey data on individual perceptions. Existing studies have had concerns about interfering with workplace tasks, but recognize the importance of systematically measuring the objective (or observed) and subjective (or survey based) environmental characteristics (MacDonald et al, 2001; Lee & Brand, 2010). As such, several components of both auditory and visual stimuli were measured. This data, specific to individual seats in a workplace, was then compared with the seat occupants' perception of their environment, as measured by several metrics, and their personality traits as measured by the Five Factors Model 44 question survey.

In an attempt to control for other variables that would impact workplace satisfaction, the intention was to find one company with several locations. The common factor of company leadership attempted to address some issues with workplace policies, while different site locations (studios) and population densities created different environmental stimuli for knowledge workers in those studios. While office based leadership and cultural differences across sites can certainly have an impact on workplace perceptions, the consistent metrics associated with auditory and visual stimuli observations, consistent survey questions regarding perceptions and the use of a standardized, valid and reliable personality test provides a baseline level of measurements to support the findings in this study.

Site Selection

The company chosen for this research is a global organization that creates digital user interface design (ustwo.com). With total of 219 people globally at the time the research was conducted, the organization had three primary offices, which they called “studios” located in New York City, New York, Malmo, Sweden and London, UK. There was also a small, fourth site located in Sydney, Australia that was not included as part of this research as the location was established just prior to the start of the study and would likely not be able to provide significant data relevant to the research. Each of the primary three sites was in the middle of some level of redesign for their physical environment and as such, the company leadership was interested in gaining a better understanding of the current workplace environment and the needs of their current and future employees. As part of the relationship, additional data analysis that is not the primary focus of this research was made available to the leadership of the ustwo organization for insights into developing a better workplace for their staff.

Each site has similar work product and policies in place that influence the use of different parts of the space. This aspect of the type of work being performed and the consistent initiatives across the three sites provided a control variable when comparing other aspects of interaction and the physical environment. The company as a whole has a very relaxed atmosphere. With a relatively young workforce, there is a casual dress code and employees are encouraged to utilize different spaces throughout the studio as they deem appropriate to collaborate with colleagues and clients. Creativity is encouraged and different elements are included in the space to foster the idea of play.

Quite literally, two of the three offices have foosball machines and the New York City office prides itself on providing a social space for which the primary purpose was to support a competitive game of MarioKart.

The leadership has also aimed to foster creativity and collaboration by providing an open floorplan design throughout their offices. Seating organized by teams in this manner also creates a level of healthy competition between groups that involves personalization of the group space. As research suggests, open floorplans do foster connections that may be hindered by more traditional office and cubicle layouts. The open floorplan does however create the potential for a greater amount of auditory and



Figure 1 Malmo Group Space

visual stimuli within the work environment which made these sites particularly interesting for the focus of this research. With consistency in work, policy and overall design concept, each site varied with specific components of the physical environment and more importantly the individual differences of the employees working in each location at the time the research was conducted.

Malmö, Sweden

The ustwo studio in Malmö had a total of 68 people and the studio size was 800 square meters or approximately 8,611 square feet. The density in this space was simply calculated out to be 126 square feet per person. The Malmö studio, during the time of the research, was located in a townhouse in the center of Malmö. The building itself is mixed-use, so ustwo shared the building with both residents and other corporate tenants. While they had been in their existing space for 3 years, they actually moved from another floor in the same building prior to occupying their studio space at the time the research was conducted. As shown in the floor plan, the space itself was broken up into a number of smaller rooms connected by a hallway that essentially, though not completely circled the entire space. The interior of the building looked out to an enclosed courtyard allowing natural light to enter from both the interior and exterior facing windows of the building. With all its charm, this workspace provided unique physical features that both support and hinder the desired interaction between colleagues and also created different sources of visual and auditory stimuli throughout the space.

The floorplan (appendix A) showed some physical separation between teams. Those teams or “studio groups” were given the liberty to choose how they arranged their desks within their space, creativity was only limited by access to plugs and ports within the space. As designated on the floorplan, the conference rooms were clustered together and located at the ends of the hallways within the space. The social areas and kitchen were slightly more centrally located, however still clustered together in one area

of the workplace. One unique component of the space, specific to the country of Sweden is the inclusion of a napping room, or quiet room within the space. The napping room within the Malmo studio, labeling the Chesterfield room, was located at the end of a circulation path and designed with dark colors, heavy drapes and a solid door to minimize stimuli that would disrupt the rest period that may be needed by two employees.

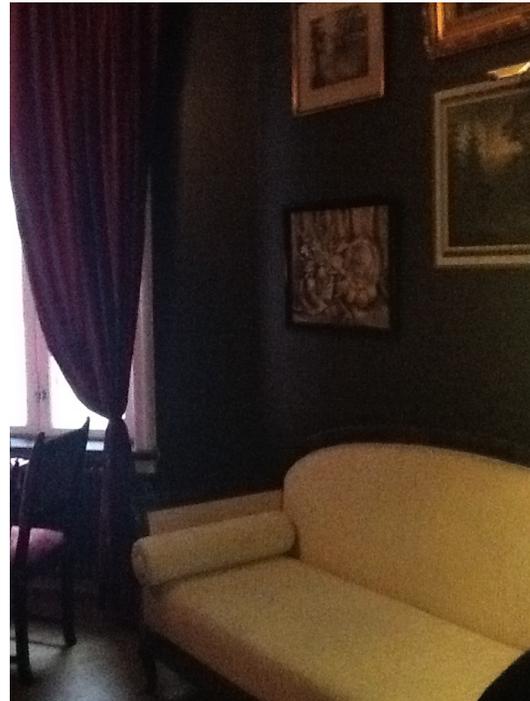


Figure 2 Malmo "Quiet" Room

New York City

The New York City studio employed a total of 40 at the time the research was conducting at this site. For workspace for the NYC studio, the company has leased 18,476 square feet on the 16th floor of a downtown Manhattan building on Broadway. The square footage as part of the lease also included elements of the building core, such as the elevator shaft, storage rooms and duct work. As such, the a more proper estimate of the square footage of the usable workspace would include a 15-20% loss factor, bringing the workplace square footage total closer to 15,000 square feet. This would provide an overall density factor of 375 square feet per person. The floorplan (appendix B) demonstrated the relatively open design of the workspace. Clusters of desks provided opportunities for studio groups to communicate efficiently with one and

other throughout the day. Conference rooms and information meeting areas were also dispersed throughout the space for use by the various teams. The conference rooms themselves had glass walls to the space that created a visual connection, but worked to limit the sound or noise that might come from meetings in the meeting spaces.

One of the more unique features of the space was the separation of the social and kitchen area from the rest of the workspace. With no adjacent walls and only

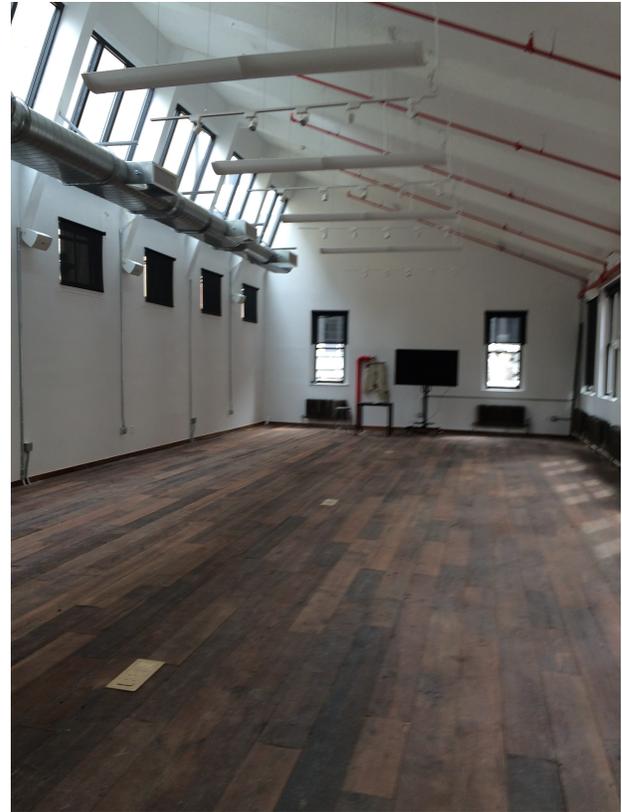


Figure 3 New York City Open Meeting Space

connected via a hallway, the sounds from the kitchen area had a minimized impact on the workspace relative to other studio workspaces where there were usually adjacent walls, if any structural barriers at all. The space adjacent to the kitchen area was also still under construction at the time of the research and lacked furniture, rendering it unusable for daily work, but carrying lots of potential for the employees within the space as an open meeting space or something more.

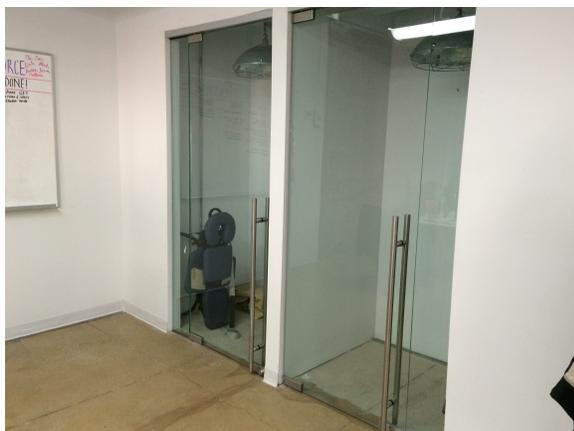


Figure 4 New York City Phone Booths (under construction)

Also under construction were the phone booths within the space that were intended to provide a more activity-based design element and create a private space

for people to take calls. At the time of the research there were limited furnishings in the phone booths and the doors lacked seals to create a noise barrier between the occupant within the phone booth and the rest of the workspace.

London

The London site was the largest of the three sites that were surveyed for this research, with a staff of just over 100 employees, the London studio occupied three floors in a warehouse style building on Shoreditch High Street in the eastern part of London, UK. Ustwo occupied the ground, first and third floors of the building, totaling



1,334 square meters, or 17,452 square feet. This created a density of approximately 175 square feet

Figure 5 London Ground Floor Kitchen and Social Area

per person across the three floors of the space. The ground floor which also held the largest kitchen area and social area for all studio meetings was 286 square meters or 3,085 square feet (appendix C). The first floor (appendix D), occupied primarily by studio groups and several conference rooms and information meeting areas was 500 square meters or 5,381 square feet. The third floor (appendix E) which contained another, smaller scale kitchen, and the studio responsible for gaming applications among other user interface design teams was 548 square meters or 5901 square feet.

The second floor of the building was the home to a company called DICE which was a ticketing application startup that was co-founded by ustwo. They occupied 167 square meters on the second floor or 1,789 square feet of space, however they were not part of this research as they did not work under the same production methods and company policies that regulated the employees of ustwo.

The design of the ustwo London site was the most open of the floorplans between the three ustwo studios. With no physical separation between the kitchens and work areas on the ground and third floors, the variety of both visual and auditory stimuli that was created by the social interactions and food prep activities in the kitchen were a significant aspect of the workplace environment on those floors. There was also an internal staircase between the ground and first floors just off the kitchen area on the ground floor that also provided additional noise to travel between the two floors. The third floor occupants had no internal connection with the ground and first floors and could only be accessed by utilizing a staircase shared with the rest of the building or the elevators shared by the building tenants.

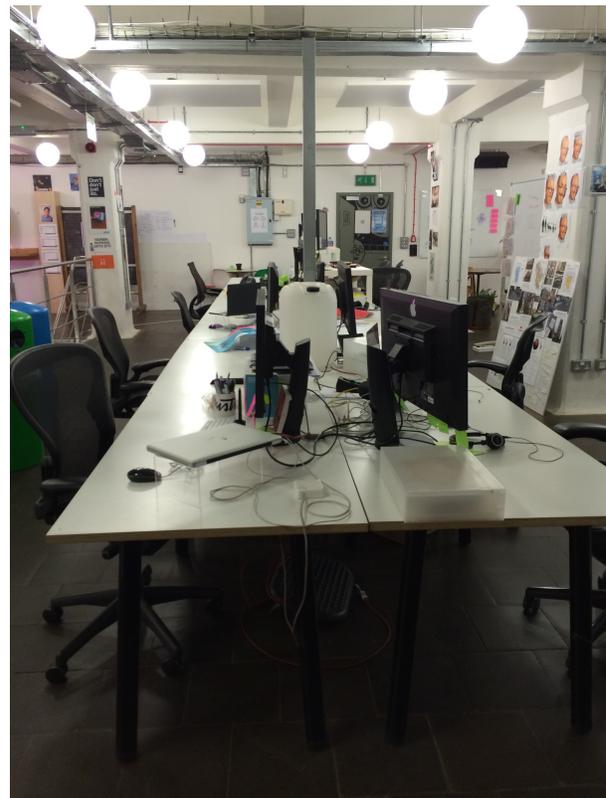


Figure 6 London Project Team Workspace

Tools

Several different tools were used in an effort to compare perceptions of components of the physical environment. While quantitative measures were the primary tools used in this research, some qualitative tools were used in an attempt to support and explain results from the study.

Participant Survey

Perceptions of the environment were gathered from participants using an online workplace survey hosted by Qualtrics software through the server at Cornell University. The survey (appendix F), had several different sections that focused on various aspects of the workplace. The primary questions were focused on participant satisfaction on the overall environment. This was described as the “current physical work/studio environment...including workstations, conference rooms, common areas, etc.” The terms “studio” was used throughout the survey, as that term was the more familiar term that participants used to describe their office workplace.

In an effort to better understand how specific people were impacted by their environment, the survey also included several questions about specific workstation and seat perceptions. Satisfaction level with a person’s seat was included as a question and also supplemented by questions about where a person spends their time throughout the workday, providing a list of available spaces throughout the studio workspace, using terms such as “soft areas” that were familiar to survey participants.

Perceptions on auditory and visual distractions in the workplace were a major component of this study and were carefully addressed in several questions within the

survey. In an effort to avoid leading questions, the questions on perceptions of noise and visual movement in the workplace provided a seven point rating scale from “Very welcome (enhancing)” to “Very disruptive,” with a midpoint value of “Neither disruptive nor welcome (generally goes unnoticed).” This same scale was used to understand these same perceptions during certain work tasks that the participant may be involved in. The tasks were listed by activity, this attempted to encompass a few focus work options that would not require interaction with others and the remaining options were different types of formal and information interaction that a person may have with their colleagues and clients.

Other components of the survey dealing with the use and perception of the physical environment, explored how and when the participant used different components of the physical environment. The survey also explored the participants’ use of headphones. This was used to provide further support to the perception of auditory stimuli in the workplace, termed “noise” throughout the survey. The headphone use related to frequency of use as well as purpose, exploring the idea of using headphones to block out existing noise, listen to their own choice of music or simply as a non-verbal signal to others that they would like not to be disturbed.

Other questions that dealt with noise were specific to the company itself. Two of the three locations (New York City and London) had incorporated a sound system called Sonos (www.sonos.com) The third location (Malmo) that did not use Sonos had been beta testing their own sound system for that studio, affectionately called “Party Pooper.” Both sound systems were controlled via an internal online interface that allowed

individuals to suggest a playlist and reject existing options that may be part of it, either prior to a song being played or during the broadcast of the song. As this sound system is a large part of the auditory stimuli in the environment, questions were asked about satisfaction with the system itself as well as satisfaction with control over music selection and volume control.

Demographics information was collected which included questions regarding age, gender and nationality as well as company specific questions about tenure and the ranking of priorities for employee attraction and retention. Gensler's Workplace Index (WPI) survey was used for reference for some of the questions within the survey. (Gensler WPI 2013). While some of the survey components were not directly relevant to the focus of the study, they did provide valuable information to the participant company.

The final component of the survey was the personality assessment. Through research on a variety of different personality surveys, it was determined that the use of the Five Factors Model (FFM) (John, O.P. et al, 1991 & John, O.P., 2008) was the more reliable form of measurement for this research. This model has been used extensively in existing research and provided five "factors" of the personality that can be assessed through a self-report survey method. Time to finish was an important consideration for participation levels of the survey. While a five question version of the FFM exists, the 44 question survey (John, O.P. et al, 1991 & John, O.P., 2008) was determined to be the most appropriate method of determining these personality components with time to complete considerations and the research focus on the personality components. The

44 questions were set up as a rating scale (in lieu of having the participant write in the score) and was broken up over two pages of the survey to minimize survey fatigue. In an effort to gain the most honest answers in the satisfaction and workplace section of the survey and not have respondents over think the questions too much, the personality assessment questions were incorporated within the last section.

The order of the components of the survey in general was an important consideration in the overall design. The questions regarding the workplace started with how much time the individual actually spending in the ustwo office and worked from general environmental perceptions and addresses more specific aspects of the environment as the survey progressed. After asking about the overall space, the survey also requested information regarding where an participant spends their time in the space. While the sites chosen for this research all have an open floor plan environment, it was still determined that having a user define their space was important. Components of the space such as storage and other resources were also part of the survey. The identifying information was also included at the end and was required to compare assessment and personality information with actual physical environment characteristics. Several questions were also added to the survey upon request of the participating client and were included in logical locations throughout the survey. Aspects such as desk and office terminology were also edited to achieve better understanding from the survey participants.

The entire survey was a total of 44 questions. There were a variety of both quantitative and qualitative open-ended questions about the respondent's perceptions of

their work environment. Survey respondents were not required to complete the survey all at once, the system setting that was chosen allowed them to return to the survey within 7 days to complete the entire set of questions. While many participants chose to not complete the entire survey at once, the average time to complete was estimated to be 15 minutes.

Client Interview

At the start of the research process, an initial meeting took place with three leaders within the organization. Upon explaining the purpose of the research and benefit to their workplace, an initial draft of the participant survey was provided. As referenced earlier, the Gensler WPI survey was intended to be a component of the overall survey design with additional components added for specific stimuli perceptions and personality traits. Use of the Gensler WPI survey would have provided reliability to the survey as it has been a tested tool for a number of Gensler clients over several years. However, even with participation and the use of the Gensler WPI survey as a reference, it was provided as a proprietary survey tool and therefore could not be used as anything other than reference material for the creation of the final participant survey used in this study.

Initial assessments from the leadership within the participant company indicated that the survey was too long, therefore some of the questions regarding less relevant perceptions of the workspace were discarded. Terminology was also updated to reflect the terms used by the company and their employees as they references different aspects of their physical environment. The leadership team was also interested in the use of entertainment elements of the space such as the foosball table and MarioKart

games that were located in different company sites. This was therefore included as a last question on the survey. The placement of the question was intended to provide a less analytical feel to the survey and leave the participant in a more lighthearted state of mind.

Focus Groups

Providing more context to the survey results and analysis, focus groups were also conducted at each of the three site locations. Participation in these focus groups was voluntary and open to any employee of the company within that space. Focus groups were scheduled to be one hour in duration, and while it was expected that participants stay for the entire time, priorities at work did impact the participants' ability to stay the whole hour. Some participants came in late and some left early, however given that all participants knew each other, it was relatively simple to catch people up in the conversation as needed.

Focus group discussions were designed to help the participants start by gaining some level of understanding of the purpose of the research. Primarily, however, the conversations were guided around the actual use of the workspace, rules and policies, both formal and informal that regulate use of the space and other aspects of the perception of the workspace that were not specifically addressed in the online survey.

Observational Method

In an effort to compare a person's individual characteristics and perceptions of the environment, measurements were also taken to record the auditory and visual stimuli within the work environment. With floor plans for the three sites and a walk

through of the physical workspace, components of the workplace were broken down into locations and given a specific location number in order of the most efficient route to be used by the researcher. Each conference room was given a location number as well areas of informal collaboration, identified as “social areas.” These would include spaces such as kitchens, couches or “soft areas” as they were referred to by the studio occupants and other “non-reservable, clusters of furniture that appeared to be used by the occupants of the space either for individual work or a meeting or gathering with others.

As most of the workplaces could be considered open floor plan spaces, workspaces within the environment were separated out based on both teams and attributes of the physical environment. Across all three sites within the company, ustwo generally assigns seating based on project group. Therefore, desks may be set up in groups of three to up to 12 people, each referred to as a “studio group.” Each group of desks was given a location number and the seats themselves were also given a seat number within that location. At the Malmo site, the built environment is a residential building that was converted to a mixed-use building. Given the initial purpose and design for the space, the floor that the company occupies is set up as a series of rooms with a long hallway and a number of doors connecting the rooms. For this space, each room holds a studio group and was therefore a logical separator for each location identifier. The number of location identifiers varied between the sites due to both variations in the physical environment as well as the number of people and teams within each space.

While the same researcher was used for all observational measurements across sites, an observation tool was created to provide consistency across measurement of different times and spaces within the environment. This tool (appendix G) contained questions relevant to data analysis such as site location, location ID, the space type, listed as: conference room, studio group, and social area. For efficiency in data collection, a question was asked to determine if there is anyone in the room. If the answer was no, then the question format jumped directly to asking for a sound reading, skipping questions about individual seats and allowing the research to move onto the next space. If there were people in the space, the tool was set up to efficiently measure individual activity in the space as a matrix table. As each seat had a unique identifier, the researcher would simply need to select if that person was present or “In seat” and if they were using headphones listed as: No headphones, Over-ear headphones and Earbuds.

Each occupied seat was also observed to see what type of activity was taking place during the time of measurement. As specific work responsibilities could not be obtained without disruption, the observations were categorized into four different elements. Focus Work was assigned to any individual that was focused on computer work, reading or any other activity that was taking their full attention. This meant anyone that was not participating in conversations with another person. The remaining three options were collaboration activities. Informal collaboration was any conversation between two or more people on the team that could be heard by observers, the topic was not identified and therefore could be both work-related or simply social

conversation. On the phone was a fairly easy to define and assess. The final category was not identified until initial observations of the space were conducted. As the company's business has a graphic design component, there is an extensive amount of visual work that is conducted. As such, there were a number of instances when two or more people would be looking at a single computer screen on the desk, this also included conversation regarding the image, however the conversation was contained in a smaller location and was therefore considered to be a different type of activity that would have a different impact on the stimuli within the space. It was initially thought that both the activities of the individual staff member and the activities of the team members within their location could be part of the analysis of the stimuli within the space.

In an effort to understand overall utilization of the space for the company, observational measurements were also taken regarding the use of the conference rooms and social areas. These questions included identifying from a variety of activities, what the space was being used for and how many people were using the space at that time.

Finally, the decibel level was measured as a peak level during the assessment of the space, generally a peak level within at most a ten second window of time. The observational tool also included a question targeted at types of auditory stimuli. Specifically, if music was playing at the time of the assessment, and any additional notes were added if there was some sort of unexpected event that would impact the decibel reading. The time to complete the survey was generally between one and two

minutes depending on the number of people present within the space at the time of measurement.

Sound Level Measurements

The level of sound within the space was measured using a Bruel & Kjaer Type 2250-L Sound meter. With setting for the maximum dBa level reset for each location measured. The meter itself was calibrated each day to ensure that travel between sites and measurements each day did not impact the accuracy of the meter.

Another tool was used to measure the exposure of decibel levels over the course of the day. Software from Faber Acoustical, LLC was used on both an Apple iphone 5S as well as an ipad. Based on research in this software (Nast, et al, 2014), this software was deemed the most accurate of measurement software available for iphone and ipad hardware to date. The ipad and iphone were used periodically throughout the observational periods at all three worksites.

Data Collection

In an effort to match environment observations with environmental perceptions as obtained by an online survey, the online survey was launched the first day of the observations at the Malmo site, which was the first site location for the research. As email introduction, created by the researcher was shared with the Malmo population via an internal colleague who also provided a supportive email encouraging voluntary participation in the online survey.

The visit to the Malmo studio started on Monday, February 16, 2015 and data was collected for three days through the end of the day on Wednesday, February 18, 2015. Using core hours of 9:00 am to 5:00 pm, measurements were taken throughout this time frame including during the lunch hour (approximately 12:30pm – 1:30pm) and sometimes extended beyond 5:00pm if a large percentage of employees were still working within the space.

The survey was launched to the London studio employees on the morning of Thursday, February 17th, 2015 and corresponded with the start of observations within the workspace. The survey was also sent out via an internal email encouraging voluntary participation in the online survey. Observations were again taken from approximately 9:00 am to 5:00 pm and many times went until 6:00 pm due to a high percentage of the population remaining in the workspace. Observations in London, due to both a higher population and time constraints for the travel to both Malmo and London, continued for four work days through the end of the day on Tuesday, February 24, 2015.

The New York Studio was in the process of moving to a new location during the same time period that research was being conducted in London and Malmo. In an effort to minimize the Hawthorne effect and report less than accurate satisfaction results, the survey and observational measurements were not started until March 30th, 2015. While this delay only gave the occupants a little more than one month in their new space, time constraints did not allow for any later measurements to take place. Survey and observation measurements were taken at the same time and again using the core hours of 9:00 am to 5:00 pm as reference points for observational analysis. The observations in the New York City Studio lasted for three days and the survey was again launched via an internal email encouraging voluntary participation. Given the researchers' relationship with the NYC studio leadership, there was also an opportunity to present the fundamentals behind the research to the entire studio population the first morning. This brief introduction focused on encouraging participation by emphasizing the participant's involvement in voicing opinions to facilitate change in their work environment. Specific information regarding research on personality differences and perception of stimuli was purposely omitted from the introduction to minimize the biased impact on survey answers.

Focus groups were conducted at all three sites during one of the days of observation. Participation in the focus groups were completely voluntary and participants did not receive any incentive for participating in these groups. Invitations to the focus groups were sent to the entire studio population and open to anyone wishing to participate.

Data Analysis

With a number of observations, generally between 12 and 15 observations per seat across all three sites, there was an extensive amount of cleaning to be done to the initial observations data. The goal of the process was to create one line of data that could describe the environment that a person in a given seat within a given office would experience. As there were also several days across which the observations were taken and there was not an efficient way to control for office population at any given point, the simplest approach was to average the data points across the observations.

Decibel level measurements were taken at every observation time and were averaged across the 12 to 15 observations respectively. However, this analysis did not account for extremes in the decibel levels, so another metric was created to look at what percentage of the times observed was the decibel level above a certain level. Research supporting this analysis has suggested that an employees' "acceptability" of noise was "strongly and inversely correlated with peak levels...suggesting that distinctive or salient sounds were least acceptable."(Sundstrom, et al, 1994) Taking this into consideration, and looking for a common metric for ambient noise, conversation appeared to be a consistent source of noise across all three sites. Conversation itself is generally considered to be measured at approximately 60 dba. While some believe that dba levels above 65 are considered distracting to office workers, it was decided that the metric would incorporate levels above 60 dba. The data was counted every time the

decibel level measured about 60 dba and was then divided into the number of measurements taken to create a percentage of time that the individual in that seat was exposed to sound levels above 60 dba.

Sound measurements, specifically dba measurements, were also taken using the Faber Acoustical software on the ipad and iphone instruments. The purpose was an attempt to gather a more comprehensive view of the noise exposure within a certain location throughout the workday. As there was limited hardware available for these measurements, only a few locations (clusters of seats) were measured. Due to this lack of consistency, the data from these instruments was not included in the overall analysis comparing observations and individual perceptions.

Beyond sound metrics, one of the more challenging aspects of the research was determining the amount of visual exposure that a person experienced in their given seat. During the focus groups, there was some discussion about the preferred seat within a group of desks or seating arrangement. The preferred seats, not surprising to the researchers, were the ones that provided the least amount of exposure from behind, or more aptly described as the back to the corner, and the ones that provided the greatest view of the space. Translating these insights to research terms, and comparable metrics it was deemed most relevant to compare it to the Prospect-Refuge Theory (Appleton, 1975). As such, three coders were used to provide scores ranging from one to five to both the prospect and refuge aspects of a space. The optimal seat for example, being the one that has a score of five for both prospect and refuge.

The scores were then averages in an attempt to have one number to score a seat's visual environmental attributes, but that failed to provide an accurate measurement as an average score would miss the difference between the prospect and refuge score and would not incorporate which score was higher. Through this process it was determined to simply keep the scores as separate variables and compare them with the survey data independently.

While headphone data was part of the observational survey, the behavior and use of headphones was only observed over the course of three days for each site. As the use of headphones was also part of the online user survey, the reported use by the user was considered to be a more accurate assessment of overall headphone use. Thinking about headphone use, the other survey metric that was also considered for the correlation analysis was the purpose for headphone use. As users were asked to provide the percentage of time the headphones were used for either, blocking out noise, listening to other music, on the phone or a visual cue to others that they wish to be left alone, the metric of blocking out noise was pulled into the initial analysis for comparison to decibel metrics and personality type, however was not analyzed beyond initial correlation tables.

Continuing to look through the respondents' survey data, satisfaction data was pulled from both questions regarding the overall satisfaction with the workplace environment as a whole (including workstations, conference rooms and common areas) as well as the satisfaction with the respondents' current seating. Both of these

satisfaction questions were on a scale from one to seven and the data was pulled directed into the statistical data analysis without any changes.

Specific to the perception of stimuli in the environment, there were several questions that looked at an individuals' perception of sound levels in the environment. These included the overall perception, which provided a seven point scale from very disruptive to very welcome (enhancing). The answers were coded from a scale of one to seven with very disruptive coded a one and very welcome (enhancing) coded a seven. While the answers were listed on a spectrum, they were by qualitative terms, and as ordinal variables, to code them into quantitative terms it was assumed, for ease of analysis, that it was an equal distance between the levels. The similar question regarding perception of the movement of colleagues, the component of visual stimuli, in the work environment had an identical answer scale and was therefore translated into quantitative data and coded in the same manner as the sound perception question.

The concept of focus also appeared to be a relevant piece of data that could provide some clues into an individuals' perception of stimuli in their environment. As such, data was pulled on percentage of time that a respondent spent on focus work over a typical workweek. This question was asked directly as a percentage over an average week and therefore did not require any additional cleaning to be including in the analysis. Building up on that focus data, both perception questions for sound/noise and movement had an additional question asking about the perceptions during specific activities in the workplace. Using the same seven point spectrum as the overall perception question, the respondents answers regarding their perception on

sound/noise and movement during activities that require focus were brought into the initial data analysis. These answers were also coded with the same assumptions of equal distance between variables on a seven-point scale.

The structure of the analysis of the personality data was clearly laid out from the authors of the 44-question test that was included in the online survey. Each of the 44 personality questions, as scored by the respondents on a scale from one to five, was aligned to one of the five domains of personality. A number of the questions also required reverse coding before they could be incorporated into one of the five domains. The reverse coding required that the answers to the reverse coded questions be subtracted from six. For example, a score of five, subtracted from six, would now have a value of one. Once all the reverse scores were calculated, each question has to be assigned to one of the five personality domains. Openness had a total of ten questions applied to its average score. Conscientiousness was assessed through nine questions. Eight questions were used to assess the personality component of extraversion. Agreeableness had a total of nine questions. Finally, neuroticism was assessed through the average scores of eight questions (John, O.P et al, 1991; John O.P. et al, 2008). As it was not clear which, if any, of the personality components had an impact on a person's perception of the stimuli in their work environment, the scores, as individual components were kept as separate variables for the initial data analysis.

Demographic data of age, within a range, gender, and office location were pulled into the data. Additionally, tenure within the company, as defined by distinct ranges of time with the company was pulled into the analysis to determine if there was a trend of

homogeneous hiring with regards to personality type, which would have an impact on the analysis of the population, but could potentially be explained by hiring practices.

Qualitative data from the focus groups was not a part of the initial data analysis. Rather, the information obtained from these sessions at each of the three sites was referenced to provide explanation or additional clarity to quantitative survey and observational results.

Results

Descriptive Statistics

Survey responses from a launch to the entire population of the London, Malmo and NYC sites (208 employees) resulted in a 42% response rate overall. After excluding incomplete survey results, there were a total of 87 complete data sets from the surveys. Broken down by population, the New York City studio had the highest percentage participation at 80%. London responses showed 35% participation and Malmo came in with just under 30% participation.

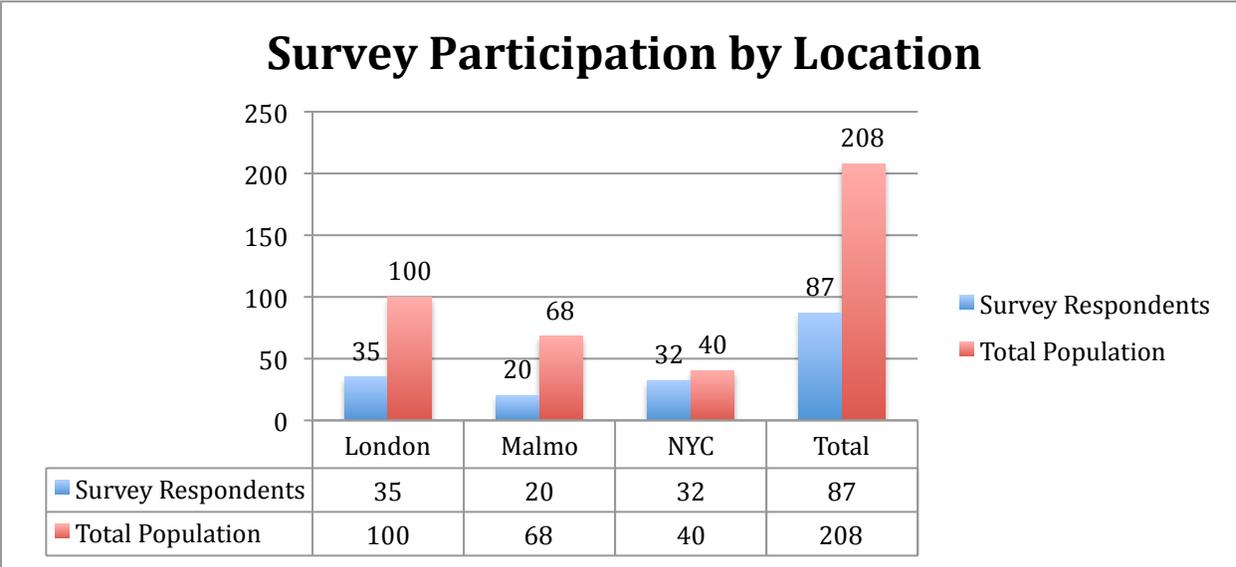


Figure 7 - Survey Participation by Location

Looking into the demographics of the survey respondents, data was broken down by gender, age and tenure with the company. Results showed an overall breakdown of 66% male and 34% female, which was consistent with informal observations by the researcher onsite. By site, the gender percentages were relatively consistent with the overall population.

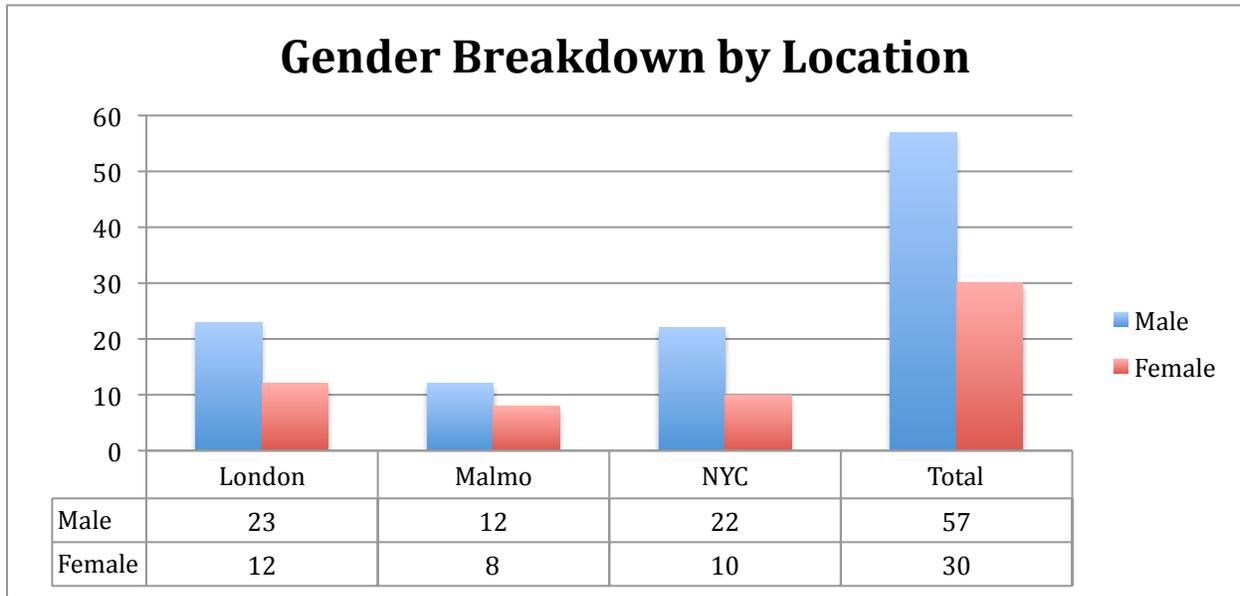


Figure 8 Gender Breakdown by Location

A breakdown by age showed 63% of participants were within the age range of 25-34 years old, with the next largest percentage of the population at 23% for those between the ages of 35-44 years of age.

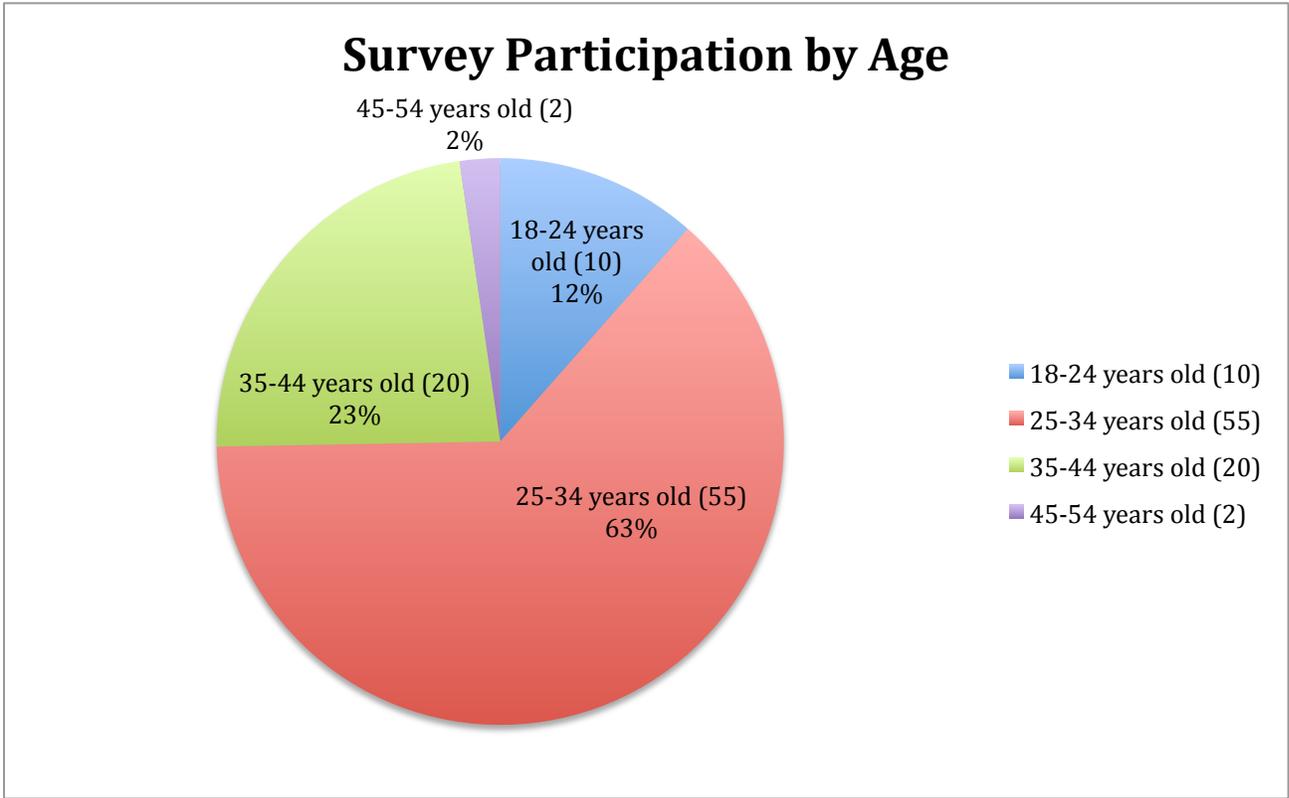


Figure 9 Survey Participation by Age

Participation broken down by tenure with the company shows that about 40% of survey participants have been with the company for under one year, and just about 70% of the total number of participants have joined the company in the last two years. Ustwo’s growth started slowly, and the relative headcount increase the past few years demonstrates the consistency in the survey respondents’ tenure breakdown.

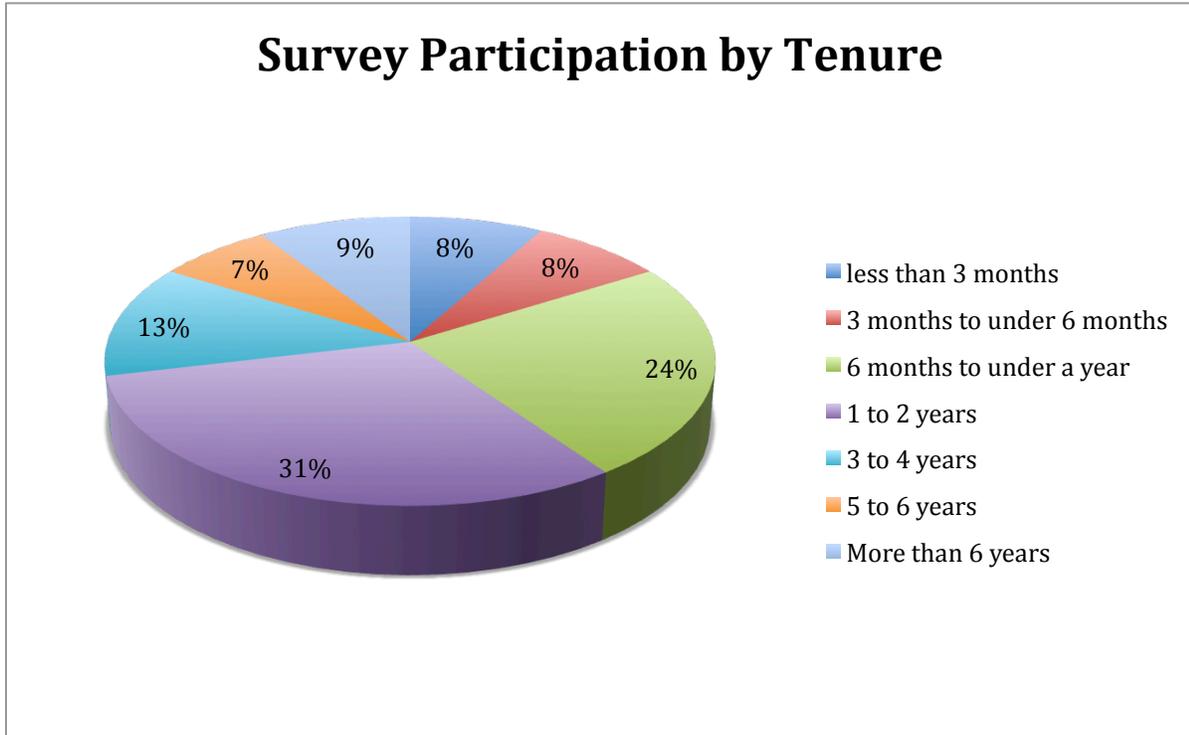


Figure 10 Survey Participation by Tenure

Exploring the data behind personality traits, average scores from the five personality traits of Openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A) and Neuroticism (N) were organized by site. Comparing this data to the averages across the five traits for the total population demonstrated relatively consistent results across the three studio locations.

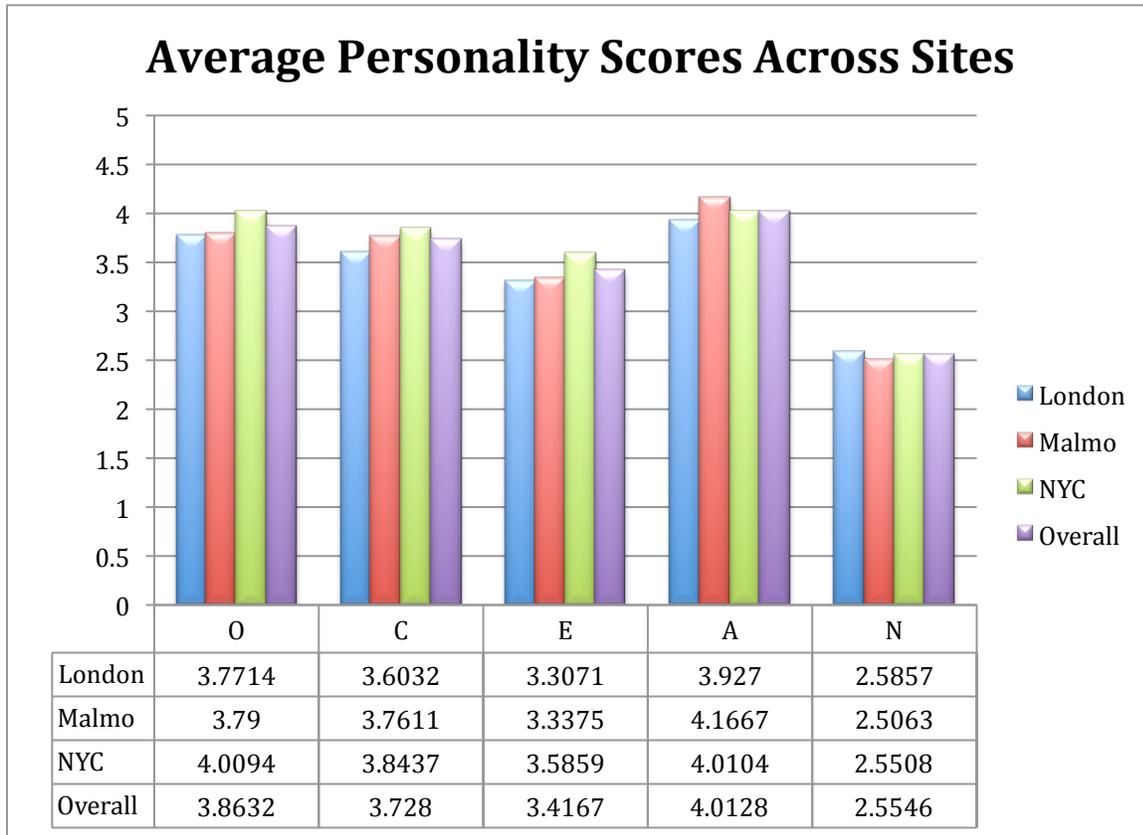


Figure 11 Average Personality Scores Across Sites

A similar analysis of personality trait by tenure with the organization demonstrated slightly less consistency across the different lengths of employment, however some of this can be explained by the uneven distribution of population between the different tenure categories.

Personality Trait Breakdown by Tenure

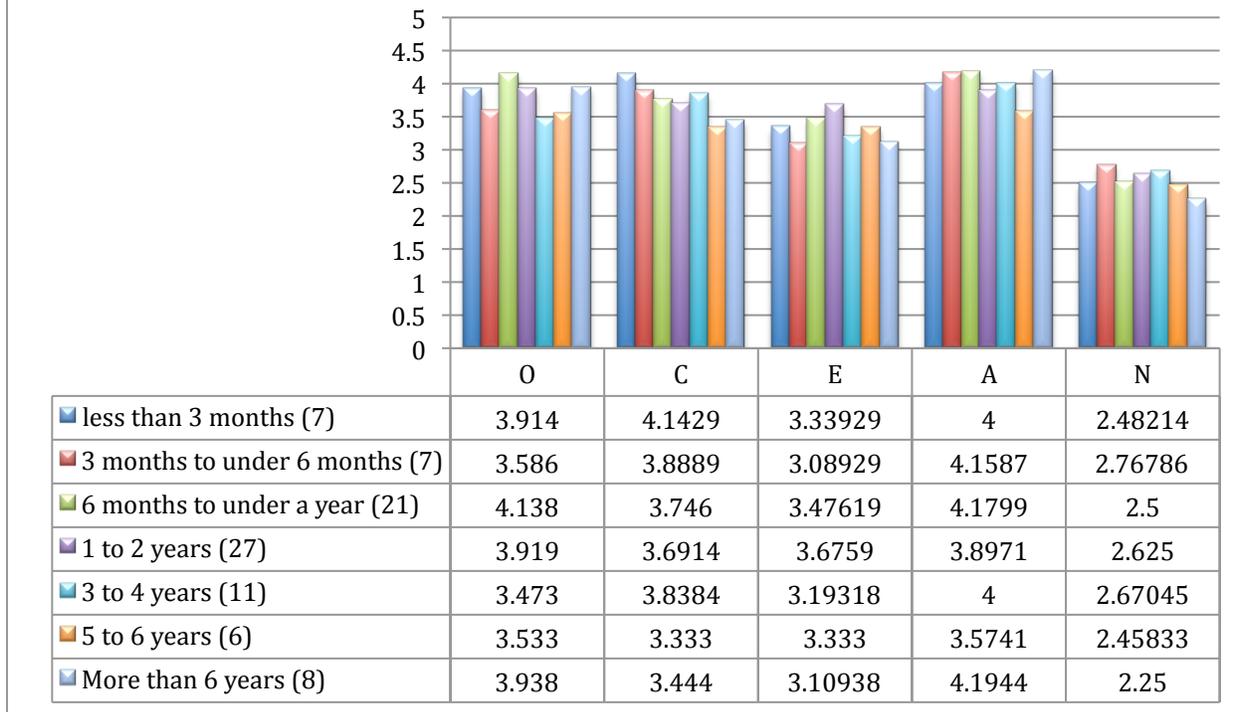


Figure 12 Personality Trait Breakdown by Tenure

Of the total 87 complete surveys, 17 participants did not provide enough data to enable a comparative analysis of the survey results with observational data. While those 17 participants' survey data were included in overall survey data analysis, their results could not be compared to seat locations at the various sites. This resulted in 70 sets of complete survey and corresponding observational data of the physical environment experienced by those survey participants.

Mixed-Models Analysis

Looking specifically at the personality traits for the FFM, Openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A) and Neuroticism (N), means and standard deviation values were calculated (TABLE 1) to further analyze the potential moderating relationship that may impact the subjects perceptions of their physical work environment. An average person among the population within those with completed survey results would have scored (via self report) at a 3.863 on the O scale, 3.7280 on the C scale, 3.417 on the E scale, 4.0128 on the A scale, and finally, a 2.554 on the N scale.

Table 1 Personality Trait Breakdown

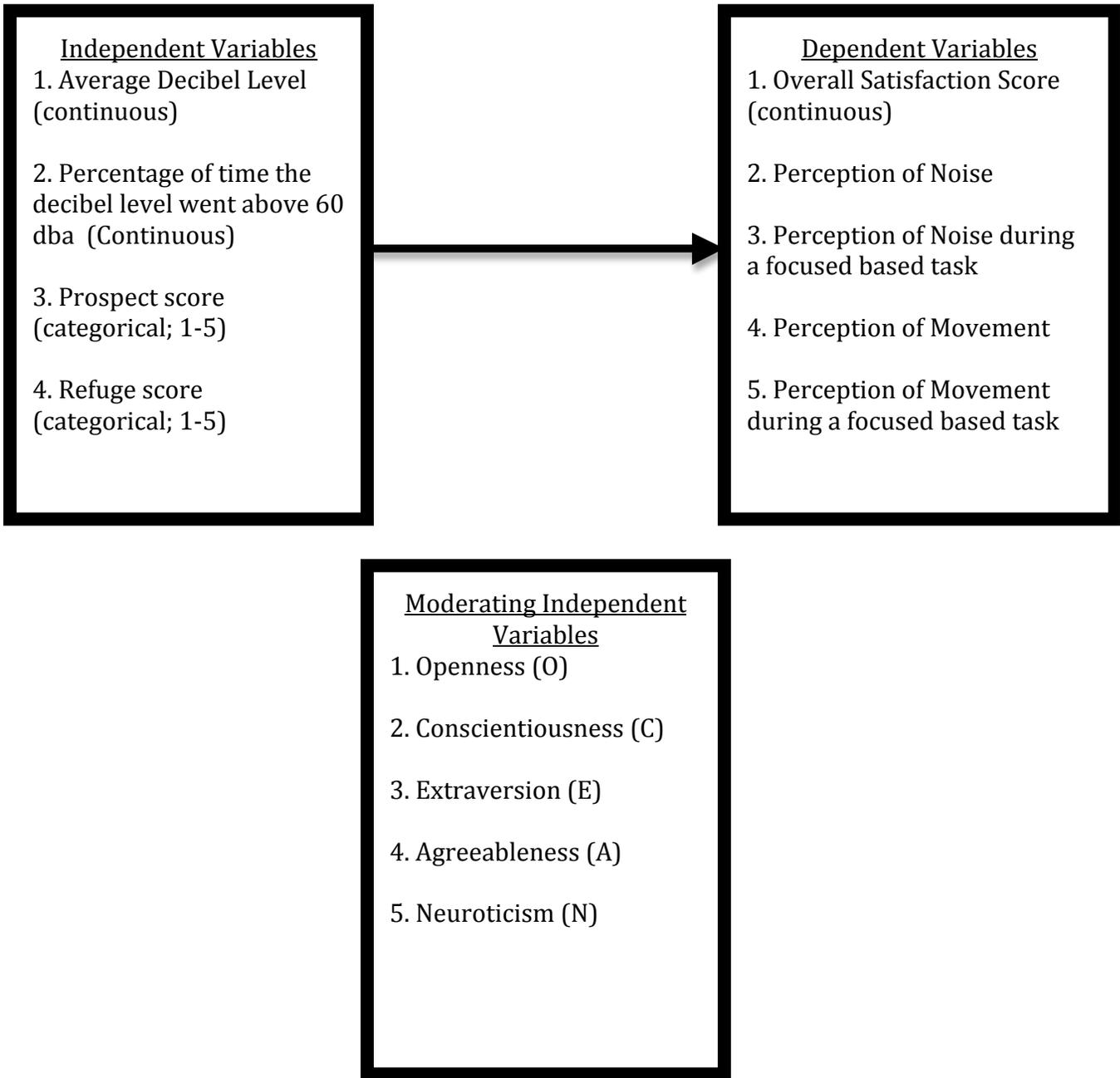
Personality Traits Breakdown					
	N	Minimum	Maximum	Mean	Std. Deviation
O	87	2.2	4.9	3.863	.5696
C	87	2.11	5.00	3.7280	.59541
E	87	1.750	5.000	3.41667	.885048
A	87	2.22	5.00	4.0128	.51907
N	87	1.000	4.250	2.55460	.657498
Zscore(O)	87	-2.91997	1.82019	.0000000	1.0000000
Zscore(C)	87	-2.71555	2.13640	.0000000	1.0000000
Zscore(E)	87	-1.88314	1.78898	.0000000	1.0000000
Zscore(A)	87	-3.44956	1.90193	.0000000	1.0000000
Zscore(N)	87	-2.36441	2.57856	.0000000	1.0000000
Valid N (listwise)	87				

Further analysis was conducted to look at the overall prospect and refuge characteristics of the space. The table (TABLE 2) details some of the metrics of the quantified approach to prospect and refuge within the space.

Table 2 Prospect/Refuge Metrics

London	Minimum	Maximum	Mean	Mode
Prospect	2	5	3.84	3
Refuge	1	5	2.68	1
Malmö	Minimum	Maximum	Mean	Mode
Prospect	2	5	3.58	5
Refuge	1	5	3.37	4
NYC	Minimum	Maximum	Mean	Mode
Prospect	1	5	3.47	5
Refuge	1	5	2.91	1

With these means established, the Z-scores of the personality traits were used to calculate, via a mixed models approach, the potential impact of environmental auditory and visual stimuli, moderated by personality trait(s), on the overall satisfaction with the workplace environment and perceptions of auditory and visual stimuli. The rationale behind the use of the Mixed Model approach was due to the fact that observational measurements were made on clusters of seats within the three different studio sites. The combination of a variety of different types of data points also made this method of analysis more advantageous over more traditional statistical approaches.



Auditory Stimuli

Analysis was started by looking at the potential impact of observed auditory stimuli on a subject's overall satisfaction level with their physical environment. The two independent variables that were used were average decibel level (MeanNoisemeandba), a continuous variable in the form of an average decibel level and the percentage of time observed that the decibel level went above 60 dba (for example 40% would be listed at 40, in lieu of .40), referred to as PercNoise60.

Initial analysis of the impact of the auditory stimuli on Overall Satisfaction with the physical work environment resulted in no significant results (full table appendix). When looking specifically at personality types, there was a main effect of the personality trait Extraversion (E) on the Overall Satisfaction level. This positive correlation of .313 was statistically significant at a .030 significance. The personality trait of Agreeableness (A), also had a main effect on the Overall Satisfaction levels with the physical work environment. This positive correlation of .361 was statistically significant at a .018 significance. (TABLE 3)

Table 3 Impact of Auditory Stimuli on Overall Satisfaction with the Physical Work Environment

Impact of Auditory Stimuli on Overall Satisfaction with the Physical Work Environment							
Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	5.168036	.152967	16.934	33.785	.000	4.845208	5.490863
ZE	.313022	.141414	66.898	2.214	.030	.030751	.595292
ZA	.361164	.148558	65.435	2.431	.018	.064511	.657817

a. Dependent Variable: Overall Satisfaction Score.

The impact of auditory stimuli was also analyzed to determine if there was a main effect of different types of auditory stimuli on perceptions of auditory stimuli. While

Impact of Auditory Stimuli on Perception of Noise in the Workplace

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	18.225842	6.740809	16.158	2.704	.016	3.947316	32.504368
MeanNoisemeandba	-.254262	.131193	16.396	-1.938	.070	-.531834	.023309
PercNoise60	.024040	.031080	20.627	.774	.448	-.040665	.088745

neither the Average Decibel level (MeanNoisemeandba), nor the Percentage of time the noise was measured about 60 dba showed a statistically significant main effect on the perception of noise in the workplace, there was a significant effect in this relationship when moderated by several personality traits. Specifically, when Average Decibel level was moderated by the personality trait of Openness (O), there was a positive effect (.113) on Perception of Noise at a statistical significance of .021. Meaning that while there is a negative relationship (-.254) between the average dba level and the perception of noise when all personality traits are at an average level within this population, this negative slope is less severe by .113 (-.254+.113) for each standard deviation of the trait Openness (O), above the mean. The percentage of time the noise went above 60 dba, when moderated by Agreeableness (A) also resulted in a positive effect (.030) on Perception of Noise with a statistical significance of .020. The positive effect on Percentage of Noise above 60 dba to Perception of noise increased (.024+.030) for each standard deviation above the mean for the trait of Agreeableness (A). Additionally, the personality traits of Openness, Extraversion and Agreeableness had statically significant main effects on the perception of noise. Openness had a negative main effect of -7.040 (.024 sig); Extraversion had a positive main effect of .461 (.018 sig) and Agreeableness a negative main effect of -1.72 (.023 sig). (TABLE 4)

Table 4 Extraversion and Agreeableness Main Effects

ZO	-7.040540	3.031128	60.270	-2.323	.024	-13.103140	-.977941
ZE	.461670	.190059	56.769	2.429	.018	.081050	.842290

ZA	-1.720696	.737404	53.802	-2.333	.023	-3.199226	-.242166
MeanNoisemeandba * ZO	.113590	.047917	59.350	2.371	.021	.017721	.209460
PercNoise60 * ZA	.030193	.012540	52.981	2.408	.020	.005039	.055346

a. Dependent Variable: Noise Sat Score.

Looking specifically at the perception of noise during focused based activities, a similar analysis was conducted to determine if a statistically significant relationship existed between auditory stimuli and perception of auditory stimuli during focused based tasks as moderated by personality traits. The results showed there was a statistically significant main effect of average decibel level on perception of noise during focus. This negative effect of -.212 was statistically significant at a .004 significance level. Percentage of noise above 60 dba had a statistically significant main effect on perception of noise during a focused based task, however this was a positive effect of .038 with a .046 significance level and since it is an interaction with Agreeableness, this is only the effect when agreeableness is at its mean since agreeableness is entered in the model as a standardized variable. Agreeableness (A) also demonstrated a main effect on perception of noise during a focused task. This negative relationship of -2.18 had a .005 significance. Because of its interaction with percentage of time the decibel level went about 60 dba, the main effect of agreeableness is the effect when the percentage of time the decibel level went above 60 dba is equal to zero. Finally, the interaction of percentage of time the decibel level went above 60 dba, with Agreeableness (A) was equal to .040 with a significance level of .003. Thus the slope of the percentage of time the noise level increased above 60 dba increased from .038 to a

slope of .079 (.038+.039) for every increase of 1 standard deviation of the trait of Agreeableness. (TABLE 5)

Table 5 Impact of Auditory Stimuli on Perception of Noise during Focused Based Tasks

Impact of Auditory Stimuli on Perception of Noise in the Workplace during Focused Based Tasks

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	14.246427	3.646970	65.000	3.906	.000	6.962925	21.529928
MeanNoisemeandba	-.212466	.072129	65.000	-2.946	.004	-.356517	-.068414
PercNoise60	.038811	.019088	65.000	2.033	.046	.000690	.076933
ZA	-2.184178	.750297	65.000	-2.911	.005	-3.682624	-.685732
PercNoise60 * ZA	.039672	.012780	65.000	3.104	.003	.014149	.065194

a. Dependent Variable: NoiseFocus Score.

Visual Stimuli

Visual stimuli, measured on a scale of 1-5 for both aspects of prospect and refuge was also measured against overall satisfaction level with the physical work environment as well as perception of movement in the workplace (disruptive to welcome) in general and specifically during focused based tasks. Compared visual stimuli and overall satisfaction levels with the physical work environment indicated no significant results.

When looking at the effect of visual stimuli on a person’s perception of movement in the workplace, there was initially some statistical significance for when both variables of prospect and refuge were moderated by Agreeableness (A). However, the results appeared to be highly correlated with the other variables and as different combinations were eliminated, the significance level was determined to not be at statistically significant level (APPENDIX H).

Analysis of the effect of prospect and refuge on perception of movement during focused based tasks as moderated by personality did however, demonstrated a statistically significant relationship. Both aspects of prospect and refuge, when moderated by the personality trait of Openness (O), had a statistically significant effect on a person's perception of movement within their environment during focused based tasks. Prospect, that showed a negative effect on perception of movement during a focused based task (-.107) had a more negative slope of -.66 (-.107 + -.552) when moderated by Openness (O). This relationship was significant to a .043 significance level. Refuge, also with a negative relationship to perception of movement during a focused based task (-.092) when all personality traits were at the average of the population (Z=0), showed a positive correlation to perceptions of movement during a focused activity with just one standard deviation above the mean for the personality trait of Openness. This slope of .541 (-.092 + .634) at just one standard deviation above the mean, was statistically significant at a .004 significance. (TABLE 6)

Table 6 Impact of Visual Stimuli on Perception of Movement within the workspace during focused based tasks

Impact of Visual Stimuli on Perception of Movement within the workplace during focused based tasks

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	4.118108	.542587	64	7.590	.000	3.034166	5.202050
Prospect	-.107774	.241114	64.000	-.447	.656	-.589454	.373907
Refuge	-.092533	.194462	64	-.476	.636	-.481016	.295950
ZO	-.001541	.518970	64	-.003	.998	-1.038302	1.035221
Prospect * ZO	-.552318	.267220	64	-2.067	.043	-1.086152	-.018484
Refuge * ZO	.634183	.211387	64	3.000	.004	.211888	1.056477

a. Dependent Variable: MoveFocus Score.

Auditory and Visual Mixed

Auditory stimuli may also have an impact on perception of visual movement in the workplace, just as visual stimuli may have an effect on a person's perception of the auditory levels in a work environment. Analysis was conducted to explore these relationships and the potential moderating variable of personality type on the results.

Looking first at the impact of visual stimuli on a person's perception of noise in their environment, no statistically significant results were found. However, when looking at the perception of noise during a focused based task, the personality trait Openness (O) had a main effect on the perception of noise during a focused based task with a significant level of .030. Further analysis found that when moderated by Openness (O), the refuge level, a person's perception of being seen, had a positive correlation to their perception of noise during a focused based activity with a statically significant level of .016. As the refuge score increased, so did the person's perception of noise during a focused based task (they found it more welcoming than disruptive). As the Openness score increased by one standard deviation, the slope defining the relationship of refuge to perception of noise increased by .2755.

Table 7 Impact of Visual Stimuli on Perception of Noise during focused based activities

Impact of Visual Stimuli on Perception of Noise during focused based activities							
Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	2.807699	.380696	61.719	7.375	.000	2.046630	3.568768
Refuge	.065967	.112663	64.692	.586	.560	-.159057	.290991
ZO	-.800593	.360950	65.998	-2.218	.030	-1.521253	-.079933
Refuge * ZO	.275522	.110879	65.766	2.485	.016	.054131	.496913

a. Dependent Variable: NoiseFocus Score.

Exploring the impact of auditory stimuli on perception of movement within the workspace found statistically significant results as well. Three traits: Openness (O), Extraversion (E) and Agreeableness (A) all demonstrated statistically significant main effects on the perception of movement within the work environment. Looking at the personality traits as moderating variables, the perception of movement decreased as the mean decibel level increased (with a slope of $-.092$), however when moderated by Openness, the slope of the relationship was a positive $.055$ ($-.0924 + .147$) when the score for O was one standard deviation above the mean, with a statistically significant level of $.003$ significance. Further analysis showed a similar relationship with the percentage of time the decibel level went above 60 and perception of movement in the workspace as moderated by Agreeableness (A). While perception of movement decreased by $-.0126$ as percentage of dba above 60 increased for a person scoring average levels on all 5 personality traits ($Z=0$), when the score for A was one standard deviation above the mean, the resulting slope was a positive $.0307$ ($-.0126 + .0433$) with a statistically significant level of $.001$ significance.

Table 8 Impact of Auditory Stimuli on Perception of Movement in the workplace

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	11.056960	3.991026	62.000	2.770	.007	3.079013	19.034907
MeanNoisemeandba	-.092449	.077820	62.000	-1.188	.239	-.248008	.063110
PercNoise60	-.012606	.020377	62.000	-.619	.538	-.053339	.028127
ZO	-9.152469	2.985443	62.000	-3.066	.003	-15.120285	-3.184654
ZE	.550639	.188411	62.000	2.923	.005	.174011	.927266
ZA	-2.462609	.764225	62.000	-3.222	.002	-3.990272	-.934945
MeanNoisemeandba * ZO	.147460	.047754	62.000	3.088	.003	.052001	.242920

PercNoise60 * ZA	.043360	.012962	62.000	3.345	.001	.017449	.069270
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a. Dependent Variable: Movement Score.

Incorporating the task of focused work into the analysis, data was analyzed looking at the impact of auditory stimuli on perception of visual movement during a focused based task. Results indicated a statistically significant (.002) main effect of Openness (O) on perception of movement during a focused based task. As a person's score of the trait Openness (O) increased, their perception of movement during focused activities decreased, with a slope of -9.723. Similarly, a statistically significant (.001) main effect was evident for Conscientiousness (C). As C increased, perception of movement during focused tasks decreased, with a slope -1.546.

Looking at personality as a moderating variable, the negative correlation of mean dba level and perception of movement during a focused task decreased at a slope of -.018, however when Openness (O) increased by one standard deviation above the mean, the relationship was positive at a slope of .1352 (-.018 +.154) with a statistically significant level of .002. The negative correlation of percentage of time the noise level went about 60 dba and perception of movement (-.020) when moderated by Conscientiousness (C), shifted to a positive correlation of .010(-.020+.031) when C was just one standard deviation from the mean (ZC=1). This was a statically significant relationship at a .001 significance level.

Table 9 Impact of Auditory Stimuli on Perception of Movement in the workplace during focused based tasks

Impact of Auditory Stimuli on Perception of Movement in the workplace during focused based tasks

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower	Upper

						Bound	Bound
Intercept	5.563193	3.961204	63.000	1.404	.165	-2.352642	13.479028
MeanNoisemeandba	-.018874	.077737	63.000	-.243	.809	-.174220	.136471
PercNoise60	-.020847	.019967	63.000	-1.044	.300	-.060747	.019054
ZO	-9.723495	2.988244	63.000	-3.254	.002	-15.695025	-3.751965
ZC	-1.546588	.464950	63.000	-3.326	.001	-2.475716	-.617459
MeanNoisemeandba * ZO	.154172	.047923	63.000	3.217	.002	.058406	.249939
PercNoise60 * ZC	.031067	.008561	63.000	3.629	.001	.013960	.048175

a. Dependent Variable: MoveFocus Score.

H 1: *Auditory and visual stimuli impacts environmental satisfaction within the workplace.*

Cannot reject the null hypothesis. There was no statically significant main effect of auditory stimuli on overall satisfaction with the physical work environment. There was also no statically significant main effect of visual stimuli on overall satisfaction with the physical work environment.

H 2: *Personality traits impact a person's perception of auditory and visual stimuli in the workplace.*

Can reject the null hypothesis. There is a statistically significant effect of personality trait(s) on a person's perception of auditory and visual stimuli in the workplace.

H 3.1: *Task type (focus based) impacts a person's perception of auditory and visual stimuli in the workplace.*

Can reject the null hypothesis. There are statistically significant results indicating that focused based tasks impact a person's perception of auditory and visual stimuli in the workplace.

Hypothesis 3.2: *Personality traits moderate impact of task type (focus based) on perception of auditory and visual stimuli in the workplace.*

Can reject the null hypothesis. There are statistically significant results indicating that personality traits moderated the impact of focused based tasks on person's perception of auditory and visual stimuli in the workplace.

Discussion

A person's behavior is essentially an interaction between a person's personality traits and the situation and/or situational variables that are present at that time. This study aimed to explore the five personality traits of Openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A) and Neuroticism (N) and the situational variables of auditory and visual stimuli in a workplace setting. Looking beyond simply the stimuli in the setting, the perception of stimuli when understood from an individual's perspective, defined by the prospect and refuge components of an individual seat, explored a different approach to the idea of visual stimuli.

Self-reported measures of overall satisfaction level with the work environment showed an average satisfaction level of 5.21 for the participant population, indicated a level between "somewhat satisfied" and "satisfied" on a scale of 1-7. This question asked the subject to rate their level of satisfaction with an environment that went beyond their work area to include common areas within the studio environment. As a company focused on creative user interface designs, there are many elements within the space such as lounge or "soft" areas, gaming, and kitchen areas that may be well suited for creative collaboration among colleagues. The environment itself, as evident through discussions with the company's leadership, is designed to create a culture of interaction. Throughout the day, an employee may be involved in an assortment of different activities that would expose them to varied levels of auditory and visual stimuli. While further research could explore the breakdown of activities and the percentage of time that is dedicated to different levels of stimuli, it is not surprising that there was no

statistically significant relationship between auditory and visual stimuli and overall workplace satisfaction.

Exploring the concept of perception further, subjects were asked about perception of stimuli on a score from 1 to 7, with 1 being “very disruptive” and 7 indicating that the stimuli was “very welcome.” The average score for perception of noise in the environment was 3.862, just between “somewhat disruptive” and “neither disruptive nor welcome” and the average for perception of movement, the term used to assess perception of visual stimuli averaged at 4.45, just between “neither disruptive nor welcome” and “somewhat welcome.” Neither of these scores should signal any red flags for leadership or users as this indicates that noise and movements in the space overall is generally not impactful on the user throughout the course of daily activities. What is more interesting is that when a user is asked about these same perception levels when they are doing individual focused work, perception of noise drops from 3.862 to 3.011 and perception of movement drops from 4.45 to 3.22.

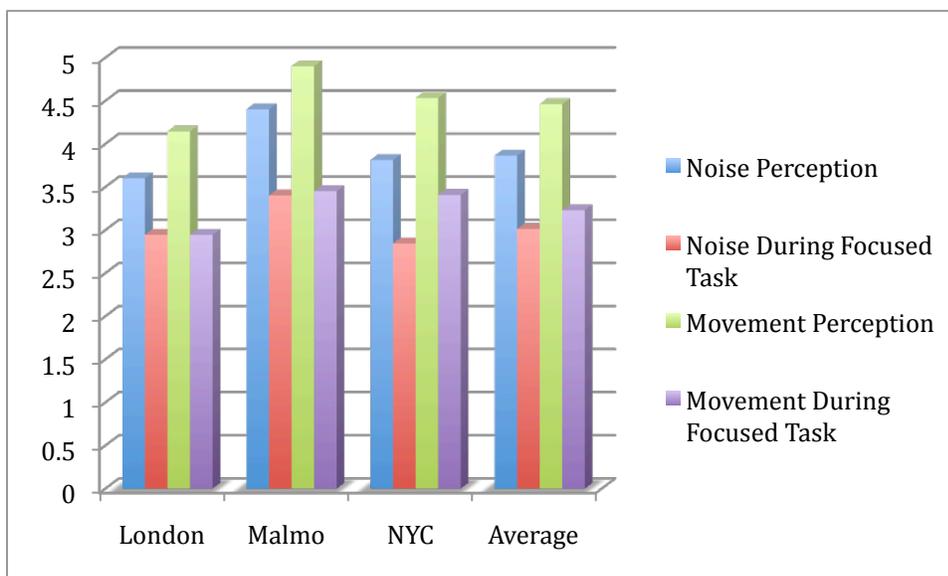


Figure 13 Perception by Location

This indicates that overall, based on data from the surveyed population, both the auditory and visual stimuli in the physical work environment is perceived as more disruptive when an individual is attempting to work on focused based tasks.

Other variables may have an impact on a person's satisfaction with their workplace or their perception of auditory and visual stimuli in their environment, but this study chose to look at the impact of personality on perception of environmental stimuli. Existing research suggests that the trait of Extraversion has some relation to a person's peak or optimal level of stimulation, basically that an extrovert would have a higher threshold than an introvert when exposed to the same level of stimuli (Cain, 2013, Geen, 1984). While this is a generalization of some of the research behind this, we found that extraversion, for some of the models, did result in a higher levels, or a more welcome perception of stimuli in the environment, however when incorporated into the research as a moderating variable, there were no significant results to indicate that an extraverted person had a different perception of stimuli than an introverted person when exposed to the same levels of stimuli.

Exploring the data behind auditory stimuli, an average person (based on personality scores within this population) would report that noise was more disruptive as the average decibel level increase. This is not a surprising finding and appears to be consistent with general knowledge in the workspace. What's interesting is that when looking at the personality trait of Openness (O), which is generally characterized as imagination and insight, the higher the score of (O) the less disruptive the average noise level is on reported perception of noise in the workplace. This could indicate that those

persons who are categorized with higher O values can tolerate higher levels of noise in the workplace before it becomes disruptive. It is important to note that while this relationship was also explored looking at the perception of noise during individual focused work, no significant relationship was found. Further research could explore other tasks beyond focused work to see if any differences in perception were evident as tasks for the individual varied.

Auditory stimuli was also examined using an observational data point that measured the percentage of time the decibel level went above 60 dba. As some studies suggest, it is not always the average decibel level that impacts a person, but rather the fluctuation in noise levels that is most disruptive. This data point attempted to provide another perspective on auditory stimuli in the environment. While range between noise highs and lows might have provided a more distinct variable to compare with survey results, the percentage above 60 dba provides some additional level of analysis aimed at exploring another characteristic of auditory stimuli.

Agreeableness (A), a personality trait generally characterized by social behavior, kindness and affection, was a significant moderating variable when looking at auditory stimuli when using the percentage of time the decibel level was measured above 60 dba. The results indicated that almost no relationship (slope = .018) existed between the percentage of time the noise went above 60 dba and perception of noise. However, when moderated by Agreeableness, there was a higher perception of noise in the workplace. It's important to remember that the higher number is not a satisfaction score, but rather a level of disruption. These results indicate that a person who is reported as

being more Agreeable, would find that the more often the noise level went about 60 dba, the more welcome it was. A similar relationship exists when looking at perception during individual focused work. The results indicate that during focused work, a person with a higher than average A score, would find that an increase in the percentage of time the dba went above 60, even more welcome than they reported in their overall score.

Perhaps this means that a person who is higher on the Openness scale, encompassing personality traits that are generally more social, might find that during a focused task, the presence of noise and increased fluctuations (above 60 dba) in noise are a welcome distraction.

Visual stimuli was slightly harder to quantify. During focus groups, there was a consistent theme in terms of desk preference within a cluster of desks. These preferred seats appeared to be in line with the concepts of prospect and refuge where the ideal seat would provide the maximum ability to observe the environment around them (prospect) while also providing the least exposure to others or ability to be seen (refuge). As there is limited research exploring the concept of quantifying this type of relationship, the lack of statistically significant results is not surprising. The survey question regarding the evaluation of visual noise (defined as “movement” within the survey) was also a relatively new approach to the idea of visual stimuli. As most research looked at complex images as a form of visual stimuli, understanding a person’s perception of the movement of people is a tough concept to communicate, especially via an online self-reported survey that lacked the ability to provide additional clarity should questions arise.

The concepts of prospect and refuge as quantified variables resulted in no impact on overall satisfaction with the work environment as well as no statistically significant impact on a person's perception of movement. Looking at the perception of movement during individual focused work did however provide statistically significant results. The data suggests, not surprisingly, that an increase in prospect, the ability to see what's around them resulted in a slightly more disruptive perception of movement in workplace during individual focused work. For a person who scores above average on the Openness trait, the perception of disruption is increases at a greater rate as prospect increases. As a person higher on the Openness scale may tend to have a broader range of interests, the idea that they are more disrupted by the activities around them makes sense as they would be interested in a larger variety of stimuli and thus be more attentive to it, which can be disruptive during a time when they are trying to focus. With the idea of refuge, the data suggested that with an increase in refuge, for an average person, there was a slight, almost non-existent relationship to the perception of movement during a focused based task. Analysis showed however, that as the O score increased, i.e. people demonstrated more characteristics of Openness, they perceived movement or visual stimuli as more welcome as refuge increased. An increase in refuge does provide a level of security, so a person eager to explore more interests, as would describe a high O personality, may find stimuli more welcome in a more secure setting, even when this is during a focused based task. Other aspects of these personality traits may also explain this relationship, however were outside the scope of this study and thus should be explored in future research.

Research has also explored the idea of pairing auditory and visual stimuli (Naser, et al 1983). Further exploring this idea, it could be that seeing where a noise is coming from or hearing what you can see, may also be impacted by environmental factors and potentially moderated by different personality types. The analysis looked at how auditory stimuli impacted perception of visual stimuli and found that average dba level resulted in a similar relationship to perception of movement as it did for perception of noise (both similar results when moderated by the Openness trait). The percentage of time the noise went above 60 dba also resulted in similar perceptions of movement in the workplace (also when moderated by Agreeableness trait). These similarities in both types of auditory stimuli and their resulting impact on perception of movement indicates that perhaps a person's perception of movement was similar to perception of noise and since the stimuli was likely experienced in tandem, it might be difficult to separate out these two different types of perception. It could also be explained by the idea that in the process of answering the survey, a subject may also perceive "movement" as both auditory and visual stimuli. Further research that could involve more controlled stimuli exposure may be able to explore this relationship in a bit more detail.

When a person is doing individual focused work, results also indicated that the higher the noise level for an average person, the more disruptive the noise, but when moderated by Openness, the noise level, as it increased resulted in an increase in perception of movement. The relationship is similar to that when asked about perception of noise in lieu of perception of movement, again supporting the idea that "movement" may have been interpreted as a perception of both auditory and visual stimuli. When

looking at how often the noise increased above 60 dba, a person's perception of movement during focused work, while initially more disruptive, when moderated by Conscientiousness (C) became more welcome. This was a statistically significant finding that was surprising as Openness and Agreeableness are traits that can logically explain these results, the trait of Conscientiousness, which is commonly defined as thoughtfulness, does not seem to be a relevant trait when it comes to perception of stimuli in the environment. While some explain this trait as organized or detail-oriented, logic would conclude that an increase in noise stimuli would result in a more disrupted perception, but it was the inverse. Further research can explore this relationship in more detail.

Real Estate

So what does this mean for real estate decisions? For a company like ustwo, much of their success is based on creative solutions for clients. Hiring practices for a company like this would likely skew towards personality traits that would be higher for Openness and this is evident in the personality profiles of the population. With these goals in mind, the company would also be incentivized to provide a physical space that would support the exchange of ideas. The focus on collaboration leads many leaders to look towards an open floor plan design. Open floor plans also enable smaller organizations to minimize real estate costs and increase density metrics without the same visible differences that would be evident in a closed office or cubicle heavy environment.

Many organizations receive informal feedback from staff that the noise levels within an open floor plan can often be disruptive. As such, design alterations such as acoustically absorbing ceiling tiles and even headphone allowances for staff are incorporated in an attempt to minimize the impact of noise on employee satisfaction and ideally productivity. Landlords attempting to appeal to moderate and growing organizations similar to ustwo can benefit from providing floorplans that require minimal structural changes, but appeal to a number of users and offer room to expand as headcount needs increase. Using this analysis, a landlord can market their properties to different companies based on structures that support personality profiles in line to support company goals. Structural changes that provide seats that offer a strong sense of protection from being seen (refuge), specifically for those scoring higher in the trait of

Openness, can result in more welcome perceptions of both auditory and visual stimuli during focused based tasks.

Developing the layout and programming of the space is also an important investment that needs to be focused in the right places. As the study suggests that stimuli in general is more disruptive for some during focused based tasks, zoning the space based on activity could provide more supportive environments for individuals in need of different space characteristics. For example, looking at individuals that score higher than average on the personality trait of Openness, they find both auditory and visual stimuli less disruptive during focused work when they are seated in a space that provides more refuge characteristics such as having their backs to a corner with little chance that they would be surprised from behind. For these same individuals, their personality trait may lead them to be more aware of stimuli in the space. The results of this study suggest that for these individuals (higher O traits) a seat with higher prospect would be more disruptive for them when they are trying to complete focused based work. These individuals would benefit from a seat that does not have direct line of sight to circulation paths or large social gathering areas.

Overall, simply understanding the components of prospect and refuge that can be created within a floorplan allows individuals to choose options that best suit their needs. The choice of seating within project groups already indicated some informal understanding of these perceptions. Created more unique seating options with increased refuge could benefit many staff, allowing them to work in an environment with fewer disruptions.

Conclusion

Open plan design in the workplace is a choice that many companies have selected and many more will continue to choose as they develop their workspace. While there are many benefits to open plan design, such as increased collaboration and visibility to colleagues, it is important to remember that these benefits come at a price. Not all open plan designs are bad, looking simply at the real estate implications, a price per square foot analysis still favors an open plan design. The impact, however, on human capital is varied. Employers need to understand their workforce and provide the appropriate types of designs and spaces in their workplace to support the individuals and their tasks.

While noise and auditory disruption has been researched and continues to be an area of concern for designers and developers, little has been done to understand the impact of visual stimuli. While many people have the ability to focus their eyes on a computer screen better than the ability to tune out noise, visual movement in a space can still be disruptive. As this study has suggested, the perception of noise is still an important consideration, but the perception of movement should also be considered. Quantifying the visual concepts of prospect and refuge, this study has demonstrated that a person's ability to "see without being seen" (Appleton, 1975) is an important consideration for designers.

When programming the space, a focus should be placed on understanding the existing architectural elements of the space. Understanding the space and exploring the

elements from a perspective of prospect and refuge can help employers get the most out of their space. Programming should work with the architectural design and utilize existing elements of refuge, such as corners of rooms instead of leaving them empty.

Individual needs influence the perception of this stimuli as well. Using the Five Factor Model, this study has demonstrated that certain personality traits can significantly influence a person's perception of their environment. Specially, those who score higher on the Openness trait (as compared to their peers in this study) have significantly different perceptions of their environment. During focused based tasks, these individuals perceive both visual and auditory "noise" as more disruptive the lower the refuge of their seat. Higher prospect values also demonstrated increased visual disruption levels during a focused based tasks. Understanding this concept, designers should look into removing focused based work areas from circulations path, instead utilizing the corners of the space as areas of refuge for individuals doing focused based work. They use of glass wall is a great solution for auditory distractions, but at times, it is important to consider a structure that provides a visual barrier as well.

More research needs to be done to explore these ideas further. Simply looking at ways to quantify visual movement within a space and understanding the importance of prospect and refuge in a floorplan is a step in the right direction. Understanding that not just individual work, but the individuals themselves vary should also be considered in further design decisions. Helping people be more productive in their environment benefits the individual and the companies' investment in their real estate and human capital.

Limitations

During the time of the observations and measurements of the Malmo space, a foosball table, previously located in a somewhat sound absorbing room (labeled the Marrakesh Room) was located in the “Eating Social Area.” When the foosball table was located in the Marrakesh Room, residential tenants in the space below voiced concerns about the noise and thus instigated the move into the common space where the foosball machine was placed on a large piece of carpet to help absorb the sound. It was not clear if the foosball table would be permanently placed within the social area, however this was a component of the space during this time.

The other consideration regarding the Malmo site that would have an impact on survey results and respondents perception of their workplace is that the office is that at the time of the survey and observation, the studio was planning on a move to a new space just a few blocks away. The new space is 1,100 square meters, or 11,840 square feet, bringing the density measurement up to 174 square feet per person. The move tentatively planned for 6 months from the date of observation. This move was common knowledge to the staff in the Malmo office and expectations of the move could either induce the respondents to indicate stronger negative reaction to push change or skew the results to the positive side with the expectation of a new and better environment.

Survey Design

Once analyzed, it appeared that the question regarding seat satisfaction, because of it's location in the survey after the question about assigned seating, could be misinterpreted to mean satisfaction regarding how seats are assigned or selected in the

workspace, rather than the individuals' satisfaction with the physical environment as experienced from their current seat.

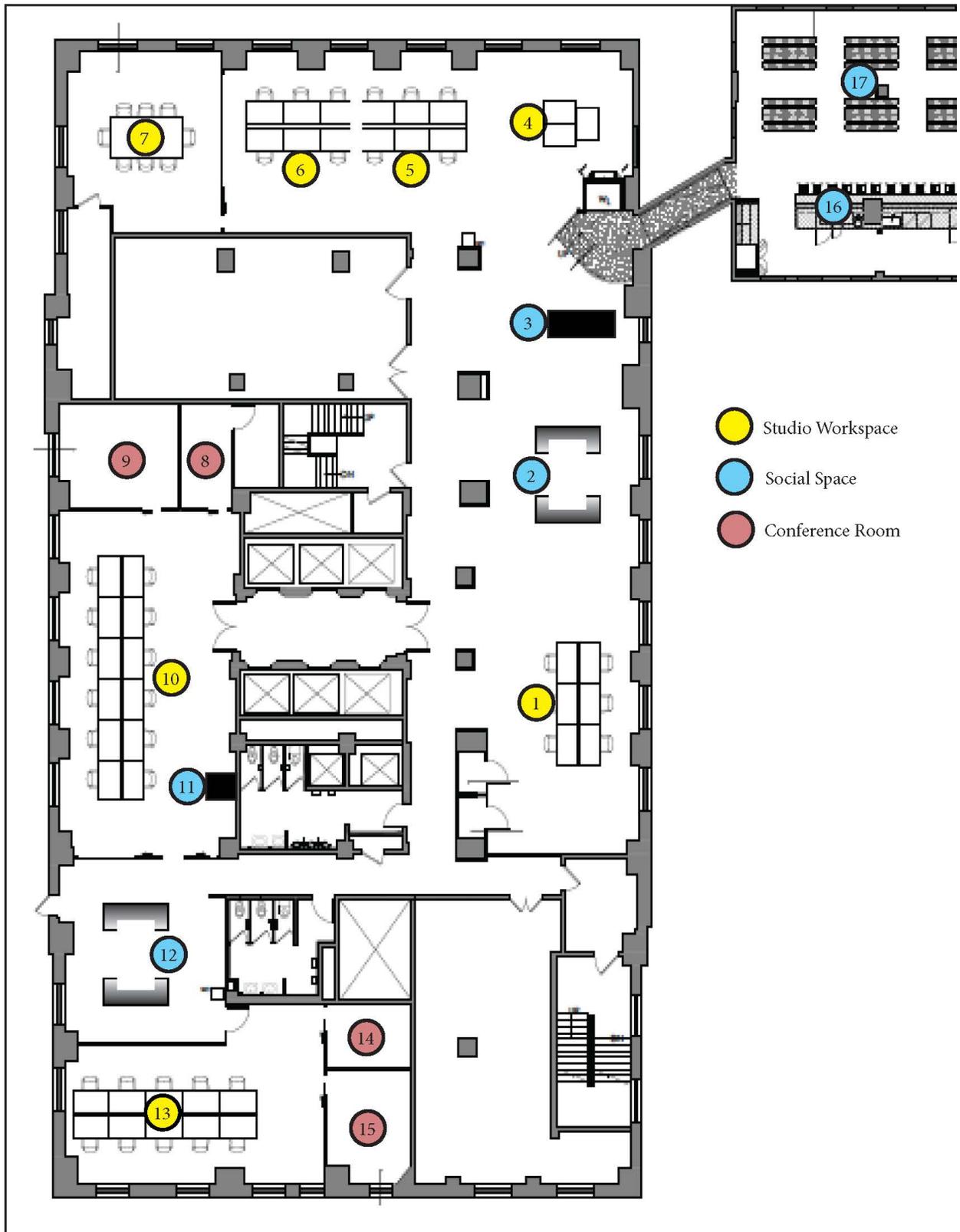
Non-response bias can be an issue when it comes to survey research. The concept basically assumes that those who did respond to the survey are in some way different than those who did not complete the survey. Attempts for higher response rates were made through persistent email reminders from internal staff as well as individual reminders by the researcher during the observational period. With an overall completed survey response rate of just under 50 percent of the population, it was not considered to be a significant factor in the data results.

Next Steps and Future Research Considerations

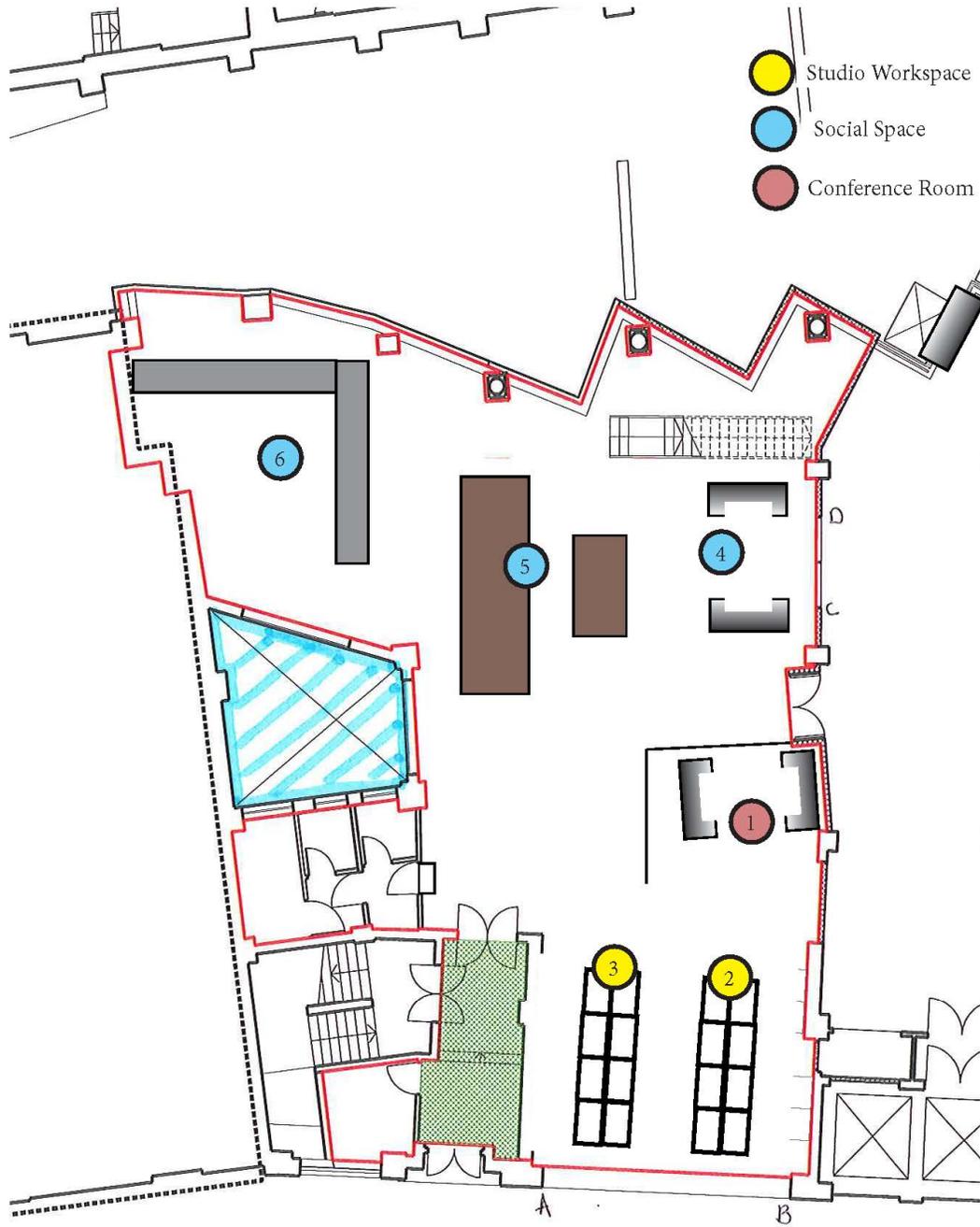
Headphone use was another observational metric that could have been analyzed and compared to survey data. Initial data collection noted a difference between earbuds and over-ear headphones, however given that advancement of earbud technology in recent years and an inability to determine brand and quality of the various headphone technology, it was determined that they would be compared as equal measures and the term “headphone use” would apply to both users of earbuds and over-ear headphones. The use of headphones could be further analysis as a type of coping behavior. Further studies might consider looking at coping behavior as an additional moderating variable for the perception of stimuli in the workplace.

The use of the Faber Acoustical software has a lot of potential for the future. With the ability to measure decibel exposure throughout the day, future considerations for measuring sound level exposure could potential include these metrics for all seats in a location to get a more comprehensive set of data for sound exposure.

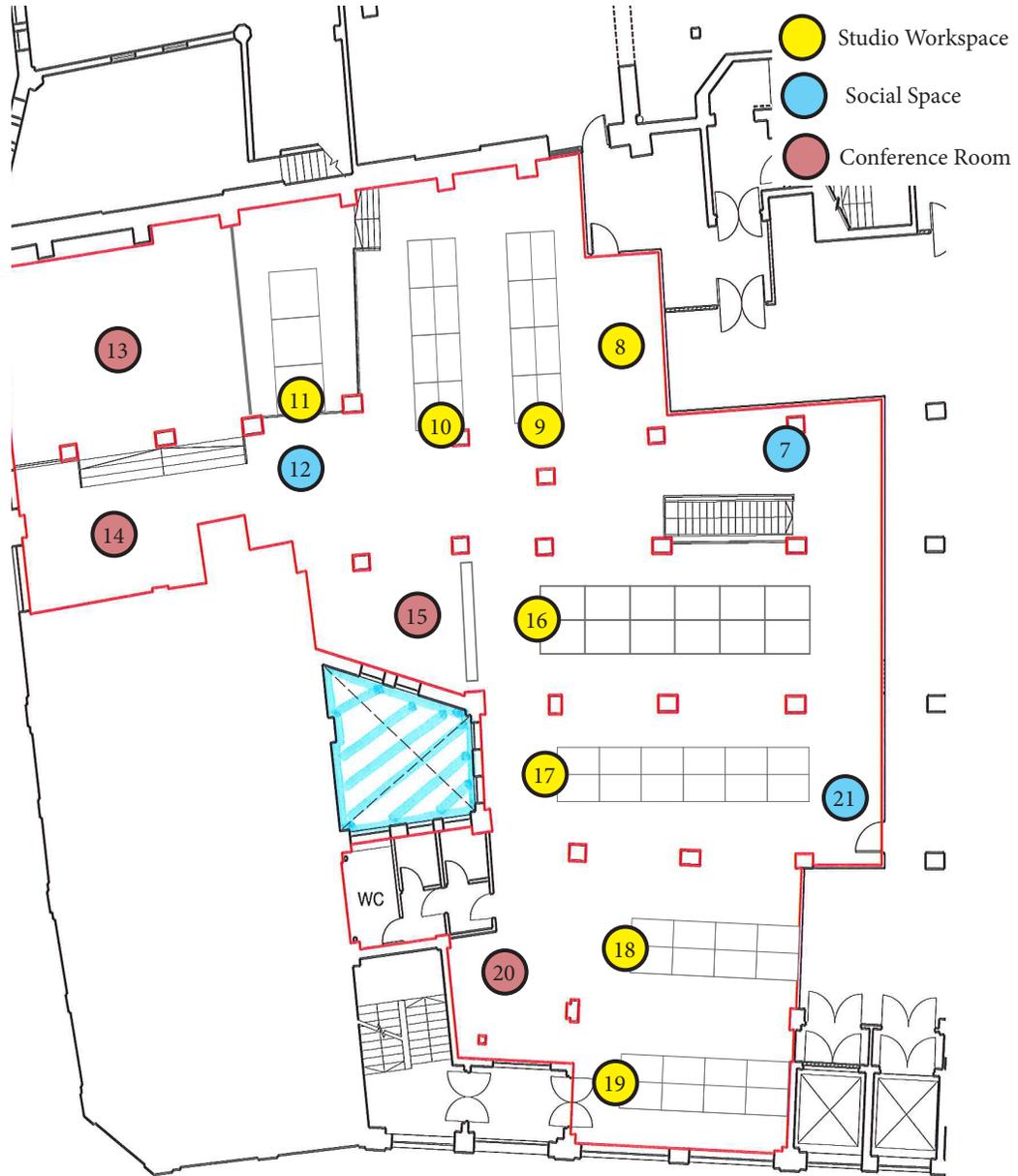
APPENDIX B - New York City Floor Plan with Location Identifications



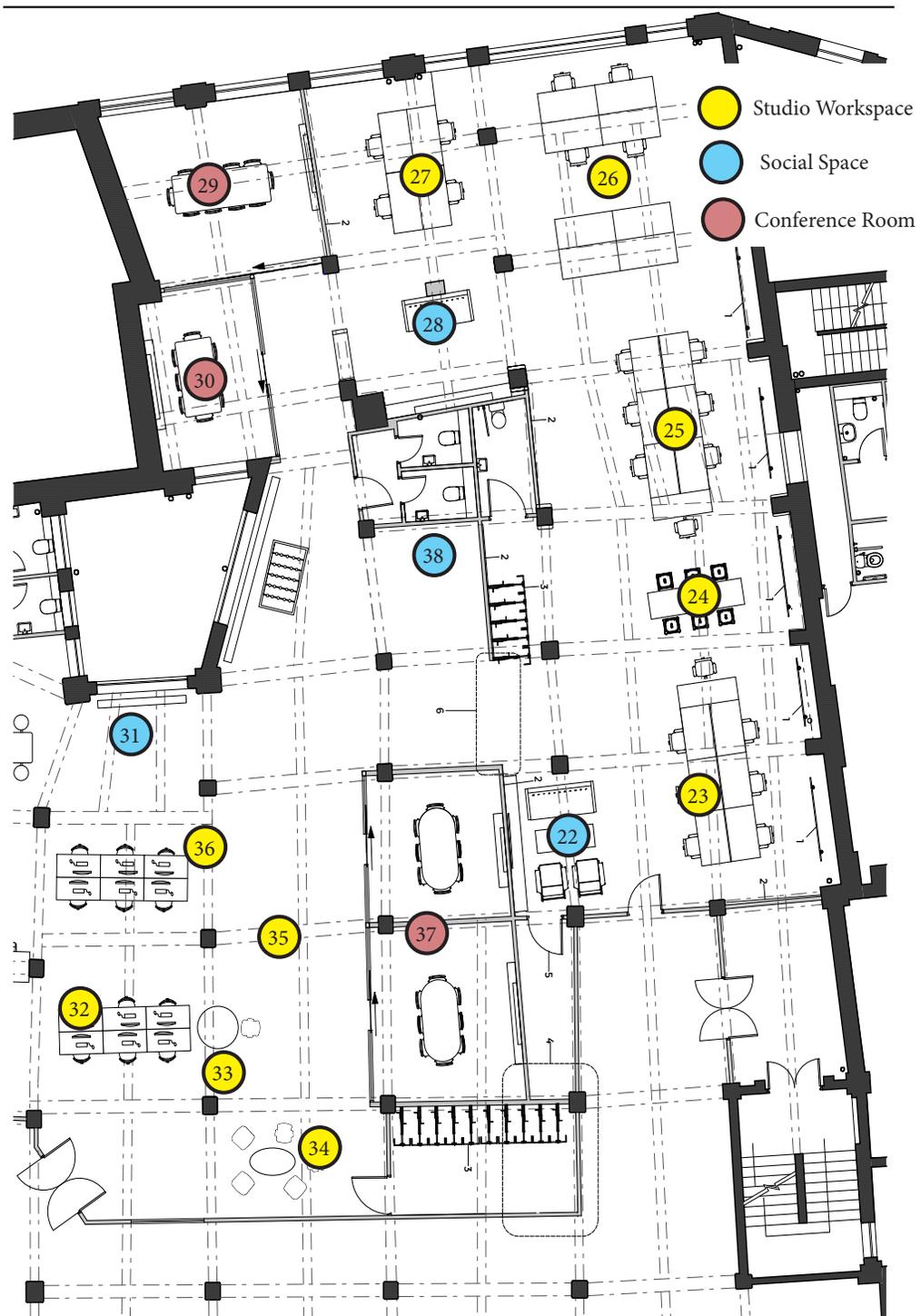
APPENDIX C - London Floor Plans with Location Identifiers- Ground Floor



APPENDIX D - London Floor Plans with Location Identifiers- First Floor



APPENDIX E - London Floor Plans with Location Identifiers- Third Floor



APPENDIX F – Employee Survey

Default Question Block

Section 1 of 4

During an average work week, where do you spend your time working? (percentages must total 100%):

- | | |
|--|----------------------------------|
| 1. Main (or primary) ustwo office/studio | <input type="text" value="0"/> % |
| 2. Other ustwo location | <input type="text" value="0"/> % |
| 3. Home | <input type="text" value="0"/> % |
| 4. Client site (visit) | <input type="text" value="0"/> % |
| 5. Traveling (for work) | <input type="text" value="0"/> % |
| 6. Other non-travel (cafe, library, etc) - please indicate below | <input type="text" value="0"/> % |
| Total | <input type="text" value="0"/> % |

Other Location(s):

Please indicate your overall satisfaction level with the current physical work/studio environment at ustwo, including workstations, conference rooms, common areas, etc?

- | | | | | | | |
|------------------------|-----------------------|-----------------------|------------------------------------|-----------------------|-----------------------|-----------------------|
| Extremely Dissatisfied | Dissatisfied | Somewhat Dissatisfied | Neither Satisfied nor Dissatisfied | Somewhat Satisfied | Satisfied | Extremely Satisfied |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

For the time you spend at your main (or primary) ustwo office/studio during an average work week, what percentage of time do you spend working at the following locations? (total must equal 100%):

- | | |
|--|----------------------------------|
| 1. Individual workspace/your desk: | <input type="text" value="0"/> % |
| 2. Conference Room: | <input type="text" value="0"/> % |
| 3. Phone Booth: | <input type="text" value="0"/> % |
| 4. Common Area (coffee, kitchen area): | <input type="text" value="0"/> % |
| 5. Couches or 'soft areas' | <input type="text" value="0"/> % |
| 6. Breakout tables/workbench | <input type="text" value="0"/> % |
| 7. Other (please indicate below): | <input type="text" value="0"/> % |
| Total | <input type="text" value="0"/> % |

Other location(s):

How would you define your individual **assigned** workspace/desk at ustwo?

- Shared office with 2 or more individuals (individual desks in office enclosed with walls & door)
- Personal desk with high partitions, cannot see over walls when standing
- Personal desk with low partitions, can see over walls when standing
- Individual private office
- Shared table/desk with no partitions
- No individual assigned workstation (free address/hoteling)
- Individual desk or workstation with no partitions (not part of a table)

How would you rate your individual workspace/desk in terms of the following attributes:

	Very poor	Poor	Somewhat poor	Fair	Somewhat good	Good	Very good
General functionality of the workspace (size, overall layout)	<input type="radio"/>						
Ease of contact to people with whom you need to conduct work	<input type="radio"/>						
Access to resources you need to conduct your work (ex. printers, copiers, other office equipment)	<input type="radio"/>						
Work storage space	<input type="radio"/>						
Space to display personal objects	<input type="radio"/>						
Space to display work related subject matter	<input type="radio"/>						
Access to plugs and necessary ports	<input type="radio"/>						
Overall interior design (your feelings on colors, materials, etc)	<input type="radio"/>						

How many hours do you work in a typical week?

How many hours in a typical week do you spend in **your main ustwo office/studio location**?

In general, what are your regular hours at work? (what time do you normally come in and what time do you normally leave on a typical work day?) e.g. 9am - 5pm

Thinking about the time you spend in **your main ustwo office/studio location**, please specify the percentage of

time you spend on the following activities during your average workweek:

1. Individual focused work	<input type="text" value="0"/> %
2. Learning new skills (ex. listening to a webinar or sitting in on skills training - not interactive)	<input type="text" value="0"/> %
3. Face-to-face work meetings (collaborate in person)	<input type="text" value="0"/> %
4. Conference calls/Phone calls with clients and/or colleagues (no video)	<input type="text" value="0"/> %
5. Virtual collaboration (Video Conference, Skype, etc)	<input type="text" value="0"/> %
6. Supplementary activities (scheduling, copying, printing, getting organized, etc)	<input type="text" value="0"/> %
7. Socialization/breaks with colleagues/other "ustwobies" (face to face)	<input type="text" value="0"/> %
8. Online chatting (ex. gchat/messaging - text based)	<input type="text" value="0"/> %
9. Town Halls/Studio Meetings/Fireside Chats	<input type="text" value="0"/> %
10. Other (please specific below)	<input type="text" value="0"/> %
Total	<input type="text" value="0"/> %

Other Activities:

Section 2 of 4

Please rate how critical each activity is to your core job role

NOTE: if you have not listed an "Other" activity above, please simply mark it as "Minimally Critical" here:

	Minimally Critical	Moderately Critical	Highly Critical
Individual focused work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learning new skills (ex. listening to a webinar or sitting in on skills training - not interactive)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Face-to-face work meetings (collaborate in person)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conference calls/Phone calls with clients and/or colleagues (no video)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Virtual collaboration (Video Conference, Skype, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplementary activities (scheduling, copying, printing, getting organized, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Socialization/breaks with colleagues/other "ustwobies" (face to face)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online chatting (ex. gchat/messaging - text based)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Town Halls/Studio Meetings/Fireside Chats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (as you identified above)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In general, is the **movement of colleagues** within your workspace/desk area welcome or disruptive? (ex. people walking by your desk, client tours, posting materials on walls) (please select one of the 7 options below that best describes your perceptions)

Very welcome (enhancing)	Welcome	Somewhat welcome	Neither disruptive nor welcome (generally goes unnoticed)	Somewhat disruptive	Disruptive	Very disruptive
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How frequently do you find the **movement of colleagues** within your workspace/desk area disruptive?

Never	Almost Never	Rarely	Sometimes	Often	Very Often	All the time
<input type="radio"/>						

How would you describe your feelings regarding the **movement of colleagues** within your workspace/desk area during these specific tasks?

(if you have not listed an "Other" activity above, please simply mark it as "Neither disruptive nor welcome" here):

	Very welcome (enhancing)	Welcome	Somewhat welcome	Neither disruptive nor welcome (generally goes unnoticed)	Somewhat disruptive	Disruptive	Very disruptive
Individual focused work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learning new skills (ex. listening to a webinar or sitting in on skills training - not interactive)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Face-to-face work meetings (collaborate in person)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conference calls/Phone calls with clients and/or colleagues (no video)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Virtual collaboration (Video Conference, Skype, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplementary activities (scheduling, copying, printing, getting organized, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Socialization/breaks with colleagues (face to face)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online chatting (ex. gchat/messaging - text based)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Town Halls/Studio Meetings/Fireside Chats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify below)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other Activities:

In general, is the **sound/noise level** within your workspace/desk area welcome or disruptive? (please select one

of the 7 options below that best describes your perceptions)

Very welcome (enhancing)	Welcome	Somewhat welcome	Neither disruptive nor welcome (generally goes unnoticed)	Somewhat disruptive	Disruptive	Very disruptive
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How frequently do you find the **sound/noise level** within your workspace/desk area disruptive?

Never	Almost Never	Rarely	Sometimes	Often	Very Often	All the time
<input type="checkbox"/>						

How would you describe your feelings regarding the **sound/noise level** within your workspace/desk area during these specific tasks?

NOTE: if you have not listed an "Other" activity above, please simply mark it as 'Neither disruptive nor welcome' here

	Very welcome (enhancing)	Welcome	Somewhat welcome	Neither disruptive nor welcome (generally goes unnoticed)	Somewhat disruptive	Disruptive	Very disruptive
Individual focused work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Learning new skills (ex. listening to a webinar or sitting in on skills training - not interactive)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Face-to-face work meetings (collaborate in person)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conference calls/Phone calls with clients and/or colleagues (no video)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Virtual collaboration (Video Conference, Skype, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplementary activities (scheduling, copying, printing, getting organized, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Socialization/breaks with colleagues (face to face)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online chatting (ex. gchat/messaging - text based)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Town Halls/Studio Meetings/Fireside Chats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify below)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other Activities:

Do alternative spaces (in lieu of your assigned workspace/desk) exist within your work/studio environment for you to use for a specific task? (ex. are conference rooms available for meetings, phone booths for calls, etc)

Yes

No

Are alternative spaces available and accessible to you within your work/studio environment for your task? (are they open for you to use?)

- Yes
 No

What is your favorite place to work within your primary ustwo office/studio location?

Please briefly explain why it's your favorite place to work:

How often do you use headphones at work?

- | | | | | | | | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Never | A few hours each day | | | | | | All Day/Every Day | | | |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| <input type="radio"/> |

When using your headphones, what percentage of the time do you use headphones for the following activities?

- | | |
|--|---|
| 1. Noise reduction/blocking out outside noise (without music) | <input style="width: 30px;" type="text"/> % |
| 2. Listening to music | <input style="width: 30px;" type="text"/> % |
| 3. For phone conversations | <input style="width: 30px;" type="text"/> % |
| 4. A visual cue to others that you do not want to be disturbed | <input style="width: 30px;" type="text"/> % |
| Total | <input style="width: 30px;" type="text"/> % |

Thinking about the studio-wide sound system (Sonos, or another brand), please answer the following questions:

	Very Dissatisfied	Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Satisfied	Very Satisfied
Overall sound level	<input type="radio"/>						
Control over the sound level	<input type="radio"/>						
Music selection (song choice/genre)	<input type="radio"/>						
Control over the music selection (choice of what music gets played)	<input type="radio"/>						

You indicated you were not satisfied with the sound level, please specify too soft or too loud using the following scale:

Too soft (I can't hear it) Too Loud

0 1 2 3 4 5 6 7 8 9 10

Section 3 of 4

Which of the following best describes your current seating?

- Assigned desk (not project based)
- Project based group seating, I am assigned a desk (no choice)
- Project based group seating, I choose a desk for entire project time period
- Project based group seating, I choose a desk according to preference every day

How satisfied are you with your current seating?

Very Dissatisfied Dissatisfied Somewhat Dissatisfied Neutral Somewhat Satisfied Satisfied Very Satisfied

If given a choice, which of the following seating would you prefer?

- Same desk over time (not project based)
- New desk every project
- New desk every day
- Don't care

Please share any thoughts/or elaborate on your seating preference:

Thinking about when you first joined ustwo, please rank in order the components of your offer that most impacted your decision to **join** ustwo (1 is most impactful, 10 is least impactful) - simply drag the components into your rank order (1 at the top, 10 at the bottom)

- Location _____
- Compensation Package (Base salary, Bonus-annual cash bonus, Benefits, Equity-company ownership) _____
- Leadership _____
- Colleagues _____
- Type of Industry _____
- Workspace (the work environment at your primary location) _____
- Company Reputation _____

-
- Growth potential/mentorship/skill development
 - Job Responsibilities
 - Management style/Company Culture (task autonomy vs. micro-management)
-

Please rank in order the component of the job that are most impactful on your decision to **stay** with us two (1 is most impactful, 10 is least impactful) - simply drag the components into your rank order (1 at the top, 10 at the bottom)

- Location
 - Colleagues
 - Leadership
 - Company Reputation
 - Compensation Package (Base salary, Bonus-annual cash bonus, Benefits, Equity-company ownership)
 - Type of Industry
 - Job Responsibilities
 - Workspace (the work environment at your primary location)
 - Growth potential/mentorship/skill development
 - Management style/Company Culture (task autonomy vs. micro-management)
-

What do you like **most** about your current work environment?

What do you like **least** about your current work environment?

Anything else you would like to share about your work environment?

To what extent do you think ustwo needs to renovate or redesign your physical office/work environment (this includes all workstations, offices, hallways, common areas, conference rooms, etc)

- Not at all Somewhat Very Much
-

How long have you been with ustwo?

- less than 3 months
- 3 months to under 6 months
- 6 months to under a year
- 1 to 2 years
- 3 to 4 years
- 5 to 6 years
- More than 6 years

Are you...

- Male
- Female
- Prefer not to answer

What is your age?

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65 years or older

Were you primarily raised?

- An only child
- 1 of 2 children
- 1 of 3 children
- 1 of 4 or more children

Please specify your ethnicity:

- White (non-Hispanic)
- Hispanic or Latino
- Black or African American
- Native American or American Indian
- Asian Indian
- Chinese
- Japanese
- Korean
- Other (please write-in)
- Prefer not to answer

Other:

What is your nationality? (British, Swedish, etc)

Section 4 of 4

How I am in general

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who *likes to spend time with others*? Please select the number next to **every** statement to indicate the extent to which **you agree or disagree with that statement**.

1	2	3	4	5
Disagree Strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree Strongly

I am someone who...

	Disagree Strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree Strongly
Is talkative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tends to find fault in others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does a thorough job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is depressed, blue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is original, comes up with new ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is reserved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Is helpful and unselfish with others	<input type="radio"/>				
Can be somewhat careless	<input type="radio"/>				
Is relaxed, handles stress well	<input type="radio"/>				
Is curious about many different things	<input type="radio"/>				
Is full of energy	<input type="radio"/>				
Starts quarrels with others	<input type="radio"/>				
Is a reliable worker	<input type="radio"/>				
Can be tense	<input type="radio"/>				
Is ingenious, a deep thinker	<input type="radio"/>				
Generates a lot of enthusiasm	<input type="radio"/>				
Has a forgiving nature	<input type="radio"/>				
Tends to be disorganized	<input type="radio"/>				
Worries a lot	<input type="radio"/>				
Has an active imagination	<input type="radio"/>				
Tends to be quiet	<input type="radio"/>				
Is generally trusting	<input type="radio"/>				

How I am in general

1	2	3	4	5
Disagree Strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree Strongly

**Next,
I am someone who...**

	Disagree Strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
Tends to be lazy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is emotionally stable, not easily upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is inventive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has an assertive personality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be cold and aloof	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perseveres until the task is finished	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be moody	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Values artistic, aesthetic experiences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is somewhat shy, inhibited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is considerate and kind to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

almost everyone	<input type="radio"/>				
Does things efficiently	<input type="radio"/>				
Remains calm in tense situations	<input type="radio"/>				
Prefers work that is routine	<input type="radio"/>				
Is outgoing, sociable	<input type="radio"/>				
Is sometimes rude to others	<input type="radio"/>				
Makes plans and follows through with them	<input type="radio"/>				
Gets nervous easily	<input type="radio"/>				
Likes to reflect, play with ideas	<input type="radio"/>				
Has few artistic interests	<input type="radio"/>				
Likes to cooperate with others	<input type="radio"/>				
Is easily distracted	<input type="radio"/>				
Is sophisticated in art, music, or literature	<input type="radio"/>				

In an effort to compare your responses to physical measurements in your work environment, please provide your first and last **name and office location** (NYC, London or Malmo). **This information will only be available to the researcher. Please note that data for any forms of publication will be aggregated and all personal identifiers will be excluded.**

One last question.....how important is it that Table Football/Foosball (for London/Malmo) / Mario Kart (for NYC) be a part of the workspace?

Not at all important										Extremely important
0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>										

APPENDIX G – Observational Survey

Default Question Block

Location

- Malmö
- London
- NYC

Floor

- Ground
- Floor 1
- Floor 3
- Dice

Room/Location ID:

Is this a:

- Conference room
- Studio Group
- Social Area

Is anyone at the table?

- yes
- no

Seat Location ID:

	In seat	Not in seat	No headphones	Over-ear headphones	Earbuds
1	<input type="checkbox"/>				
2	<input type="checkbox"/>				
3	<input type="checkbox"/>				
4	<input type="checkbox"/>				
5	<input type="checkbox"/>				
6	<input type="checkbox"/>				
7	<input type="checkbox"/>				
8	<input type="checkbox"/>				

9	<input type="checkbox"/>				
10	<input type="checkbox"/>				
11	<input type="checkbox"/>				
12	<input type="checkbox"/>				

Click to write the question text

	Focused Work/Computer Work	Informal Collaboration	On the phone	Meeting w/ Colleague over computer
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Is conference room/social area in use?

- yes
- no

Activity (check all that apply):

- Individual focused work
- Learning new skills (ex. listening to a webinar or sitting in on skills training - not interactive)
- Face-to-face work meetings (collaborate in person)
- Conference calls/Phone calls with clients and/or colleagues (no video)
- Virtual collaboration (Video Conference, Skype, etc)
- Supplementary activities (scheduling, copying, printing, getting organized, etc)
- Socialization/breaks with colleagues (face to face)
- Online chatting (ex. gchat/messaging - text based)
- Other (please specify below)
- Working over a common computer

Other:

How many people total involved in the activity?

Sound meter reading (max):

Stop 33 -Is there a meeting going on at the next table?

- Yes
 - No
-

How many people are in the meeting?

Stop 37

	Not in use	In use	More than 1 person	Door open
War Room 1 (by wall)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conf Room 2 (middle)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
War Room 3 (by hallway)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Is foosball being played?

- Yes
 - No
-

Is music being played (sonos)?

- Yes
 - No
-

Additional Notes:

APPENDIX H

Impact of Visual Stimuli on Perception of Movement within the workplace

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	8.254018	5.092952	50.000	1.621	.111	-1.975477	18.483513
Refuge	-.091020	.251896	50	-.361	.719	-.596968	.414928
Prospect	-.056695	.325764	50	-.174	.863	-.711011	.597622
PercNoise60	.006530	.028148	50.000	.232	.817	-.050006	.063066
MeanNoisemeandba	-.056318	.102245	50.000	-.551	.584	-.261682	.149047
ZO	.011975	.702189	50.000	.017	.986	-1.398413	1.422364
ZC	-.860196	.681410	50	-1.262	.213	-2.228849	.508456
ZE	1.291484	.786458	50	1.642	.107	-.288164	2.871132
ZA	-.525067	.744281	50	-.705	.484	-2.019999	.969864
ZN	-1.052603	.906398	50	-1.161	.251	-2.873156	.767951
Prospect * ZO	-.259210	.339213	50	-.764	.448	-.940539	.422119
Prospect * ZC	.364895	.313862	50	1.163	.251	-.265515	.995304
Prospect * ZE	-.095257	.286964	50	-.332	.741	-.671641	.481127
Prospect * ZA	.755670	.369795	50	2.043	.046	.012915	1.498425
Prospect * ZN	.602043	.396168	50	1.520	.135	-.193684	1.397771
Refuge * ZO	.372504	.271022	50	1.374	.175	-.171860	.916869
Refuge * ZC	-.160912	.268685	50	-.599	.552	-.700581	.378758
Refuge * ZE	-.183708	.223628	50	-.821	.415	-.632879	.265462
Refuge * ZA	-.741495	.349938	50	-2.119	.039	-1.444366	-.038623
Refuge * ZN	-.433026	.303659	50	-1.426	.160	-1.042944	.176891

a. Dependent Variable: Movement Score.

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