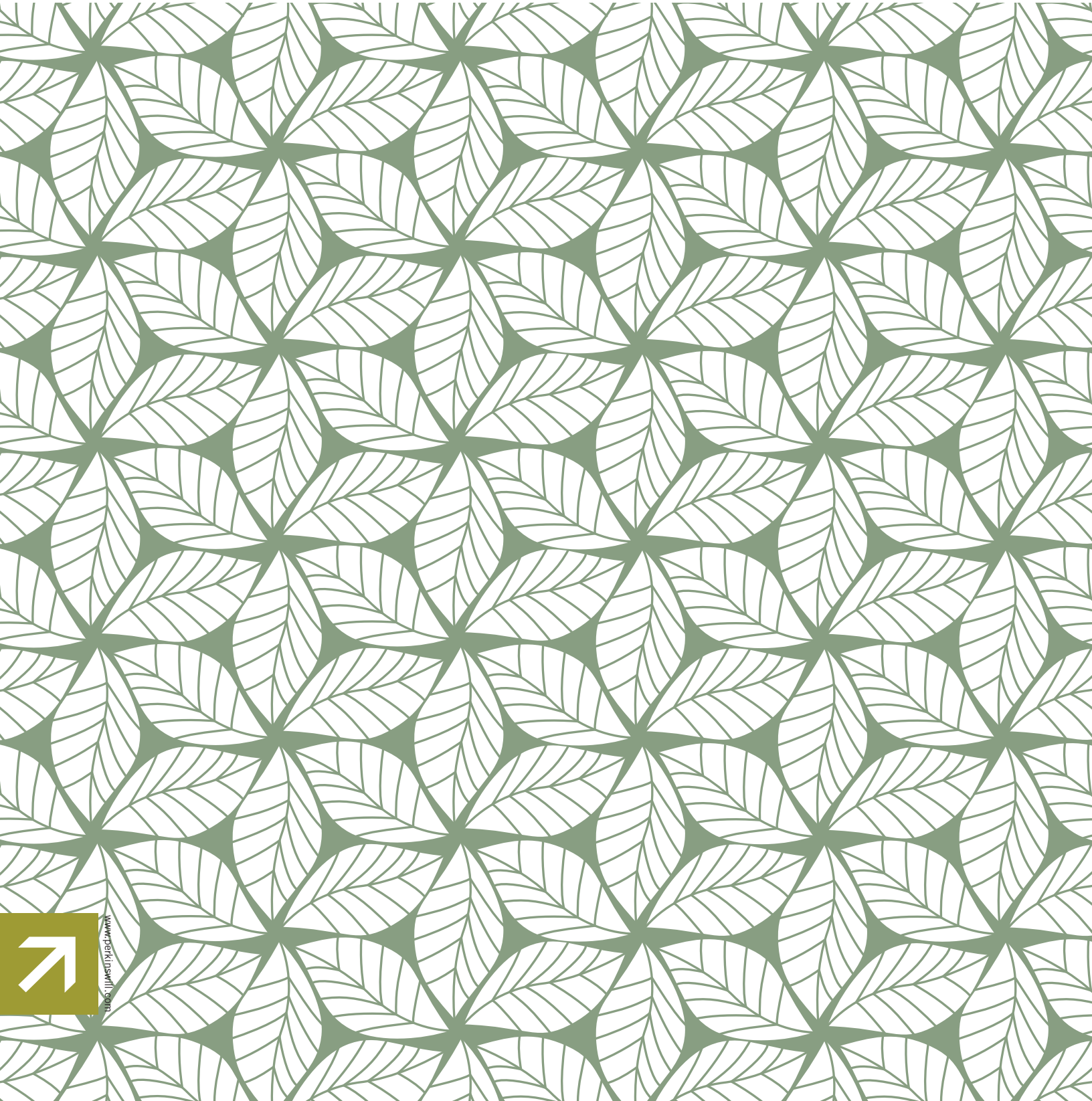


PERKINS+WILL

Research Journal



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JOURNAL OVERVIEW

The Perkins+Will Research Journal documents research relating to the architectural and design practice. Architectural design requires immense amounts of information for inspiration, creation, and construction of buildings. Considerations for sustainability, innovation, and high-performance designs lead the way of our practice where research is an integral part of the process. The themes included in this journal illustrate types of projects and inquiries undertaken at Perkins+Will and capture research questions, methodologies, and results of these inquiries.

The Perkins+Will Research Journal is a peer-reviewed research journal dedicated to documenting and presenting practice-related research associated with buildings and their environments. The unique aspect of this journal is that it conveys practice-oriented research aimed at supporting our teams.

This is the eighteenth issue of the Perkins+Will Research Journal. We welcome contributions for future issues.

RESEARCH AT PERKINS+WILL

Research is systematic investigation into existing knowledge in order to discover or revise facts or add to knowledge about a certain topic. In architectural design, we take an existing condition and improve upon it with our design solutions. During the design process we constantly gather and evaluate information from different sources and apply it to solve our design problems, thus creating new information and knowledge.

An important part of the research process is documentation and communication. We are sharing combined efforts and findings of Perkins+Will researchers and project teams within this journal.

Perkins+Will engages in the following areas of research:

- Market-sector related research
- Sustainable design
- Strategies for operational efficiency
- Advanced building technology and performance
- Design process benchmarking
- Carbon and energy analysis
- Organizational behavior

EDITORIAL

This issue of Perkins+Will Research Journal includes four articles that focus on different research topics, such as the impact of active workstations in office environments, methods for integrating material health research with the design process, influences of indoor plants on psychological well-being in workplaces, and effects of a mentoring program in design practice.

“Activating the Workplace: The Impact of Active Workstations on Employee Effectiveness” discusses how active workstations affect physical and psychological well-being, as well as employee effectiveness in office environments. This literature review study analyzed existing publications. It offers an insight how height-adjustable workstations and treadmill desks impact cognitive functions, productivity and performance of office workers.

“Material Health and Transparency: Methods for Improved Integration with Design Process” presents how material health research can be improved through user-friendly online databases and physical material libraries. The article discusses relationships between materials, their impacts on health, and designers’ decision-making in selecting and specifying healthy materials. The article also discusses how online databases and physical material libraries can be improved to facilitate integration of material research and design process.

“Outside In: Influences of Indoor Plants on Psychological Well-Being and Memory Task Performance in a Workplace Setting” presents an experimental study that investigated relationships between indoor plants, psychological response and performance of office workers. The results of the study indicate marginal increase in memory task performance with the presence of plants, but improvements in psychological well-being were not found. The findings suggest that plants in the workplace may not be noticed by employees due to complexities of daily tasks. Indoor plants may have more impact on psychological well-being in restorative environments, such as healthcare facilities.

“Learning Through Osmosis: A Report on the Seattle Mentorship Program’s Pilot Session” considers an alternative approach to mentorship in design practices, which links mentors and mentees in a less formal way than traditional mentorship programs through shadowing opportunities. The article reviews structure of the program, processes and outcomes of a pilot session, where focus groups and surveys were used to understand the effectiveness of the program. Results indicate that mentees gained greater career insight and knowledge about the intricacies of the design practice.

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01.

ACTIVATING THE WORKPLACE:

The Impact of Active Workstations on Employee Effectiveness

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ABSTRACT

Today's workforce understands that sitting all day is not healthy. As a result, employees are increasingly requesting more opportunities for movement throughout the workday. Workplace design has evolved to address sedentary behavior through active workstations, which allow individuals to experience the benefits of movement and posture change while engaging in productive work.

Research on the health impacts of active workstations is well established, and most studies show an inverse relationship between the availability of active workstations and workers' sedentary behavior. However, evidence of how these interventions impact employees beyond reducing sedentary behavior is still emerging. This paper contributes to this developing body of research by providing an overview of how active workstations affect an individual's ability to effectively perform everyday job responsibilities. For the purposes of this paper, active workstations are defined as height-adjustable and treadmill desks.

To explore the relationship between active workstations and employee effectiveness, a literature search was conducted. Articles were reviewed if they were published in a peer-reviewed journal within the past 10 years, analyzed more than just sedentary behavior, and were generalizable to the workplace.

Findings suggest that height-adjustable desks have a neutral or positive impact on cognitive function and productivity/performance, and a positive impact on psychological outcomes, such as mood or energy levels. Research on the relationship between treadmill desks and employee effectiveness is still emerging, but preliminary evidence suggests that treadmill desks have a neutral or positive effect on cognitive function and psychological outcomes like boredom and satisfaction, and a mixed impact on productivity/performance. More robust, long-term studies are necessary to determine the impact that active workstations have on employee effectiveness over time.

KEYWORDS: active workstation; workplace; cognitive function; productivity; well-being

1.0 INTRODUCTION

You may want to stand up for this: Research shows that sedentary behavior causes or intensifies a wide range of health problems^{1, 2, 3}. Contrary to popular belief, physical inactivity and sedentary behavior are two distinct behaviors. A mounting body of evidence suggests total sedentary time is negatively associated with health risks like heart disease, diabetes, musculoskeletal pain, and

abdominal obesity independent of “protective contributions of moderate-to-vigorous physical activity”⁴. To put it bluntly, no matter how much you exercise, if you spend the majority of your day sitting, you may be prone to serious health risks.

A 2013 study reported that sedentary time accounts for 82 percent of employees' work hours⁵. Several studies

have validated that office workers spend the majority of their workday sitting down^{6, 7, 8}, and estimates of cumulative daily sedentary time (including sleep) reach 11 to 16 hours a day^{9, 10, 11}. Because sedentary behavior is so prevalent during work hours, health professionals have pinpointed the workplace as a prime location to reduce sitting. Organizational leaders have taken note, and many companies now provide employees with active workstations to encourage more standing and movement in the workplace.

In response to active workstations' growing popularity, researchers have designed experiments to verify whether or not the interventions are successful in decreasing workplace sedentary behavior. These experiments also frequently evaluate health measures like caloric expenditure, blood pressure, and heart rate, among others. Perhaps unsurprisingly, the adoption of active workstations has been linked to decreased time spent sitting at work, and has also had demonstrated effects on employees' health and well-being.

However, evidence on how active workstations impact employees beyond sedentary behavior is still emerging. Many employers, while intrigued by the established health benefits of active workstations, wonder if these non-traditional interventions might impede workers from completing normal work tasks.

To help answer this question, this article reviews an emerging body of research that asks how active workstations affect an individual's ability to effectively perform his/her everyday job responsibilities. The active workstations considered in this article are height-adjustable and treadmill desks, since they are the most common active workstations on the market today. Specifically, this article explores the relationship between active workstations and employee effectiveness through three main areas: cognitive function, productivity/performance, and psychological outcomes. Preliminary evidence on the relationship between these employee effectiveness areas and active workstations, along with their proven impact on workplace sedentary behavior, make a compelling case for the active workstation as a tool to promote workplace well-being.

1.1 Methodology

The author conducted a literature review of articles published from January 2007 to May 17, 2017. An article was included in this review if it met the following criteria: (1) published in a peer-reviewed journal within the past 10 years, (2) analyzed more than just sedentary behavior and or physical health, and (3) was gen-

eralizable to the workplace. Ultimately, 16 articles met this inclusion criteria, with approximately 70 percent of considered papers excluded. The main reasons for exclusion included: a lack of consideration of employee effectiveness measures (the study solely measured sedentary behavior or physical health), and a lack of generalizability to the workplace (the study took place in an elementary school classroom). All graduate student dissertations and theses were excluded unless they were published in a peer-reviewed journal.

1.2 Definitions

Three main concepts related to employee effectiveness were researched for this review. The following definitions are adopted from articles that explore these topics.

Cognitive function: A set of mental processes responsible for perception, memory, learning, and action, involving skills such as planning, problem solving, task switching, decision-making, and critical thinking¹².

Productivity/performance: Across the studies, productivity/performance are generally measured by how efficiently and accurately an individual performs the tasks that constitute his/her job responsibilities^{13, 14, 15}.

Psychological outcomes: Psychological states and feelings, measured by variables such as:

Arousal: Feelings of activation and reactivity, associated with productive coping responses

Boredom: A state of being restless through lack of interest, often associated with distraction from work

Stress: Negative cognitive outcomes associated with completing a task, often causing mental or bodily tension

Task satisfaction: Refers to a pleasurable or positive emotional state resulting from completing a task¹⁶.

2.0 ACTIVE WORKSTATIONS—WORKPLACE TREND OR THE NEW NORMAL?

Attention-grabbing headlines like "Sitting is the New Smoking"¹⁷ have made the health risks of excessive sedentary behavior well known among the general public. Similarly, health benefits of active workstations are growing more apparent, due to favorable popular

press^{18, 19, 20} and even celebrity endorsements from the likes of late-night television host Jimmy Kimmel and fashion designer Victoria Beckham, who are both avid treadmill desk users^{21, 22}.

This widespread media coverage relates to a growing interest in workplace health and wellness. A recent report dubbed wellness “the next trillion-dollar industry,” indicating that “the trends all point in a single direction—more and more consumer spending on health and wellness...as employers invest in healthy living programs and as customers take more responsibility for optimizing their own health”²³. And if the rise of wellness certifications, such as Fitwel or WELL, are any indication, health and well-being in the workplace are taken seriously by employers and designers alike.

Active workstations—especially height-adjustable desks—are becoming more commonplace across different industries, playing a key role in workplace reengineering for health and well-being. According to the Perkins+Will benchmarking database, 60 percent of our benchmarked projects offer height-adjustable desks for employees²⁴. While the database does not quantify

treadmill desk implementation, Perkins+Will designers have observed clients’ growing interest in treadmill desk programs. For example, one consumer products company implemented a “walkstation” treadmill desk program, which offered the desks in both open and private areas within their office. Another client took treadmill desks a step further by including a treadmill conference table, facilitating simultaneous walking, computer work, and collaboration. Design experts forecast that the ubiquity of active workstations will only continue to grow, especially as a healthy workplace is solidified as a competitive advantage for companies attempting to attract and retain talent²⁵.

2.1 A Brief Summary of the Known Health Impacts of Active Workstations

Although this article focuses on how active workstations impact employee well-being beyond physical health, background information on the health impacts of height-adjustable and treadmill desks will help establish how active workstations support workers’ ability to succeed on the job.



Figure 1: “Height-adjustable desks, or sit-stand desks” allow workers to easily move their work surface up or down to facilitate standing throughout the day.

Height-adjustable desks (commonly called “sit-stand desks”) allow workers to easily move their work surface up or down to facilitate periods of standing and posture change throughout the day, as seen in Figure 1. As workers change posture, large muscle groups in the legs and trunk are exerted, pumping blood throughout the musculoskeletal system²⁶. Overall, compared with sitting all day, using height-adjustable desks promotes:

higher caloric expenditure²⁷, reduced risk of type 2 diabetes²⁸, and reduced risk of cancer²⁹. However, researchers caution that impactful sit-stand desk usage is dependent “on the culture instituted in the workplace” and that “workers must be diligent about changing heights throughout the day over the long term”³⁰ in order to enjoy significant health benefits.



Figure 2: Treadmill desks allow employees to walk at a slow pace while performing normal job responsibilities.

Treadmill desks allow employees to walk at a slow pace while performing normal job responsibilities, as seen in Figure 2. According to numerous studies, the availability of treadmill desks at work results in significant reductions in workplace sedentary behavior,^{31, 32, 33, 34} with one study reporting that participants reduced time spent sitting by 66 minutes per day, which represents a 224 percent decrease³⁵. Compared to height-adjustable desks, treadmill desks allow for an even higher caloric expenditure³⁶ and greater physiological improvements like “sustained reductions in blood pressure”³⁷. They have also been associated with moderate decreases in body weight and weight circumference^{38, 39, 40}. Most researchers agree, however, that the primary benefit of treadmill desks is reduced sedentary behavior, acknowledging that modest weight loss is associated with long-term usage and mainly occurs in obese participants. In short, treadmill desks should not be deemed a substitute for vigorous physical activity, but should be seen as a valuable tool to help increase movement throughout the day.

The introduction of height-adjustable and treadmill desks into the workplace can be an effective strategy to combat workplace sedentary behavior. These interventions also have demonstrated effects on key health outcomes, especially when used over the long term.

3.0 ACTIVE WORKSTATIONS—BEYOND PHYSICAL HEALTH

Decision-makers at companies often understand the importance of decreasing sedentary behavior at work, but want more than just health information when deciding whether or not active workstations are a good fit for their workplaces. An emerging body of research responds to this concern by focusing on the impact of active workstations on how employees think, perform, and feel. The following sections review evidence on how height-adjustable and treadmill desks influence employees’ cognitive function, productivity/performance, and psychological outcomes.

3.1 Cognitive Function

Cognitive function, or cognition, refers to a set of mental processes responsible for perception, memory, learning, and action, and involves skills such as planning, problem solving, task switching, decision-making, and critical thinking⁴¹. The cognitive process is constantly present in our everyday lives, whether we are aware of it (such as when we complete a complex math problem), or not (when we automatically stop our vehicles when

we see a red light). Studies on cognition are especially relevant to the workplace, because cognitive abilities like communication, thinking, and learning form the foundation of all workplace activities—from the simple to the complex. This section asks whether or not active workstation use promotes or impedes cognition in the workplace.

Height-Adjustable Desks

Current research on the relationship between height-adjustable desks and cognitive function is underdeveloped. Most researchers design their experiments on active workstations and cognition to study the impact of movement. Because of this, it is possible that height-adjustable desk usage may not be considered relevant for this research focus, since the intervention promotes posture change and standing, but not continuous movement. Nonetheless, the relationship between cognition and height-adjustable desks is addressed in two recent studies. Findings from these studies suggest that height-adjustable desks have a positive or neutral effect on cognition.

A 2016 comparison study on cognitive effects following periods of standing and walking at active workstations reported promising findings. Significant performance improvements were found in both the standing and walking conditions for psychomotor function and working memory and attention, suggesting that posture change may be as effective as walking for these cognitive effects⁴². However, executive function performance, or reasoning and problem solving, remained neutral in both conditions. Researchers reason that “chronic exposure to standing may be required to elicit improvements,” citing a longer-term study of height-adjustable desks in schools which reported improvements in executive function⁴³. This study suggests that the performance effects of active workstation use may vary by area of cognition, but notably did not find significant decreases in cognition in the standing or walking conditions.

Furthermore, a 2011 study on attention and memory while sitting, standing, or using a treadmill workstation also reported favorable findings⁴⁴. While researchers did not observe significant improvements in attention or memory while standing or walking, they also did not report significant detriments to these aspects of cognition. Therefore, the authors of this study support the use of active workstations while performing activities that require memory and attention, since cognitive performance remains neutral, yet the benefits of decreased sedentary behavior can be achieved.

Treadmill Desks

Compared to height-adjustable desks, research on the relationship between cognition and treadmill desks in the workplace is more fully developed. It is possible that there is a greater interest in this relationship due to the precedent set by neuroscientists and health scientists, who frequently study cognition and movement together when exploring how exercise may benefit memory and intelligence. Additionally, organizational stakeholders often express concerns over the “dual demands” of mental processing and walking that treadmill desk usage requires⁴⁵. In response, researchers have employed a variety of cognitive battery tests in lab settings to explore how walking at a treadmill desk impacts cognition at work.

Overall, study results suggest that treadmill desks have a neutral or positive impact on cognitive function^{46, 47, 48, 49, 50}. For example, a 2014 study found no significant differences in response speed or accuracy for any of the cognitive tests performed between the walking and seated conditions⁵¹. Similarly, a study on memory did not find any significant impairments in cognition between the seated and walking conditions, indicating that “subjects performed the spatial working memory task equally well at all walking speeds”⁵².

Notably, although both of these studies have similar outcomes, their designs were dissimilar with regard to walking speed. The first study allowed participants to select their walking speed, while the second study required participants to walk at a range of speeds determined by the researchers during the experiment. However, participants performed equally well on their tasks across all walking speeds, suggesting that walking speed does not affect cognitive performance, and that the population examined has the ability to allocate sufficient resources to cognition regardless of walking speed⁵³. Although generalizability to the workplace has not yet been established, initial results on the relationship between cognition and treadmill workstation use are promising.

3.2 Productivity/Performance

Employees’ productivity/performance play an essential role in the financial and operational success of organizations. Although these parameters are defined differently across companies, their core meaning relates to how efficiently and accurately an individual performs the tasks that constitute his/her job responsibilities. The Harvard Business Review summarizes the importance of productivity succinctly:

“The ultimate...goal is a large organization in

which all knowledge workers have full context, tools, and support to focus their time on the biggest drivers of the business without being bogged down...That’s exciting not only for the actual productivity gains that will result at an organizational level, but also for each employee who will finally have a clear sense of what matters and how to be successful”⁵⁴.

Suffice it to say, any tool that appears to threaten employee productivity would give a company’s leadership pause. Because active workstations are often associated with movement and posture change before they are associated with work, many wonder if they negatively impact productivity/performance in the workplace. This section explores research that addresses active workstations in the context of productivity/performance.

Height-Adjustable Desks

Although evidence is inconclusive, studies suggest that height-adjustable desks have a neutral or positive impact on employee productivity/performance. Across relevant studies, productivity was measured objectively and subjectively. Objective measurements in the studies considered have limited potential for generalization since they specifically referred to aspects of productivity relevant to call centers. For example, a 2016 study at a call center measured productivity via call handling time and time spent concluding a call. However, these studies also measured more universal aspects of performance, such as attendance and sick leave⁵⁵. No significant changes in productivity outcomes were found for these objective measurements in these studies^{56, 57}.

Subjective productivity/performance measures were employed in all relevant studies, with most using self-report surveys to poll respondents. For example, a study on height-adjustable desk usage at a Perkins+Will office asked participants to respond to statements like “there are no substantial obstacles at work to doing my job well”⁵⁸. In this particular study, “65 percent of participants reported increased productivity after both six and 12 months” through self-reported measures⁵⁹. While this finding is initially impressive, this outlier sample is from an architecture and design firm, and thus respondents may have been more likely to report higher productivity since they may have been aware of perceived benefits of height-adjustable desks. However, positive or neutral results were reported across several other studies, with some also noting the physical benefits of height-adjustable desks: “A result... was a decreased level of discomfort...without having any adverse impact on the productivity indices”⁶⁰. Notably, none of the stud-

ies included in this review found decreased employee performance or productivity as a result of using height-adjustable desks.

Treadmill Desks

While evidence supports the use of height-adjustable desks for facilitating productive behavior in the workplace, the impact of treadmill desks on productivity/performance is inconclusive^{61, 62, 63, 64}. Although the majority of studies found no significant impact on productivity, two recent studies suggest that treadmill desks may be better suited for reading comprehension and administrative tasks than tasks that involve extensive problem solving or frequent clicking or typing^{65, 66}. For example, a 2009 lab study found significant differences in performance between reading comprehension tasks and computer and math skills tasks. Researchers found that for participants in the treadmill condition, “scores on tests of typing and mouse proficiency, and math solving ability” were lower by approximately 6 to 11 percent compared to the sitting condition but did not find significant differences between the two conditions for reading comprehension or administrative tasks⁶⁷. Researchers hypothesize that this difference may be due to the increased load on mental processing and motor control when walking is paired with a fine motor movement or math, suggesting that these tasks “require a more complex interaction with cognitive abilities, and increased recruitment of attentional resources” compared to the attentional resources required for the administrative and reading comprehension tasks in this experiment⁶⁸.

However, field studies that measured performance and productivity in more general and subjective terms had more favorable results^{69, 70}. For example, a year-long experiment at a financial services company used self-report and supervisor surveys to capture productivity, and found positive performance effects for both employee and supervisor ratings. The authors acknowledged the limitations of this approach, but noted that their data is “consistent with the favorable effect of physical activity on performance found by other researchers using within-person design”⁷¹. In general, research suggests that treadmill desks have a neutral or favorable effect on overall workplace productivity/performance, but when an office job is drilled down into more specific tasks (e.g. prolonged typing, precise clicking, or complex problem-solving), walking on a treadmill desk may negatively impact performance on those specific tasks. Furthermore, several studies indicated an initial decline in performance while participants learned how to adjust to walking while working so experts suggest that training on the best tasks to perform while walking at a treadmill

desks may shorten the adjustment and learning period.

3.3 Psychological Outcomes

While not predominantly associated with an effective workforce, psychological states and feelings play an integral role in employee effectiveness. Psychological outcomes can have positive or negative associations. For example, arousal is associated with productive coping responses, and task satisfaction refers to a pleasurable emotional state from completing a task. Both of these outcomes positively contribute to an individual’s overall effectiveness at work, the logic being: if you feel good at work, you will be better equipped to perform your job responsibilities. Researchers have tested this logic in the lab, finding that positive feelings at work make people about 12 percent more productive⁷².

Conversely, outcomes such as boredom, often associated with distraction from work, or stress, which leads to mental or physical tension, are also common in the workplace, and have a detrimental effect on an individual’s ability to perform their job. According to the American Psychological Association, job stress frequently causes burnout, which not only leads to “emotional exhaustion and negative or cynical attitudes” but can also lead to chronic depression, which is linked with a wide range of health concerns⁷³. This section discusses research on how active workstations have been studied in the context of the aforementioned psychological outcomes, examining whether the interventions help or harm how employees feel at work.

Height-Adjustable Desks

Compared to research on sedentary behavior and productivity/performance, research on how height-adjustable desks impact psychological outcomes is underdeveloped. Only two of the studies considered for this project addressed psychological outcomes, and both evaluated psychological outcomes as secondary variables. Furthermore, both studies measured psychological outcomes using self-report surveys modeled off validated psychological test measures.

Brewer found “enhanced [not statistically significant] workplace wellness,” and also observed indications of psychological wellness through unstructured interviews with participants⁷⁴. For example, one participant remarked: “[The sit-stand desk] has made my post-lunch energy slump disappear”⁷⁴. Pronk observed more structured and statistically significant results, indicating that “the intervention group experienced significant improvements...for fatigue, vigor, tension, confusion,

depression, and total mood disturbance⁷⁵. While initial results are promising, there is currently no conclusive evidence on the impact that height-adjustable desks have on psychological outcomes in the workplace.

Treadmill Desks

Similar to height-adjustable desk research, evidence on the relationship between treadmill desk usage and psychological outcomes is not fully developed. Only one study considered addressed this relationship⁷⁶. This lab study evaluated boredom, task satisfaction, stress, and arousal as primary outcomes using subjective survey questionnaires. For example, the Job Boredom Scale was utilized to ask participants questions like “Did the tasks go by too slowly?” and the Michigan Organization Assessment Questionnaire polled respondents on statements like, “In general, I liked this set of tasks”⁷⁶. Findings from this study suggest that participants in the treadmill desk condition experienced “higher satisfaction and arousal and experienced less boredom and stress” than participants in the seated condition⁷⁷. The authors of this study propose that these positive effects may be attributed to the variety that treadmill workstations adds to a workday⁷⁸. Additional studies on the relationship between treadmill desks and psychological desks must be administered to determine generalizable effects, especially for long-term treadmill desk usage.

4.0 DISCUSSION

Overall, the 16 articles considered for this review make a case for implementing an active workstation program in the workplace. Preliminary evidence generally supports that active workstations have neutral or positive impacts on employee effectiveness outcomes like cognitive function, productivity/performance, and psychological outcomes. However, as most of the studies acknowledge, firm conclusions cannot be drawn because participant groups were generally small and demographically homogenous^{79, 80, 81, 82, 83}. Furthermore, many of the studies took place inside labs, with experiments imperfectly replicating workplace environments and tasks. While many of these experiments have been identified as appropriate substitutes for workplace tasks by experts, it is important to note that generalizability to the workplace is limited. For example, in many of the lab studies, participants were given specific tasks to complete in a set period of time, with no interruptions. This experimental design bears little resemblance to a typical office environment, where focus is often disrupted by colleagues, meetings, telephone calls, or breaks.

However, there were longer-term field studies that took place in actual offices^{84, 85, 86, 87, 88}, which may allow for greater generalizability. Notably, a few of these studies also included support strategies to train employees on the health benefits of using active workstations, which may have impacted utilization and perceived success of interventions from the standpoint of participants^{89, 90}. An interesting omission from these training programs was a lack of active workstation usage guidelines e.g. how long and how often height-adjustable or treadmill desks should be utilized, or which tasks are appropriate for active workstation use. Although none of the studies specifically address this omission, it may be due to a lack of scientific evidence to support such guidelines or recommendations. Since this review has identified task appropriateness as a key consideration for using the interventions, especially treadmill desks, such guidelines would be an essential part in making active workstation programs a success.

4.1 Limitations

The main limitation of this review is the small number of studies included for analysis. Because of this project's narrow focus (see section 1.1), many of the articles initially considered for review were eliminated. As the sedentary behavior and physical health impacts of active workstations continue to be established, the body of work on non-health implications of these interventions will likely be studied more rigorously.

4.2 Recommendations for Future Studies

None of the studies considered in this review were longer than a one-year period, and longer-term studies are necessary in order to examine employee effectiveness impacts beyond pilot periods. Echoing a systematic review on the impact of height-adjustable workstations and sedentary behavior, additional well-conducted and adequately powered randomized trials are necessary to determine the employee effectiveness benefits of active workstation use, both in the short and long term⁹¹. Furthermore, studies should be designed to help formulate evidence-backed guidelines for active workstation use to ensure the strategic and safe use of these interventions in the workplace.

5.0 CONCLUSION

This review acknowledges that the evidence on the relationship between active workstations and employee effectiveness is limited. Nonetheless, relevant data suggest that active workstations combat the ubiquity

of sedentary behavior in the workplace without inhibiting employee effectiveness. If task appropriateness is taken into account, current evidence suggests that active workstations have a neutral or positive impact on employee cognitive function, productivity/performance, and psychological outcomes.

While there are several factors to consider when applying the results of these studies to the workplace, these studies form a compelling body of research that adds value to current understanding of how active workstations impact not only workplace sedentary behavior, but also employee effectiveness.

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02.

MATERIAL HEALTH AND TRANSPARENCY:

Methods for Improved Integration with Design Process

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ABSTRACT

Material health is important for every designer, no matter if we specify construction and building materials, finishes for interiors, or ancillary items like furniture and equipment. Information about products and various types of material properties, including their impacts on health, is becoming more prominent. However, lack of guidelines and potential tools that could help us access this data makes the process of material and product search unintuitive for designers.

Knowing this, how can we make our research of material health, a subject essential to our practice and commitments as a firm, more natural, self-expanding and intuitive? This study applies findings found in different case studies and research to ultimately develop tools, such as a material database and improved material libraries, to facilitate integration of material research and design process.

KEYWORDS: material health; transparency; materials library; materials database; materials research

1.0 INTRODUCTION

The objective of this study was to investigate how we could improve integration of material health research with the design processes, and develop intuitive interfaces for the designers. Also, the process of ordering material samples was studied in an effort to reduce packaging waste, and possible improvements to the material libraries in our offices (using Perkins+Will New York office's library as a case study, shown in Figure 1). The methodology for this research included a literature review, the review of appropriate case studies for potential new interfaces, library spaces and packaging, and the creation of new design solutions supported by imagery. The later can be used as guidelines for future firmwide initiatives, although further study would be needed to gauge their effectiveness and outcomes on the design process.

1.1 Background

Perkins+Will's commitment to sustainability and healthy environments has produced valuable research and tools, such as the Transparency website launched in 2011. The website publicly shares valuable information, such as a precautionary list of substances known

or suspected to cause harm to human health and the environment. This, in combination with other lists that target harmful flame-retardants and asthma triggers, contributed in placing at the forefront in our firm – and the design industry in general – conversations about material health and ingredients that we should actively avoid.

It is important for us to continuously expand the reach of these tools, making them a priority in our projects. Although material health is discussed regularly in design meetings and among team members, it is still not clear how we can integrate research more successfully in our design process. Can vetting materials against these lists for suspiciously harmful substances be something that becomes second nature to us and not an afterthought? Can we build with the knowledge acquired by our designers a material database that helps to make the process more efficient? Can we exert our influence not just in the process of selecting healthy materials, but also in doing something about the excessive amount of packaging produced in many cases from ordering material samples? Have we thought about the mission of each of our material libraries? Can they be designed as spaces of collaboration that encourage efficient research?



Figure 1: Conceptual image for the NY office's materials library re-design. A light color palette will make the space feel larger and brighter, while serving as a neutral background for palettes reviewed in the space. LED fixtures above the tables with the capacity to switch between color temperatures will make the room also work as a material's lighting lab. Barcode scanners will prompt at-a-glance transparency information for each product sample.

2.0 MATERIAL HEALTH AND TRANSPARENCY

Our society has seen a dramatic shift in the way we look into the components of everything we interact with and consume on a daily basis. Demand for healthier foods with more natural ingredients that avoid the use of artificial colorants and flavors has increased. Major manufacturers have been forced to rebrand themselves and relocate resources to create a market for healthy products with “clean labels”. Now a major trend, clean labels answer the call for simpler ingredients in our foods. Three-fourths of consumers in the United States claim to read nutritional labels, and nearly as many “strongly agree” that it is important for food labels to contain mostly recognizable ingredients¹.

In the fashion and technology industries, the call for transparency of material composition has also increased. While creating different products that range in complexity from a cellphone to a shirt, cradle-to-cradle practices have been widely adopted in an effort to eliminate waste and optimize the use of every material. The increasing use of upcycling practices has put pressure on the research of every component present in these products. Many manufacturers are not fully aware of all of the chemicals present in their own products, particu-

larly when complicated supply chains dilute their control and understanding of material components.

As recently as June 2016, U.S. Senate updated toxic-chemical regulations to overhaul the nation's 40-year old law governing the use of toxic chemicals in homes and businesses². Public health advocates complained for decades that outdated laws left Americans exposed to harmful chemicals not subjected to testing or regulation. A new bill would require the Environmental Protection Agency (EPA) to begin conducting tests on as many as 64,000 chemicals used in everyday products². According to the EPA, Americans spend 93 percent of their lives indoors, inside either a building or a car (87 percent in the former). Concentrations of some pollutants are often 2 to 5 times higher than typical outdoor concentrations in interior environments³. As a result, the building industry's call for transparency of components has increased, becoming a major trend.

It is interesting to ascertain that the users or habitants of a building typically do not have direct access to material health information, or control over what building materials surround them. This represents a major problem since the same pressure fashion labels, technology

manufacturers and food makers receive from people requesting transparency in their practices is not applicable to building products. Building specifications are not documents accessible to people in the same way ingredients lists are when reading nutrition labels, or the product information of electronic devices. The problem is heightened by the lack of a standard certification for healthy material ingredients and the continuous greenwashing of products and practices in our industry.

The lack of standardization and guidance for designers while specifying products is due in big part to how the green buildings movement came to place in the early 1990's with the founding of the U.S. Green Building Council (USGBC) and their Leadership in Energy and Environmental Design (LEED) program. The USGBC and LEED are widely regarded as the official framework in which buildings can achieve high performance and sustainable development. That said, the program, with its focus on achieving energy efficient buildings, lacks clear guidelines for how designers can avoid toxic chemicals in the process of selecting materials. LEED Version 4 made an effort to address material health, rewarding projects that use products with chemical ingredients inventoried by an accepted methodology, and rewarding project teams for selecting products that minimize the use and generation of harmful substances. Greenwashing, defined as deliberately representing a product or service as more environmentally friendly than it is, also adds convolution to the process of vetting any finishes for construction projects. A false impression of product sustainability, supported by false advertisement and socially irresponsible manufacturers and representatives, only exacerbates the lack of confidence when evaluating materials.

2.1 Perkins+Will Precautionary List and Product Certifications

Launched in 2011, the Transparency website was the first built environment's free, universally accessible database aimed at creating greater transparency into building materials. The database contains substances that are publicly known or suspected to be associated with an adverse finding in relation to human and environmental health. The database is the result of the review of published scientific papers, which identify "precautionary" substances. This research is based on the Precautionary Principle, the idea that in the absence of scientific consensus, an action merits precautionary treatment if it has a suspected risk of causing harm to humans or to the environment⁴. The intent of the list is to encourage the building product marketplace to be-

come more transparent from extraction to the end of lifecycle, from manufacturers to de-constructors. With this information, designers are empowered to make informed decisions when specifying products, also taking into account the products' maintenance and disposition. The website tool lists substances like phthalates and chlorinated polyvinyl chloride, where are they commonly found, their origin, how are they categorized, what are their known or suspected health effects, and offers alternative materials that can replace them.

In terms of product certifications, three of the most well-known are the Cradle to Cradle certification, the Declare product label, and the Healthy Product Declaration (HPD). The Cradle to Cradle Certified Product Standard guides designers and manufacturers through a continual improvement process that looks at a product through five quality categories—material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness⁵. A product receives an achievement level in each category - Basic, Bronze, Silver, Gold, or Platinum - with the lowest achievement level representing the product's overall mark. Product assessments are performed by independent organizations in North America, Europe and South America. One of the goals of the certification is to avoid architects and designers having to scrutinize every material for consistency with their sustainability goals. A product that is certified will give designers at-a-glance information about its recyclability and safety for human health, an assessment of toxicity hazards of all of its ingredients through the supply chain, and an improvement path for an optimized design and manufacturing process. Selecting Cradle to Cradle Certified products can help earning points on LEED V4.

Declare, on the other hand, is a "nutrition-label" for building products, providing a clear and informative method to disclose ingredients⁶. The certification relies on the International Living Future Institute (ILFI) Red List as its primary basis for material evaluation. The Red List numbers 22 substances that are to be avoided in the products and materials used to build a Living Building Challenge (LBC) project, mainly due to health concerns. Because some of the items on the list describe families of chemicals, the actual number of individual substances identified at chemical level is much larger. LBC provides some "temporary exceptions" that allow project teams to use products with red-listed substances as long as they document their efforts to find compliant alternatives, and write to manufacturers expressing their interest in such alternatives. These products are deemed "LBC-compliant", not Red List free. In creat-

ing a Declare label for a product, a manufacturer must disclose all of that product's intentionally added constituent chemicals to the designated 100 parts per million (ppm) reporting threshold. Declare's website offers a product database that allows designers to see which products meet LBC's stringent material requirements.

Finally, the Healthy Product Declaration (HPD) is supported by the Health Product Declaration Collaborative (HPDC), a non-profit organization committed to the continuous improvement of the building industry's performance. The HPDC created, and continually seeks to evolve, the Health Product Declaration Open Standard as a format and set of instructions for the accurate, reliable and consistent reporting of product contents and any associated health information⁷. HPDs provide disclosure of the chemical composition of a product, including potential health hazards from those chemicals. Manufacturers with proprietary ingredients can publish an HPD that discloses hazards while concealing the proprietary chemical. HPD Version 2.0 was released on September 10, 2015 increasing the usability for both users and creators of the documents, and harmonizing the open standard specification with other standards and certifications used in the building industry. HPDs can also contribute points under LEED v4.

3.0 THE CHALLENGE

There are many reasons for a lack of knowledge and familiarity with product transparency among many designers. The reason for this is primarily due to the absence of standards in the building industry for the evaluation of material health. Missing an interface that helps research materials has also contributed to this lack of knowledge among them.

The challenge of researching material health can be tackled by the revision of many of our firmwide practices through the implementation of a better material search interface and the improvement of the design of our material libraries. The latter could also improve the way we handle the residue produced by the over-packaging of our samples.

3.1 The Interface

As designers have constant access to smart phones, tablets and personal computers, any type of information can be available in the middle of vetting and specifying materials. This unprecedented access can be both a blessing and a curse. Being able to gain access to product information through manufacturers' websites

reduces our legwork considerably. It also guarantees that we have at least some extent of access to the most up to date information, right from the manufacturers' hands, as opposed to outdated printed material. That said, when we lose contact with the expertise of product representatives or other design professionals, grounding our choices only on online resources can be a potential danger. Unclear product information, greenwashing practices and different methods of reporting transparency, can all combine leaving us ultimately conflicted about our own material choices.

It is important to create the correct tools that will help us with this type of research. The interface we interact with while sorting through products and available materials should be simple and intuitive, put together in a comprehensive way that avoids multiple steps while remaining as close as possible to a "one stop shop" model⁸. This new tool can also work as a place where peers' recommendations and experiences with materials and products become a tangible and powerful resource.

3.1.1 Interface Case Study: Designer Pages

A good interface model to learn from in order to design our own would be the Designer Pages website, conceived in 2007. The tool helps designers to find products for their projects and build specification documents online, while also connecting them with manufacturers easily. The website has a database of around 350,000 products that represent more than 5,500 brands from across the globe⁹. Different filters can be applied while looking for products, some of them related to health and sustainability; filters can be applied to only show products that have HPDs identified on the database, Cradle to Cradle certifications, or the Declare label.

When users stumble upon a product that has not been added to the system, they can create a "product stub" that makes a placeholder in the database and notifies the website's content producing team. The team then proceeds to reach out to the corresponding brand and invites them to fill the product information and possibly upload the rest of their catalogs. This process helps the website grow, while giving users a say in what type of new products are added.

The Designer Pages Pro option offers more features to design firms. Project folders are easy to make and not only contain product's information, but also the project's location, budget, type and client. Options for creating and printing different types of schedules are also available. An augmented search component in the website allows designers to make better use of each

of their firm's collective knowledge and insight. When specifying a product, being able to find out who else has used it and can vouch for it can prove time saving. Finally, a news feed adds social media characteristics to the database and allows users to get an overall picture of what products are trending amongst colleagues.

3.2 Material Libraries

Libraries have always been amongst the most important buildings in modern society, and beacons of knowledge that engage communities. Throughout history, their mission has evolved. Non-traditional libraries can still maintain at the core of their values a desire to help with research and education, but more and more they seem to shift focus on creating spaces for collaboration that put people at the forefront.

The move to a technological society has meant increased use of mobile apps and digital technology that bring information to a wired world. When libraries adapt to these new trends faster, they become more successful at maintaining their subscribers and remaining valuable and relevant. For many of them this means adopting a more community-driven identity. Some libraries are re-imagined as community centers that provide users with specific services relevant to their main local needs (assisting with overcoming economic, social and geographical hurdles for example). Others offer a combination of flexible meeting spaces with different technological outputs, innovative display systems and catalogues, and even cafés that fill out the need for a third space.

Material libraries for design firms can adopt some of these new tendencies and offer a fresher and more interactive experience. When we think about our material libraries, usually the first thing that comes to our minds are shelves full of binders and boxes with loose samples, many times outdated. These spaces are rarely seen as open to collaboration or traditional research. Material libraries are spaces for quick discovery and reference, complimentary to our daily routines and design processes that hinge in our computers.

Material libraries should move away from this model and involve every type of designer on a more personal level. Their engagement with research and learning has to be priority and reflect the needs of new generations of designers who could use the space as an escape from their workstations and highly structured daily routines. Libraries should be reinterpreted as material research labs with a curated environment of samples and products that remains current and has a constant dialogue

with each designer's goals, and a general desire for an augmented transparency in everything that we do.

3.2.1 Material Libraries Case Study: The Material ConneXion

The Material ConneXion is a materials consultancy service that helps different companies source advanced materials to enhance the performance, aesthetics and sustainability of their projects¹⁰. Their online archive and material libraries, based in seven cities worldwide, feature over 6,500 of the world's most cutting-edge and commercially available materials. Each month an international panel of experts review 50 to 60 new materials for the library, selecting only a few. The archive of materials is organized by a category system, based on the materials' compositions: polymers, ceramics, glass, metals, cement-based materials, natural materials, carbon-based materials, and processes.

New York's Material ConneXion library, located in the global headquarters of Sandow, has over 7,500 individual materials. It serves different members of the design community, ranging from architects and interior designers to fashion designers, automotive companies, and industrial designers. Materials samples are displayed in the library using boards called MateriaTabula. These gray boards not only show the materials in an aesthetically pleasing way, but also provide key statistics related to sustainability, and contain QR codes and barcodes that give access to more in-depth information about their compositions. The powder-coated display system of interactive panels makes the space feel like an art exhibit, different from the usual dense material library stacks in architectural offices or design schools. Although only around 2,500 of the materials are displayed using these boards, the rest of them never disappear, as they are kept in a large material's vault in the premises that makes use of movable high-density storage.

3.3 Packaging

According to EPA, in 2013, Americans generated about 254 million tons of trash and recycled and composted about 87 million tons of this material, equivalent to a 34.3 percent recycling rate¹¹. Packaging material, particularly paperboard, makes up for a large percentage of this recycled material. The Paperboard Packaging Council reports that paper-based packaging accounts for 71 percent of the nearly 27 million tons of packaging material recovered for recycling, also based on numbers from EPA¹². A large number (96 percent) of the U.S. population can recycle paper and paperboard material through curbside or drop-off recycling programs, which has helped with the overall increase of the recy-

cling of packages, such as cartons and boxes (nearly doubled since 1990).

Even with an increasing rate of recycling, packaging materials sustainably is still a “hot-button” in the packaging industry. Companies often over-package their products for shipping and, without realizing it, create a surplus of packaging material left for consumers to handle. Many European countries have produced laws aimed at reducing packaging waste, but the U.S. still has not addressed this issue.

The design or type of package for shipping products can be re-conceptualized to help fill the void that unwritten laws and lack of recycling habits create. New bioplastics, and new 100 percent recycled paperboard packing products are all trends in the sustainable packaging industry to keep an eye on.

3.3.1 Packaging Case Study: eBay Sustainable Boxes

In 2011, eBay developed a set of sustainable boxes as part of a pilot program that gave away 100,000 shipping boxes to different sellers, encouraging their re-use. If each box got used five times, the program could protect nearly 4,000 trees, save 2.4 million gallons of water, and conserve enough electricity to power 49 homes for

a year¹³. One of the most interesting elements of the packaging was its series of illustrations that emphasized the benefits of a greener box. A section in the interior flap asks “Where has your eBay box been?” prompting the shipper to make a note on the box so that the next person who receives it knows how far and for how long it has traveled. The boxes are made with 100 percent recycled content, printed with water-based inks, and designed to require minimal tape. Once they reach the end of their useful shipping life, they are fully recyclable.

4.0 THE PERKINS+WILL SOLUTION

The first step to improve the way that we do transparency research of building materials and finishes is to create an easy to use materials database. The “Perkins+Will Materials Database” could be tested firmwide and later launched as a new service offered within the Transparency website, thus expanding its reach and becoming a more meaningful contribution to the design industry in general. The database would be an online resource that would function as a catalogue of the products we specify, each displayed prominently on its own product page.

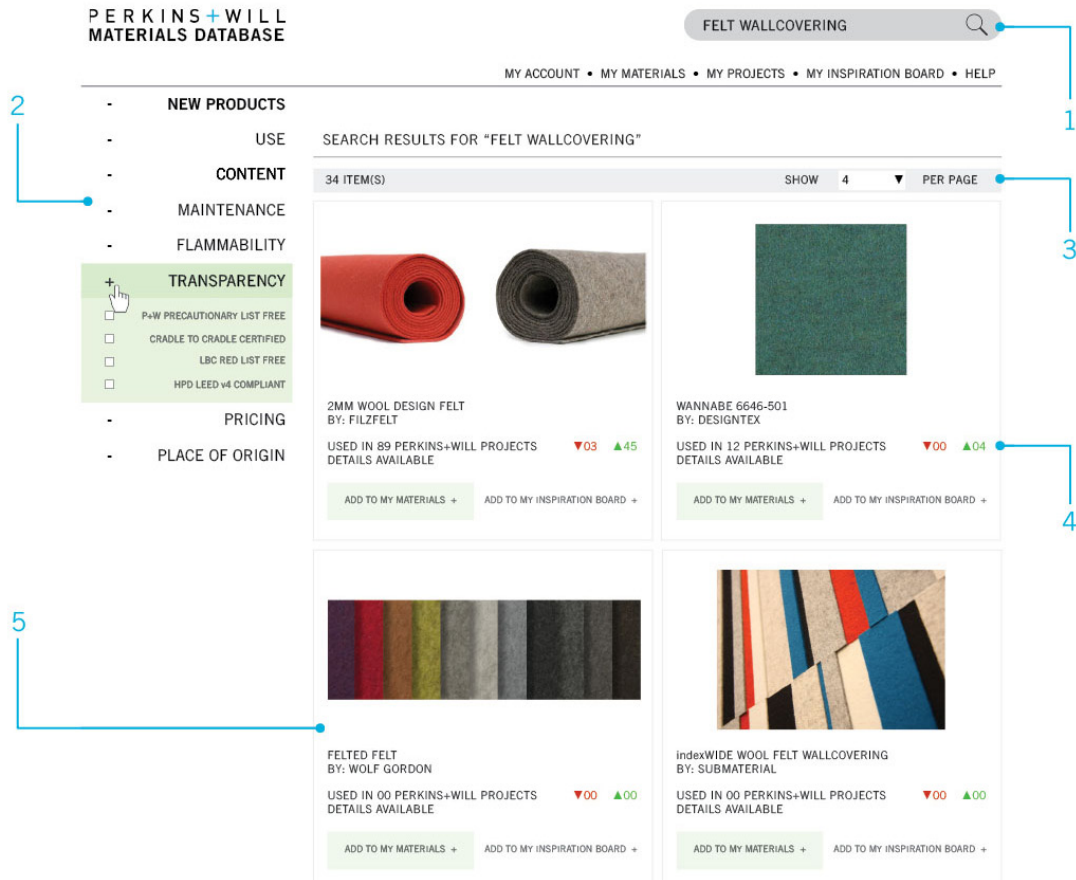


Figure 2: Layout for how the product search would look like.

The interface should be visually attractive and intuitive, designed in a clean and consistent layout that follows the Perkins+Will brand guidelines, as seen in Figure 2.

- 1 A search bar would be prominently featured, promoting easy product research.
- 2 Different categories, such as “Use”, “Content”, “Maintenance” and “Transparency”, would help filtering the results. In the “Transparency” category, items like “Perkins+Will Precautionary List Free” or “LBC Red List Free” can be selected in order to narrow the search even further.
- 3 The results can be sorted in a variety of ways for enhanced clarity and comparative purposes.

- 4 An upvotes/downvotes feature, only usable by Perkins+Will designers in the testing stage, would show how products are reviewed across the office.
- 5 Relevant product information, imagery and the option to add to “My Materials” or “Inspiration Board” will be also quickly accessible. The “My Materials” or “Inspiration Board” tabs will give access to user-specific pages. On “My Materials” a catalogue of every product specified over time by each designer/user will be shown. “My Inspiration Board” would give access to a Pinterest-type component unique to participant firms and sharable between team members.

PERKINS+WILL

MATERIALS DATABASE

MY ACCOUNT

MY MATERIALS

MY PROJECTS

MY INSPIRATION BOARD

HELP

WANNABE 6646-501 BY DESIGNTEX

USED IN 12 PERKINS+WILL PROJECTS

▼00 ▲04

-

+

ADD TO MY MATERIALS +

ADD TO MY INSPIRATION BOARD +

ADD TO MY PROJECTS +

NYULMC 222E

NYU 333 LOBBY

CCRM CLINIC

7

USE

CONTENT

MAINTENANCE

FLAMMABILITY

PRICING

ORIGIN

WEBSITE

Wallcovering

5% Polyester (Preconsumer Recycled, Solution Dyed), 95% Polyester (Postconsumer Recycled, Solution Dyed)

Water-based/Solvent (WS)

ASTM E 84 Adhered Class A

\$37.00 per yard

United States

<http://www.designtex.com/wannabe.html>

TRANSPARENCY

P+W PRECAUTIONARY LIST FREE

CRADLE TO CRADLE CERTIFIED

LBC RED LIST FREE

HPD LEED V4 COMPLIANT

YES

N/A

N/A

YES

8

DOWNLOADS

PRODUCT SPEC

HBD FORM

INSTALLATION INSTRUCTIONS

SHARE YOUR EXPERIENCE WITH THE PRODUCT

9/26/2016 11:30AM

ANTONIO A RODRIGUEZ (NYO)

the product looked great installed, recommended

11/07/2015 5:24PM

JAMES SMITH (LA)

I've used the product many times and it performs well every time. Best colorways for felt wallcoverings IMO.

+ WRITE A COMMENT

9

P+W INSTALLATION PICTURES OR DETAILS

10

ADD JPG OR PDF

+

ADD JPG OR PDF

+

ADD JPG OR PDF

Figure 3: Layout for how the individual product profile would look like.

27

- 6 Individual product information profiles would give designers the option to upvote and downvote a product based on a personal experience.
- 7 High quality photos of colorways and available finishes would be prominently displayed and updated regularly.
- 8 Available transparency documents would be highlighted and easy to download.

Two social features catered towards Perkins+Will designers, and later to be adapted for general audiences, would make the database more personable, as seen in Figure 3.

- 9 A comments section would allow designers to share their experiences with any product.
- 10 Another area would also be provided for designers to upload installation photos of the products on their projects.

Re-designed library spaces will work in conjunction with the Perkins+Will Materials Database to create a better workflow for any designer researching material health and finishes in general, shown in Figure 4. Proposed is the reconfiguration of the existing material library in our office in New York, expanding its footprint and taking over an adjacent printing area. This move allows making use of windows the library currently lacks, creating a sun drenched workspace where designers can lay out their palettes and perform research tasks.

- 11 A combination of fixed open shelves and high-density storage would store loose samples and binders with tip cards and/or finishes representations. The fixed open shelves would host the more in demand finishes (carpet samples, fabric memos and wallcoverings) and the heavier samples (tile, stone, wood, etc.). The high-density files will store less frequently procured samples, doubling the capacity of our existing storage. The option to combine all these shelves together would keep the space less visually cluttered.

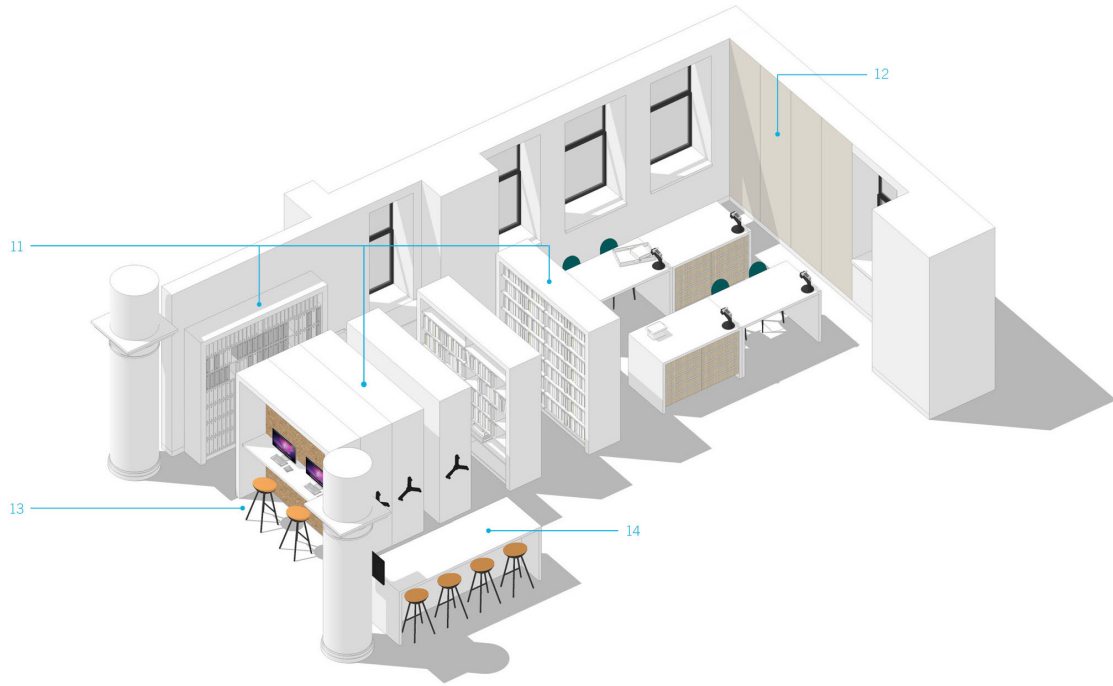


Figure 4: Isometric view of the proposed NY office material's library design.

12 Pinup space would be added to illustrate concepts in-process and create a more visually stimulating and inspirational space. A fixed cabinet with large, color-calibrated monitors would be designated as a research station where designers, product reps and librarians can collaborate.

13 A fixed cabinet with large, color-calibrated monitors would be designated as a research station where designers, product reps and librarians can collaborate. Codebooks, lighting

fixtures catalogues and plumbing fixtures catalogues would be uploaded and accessible on the computers, freeing valuable storage space elsewhere.

14 Project drawers would be removed from the current kitchen island to make space for stools and a cleaner flow of people. The area would still function as a hub where product representatives can host informal presentations and make use of the wall-mounted flat screen.

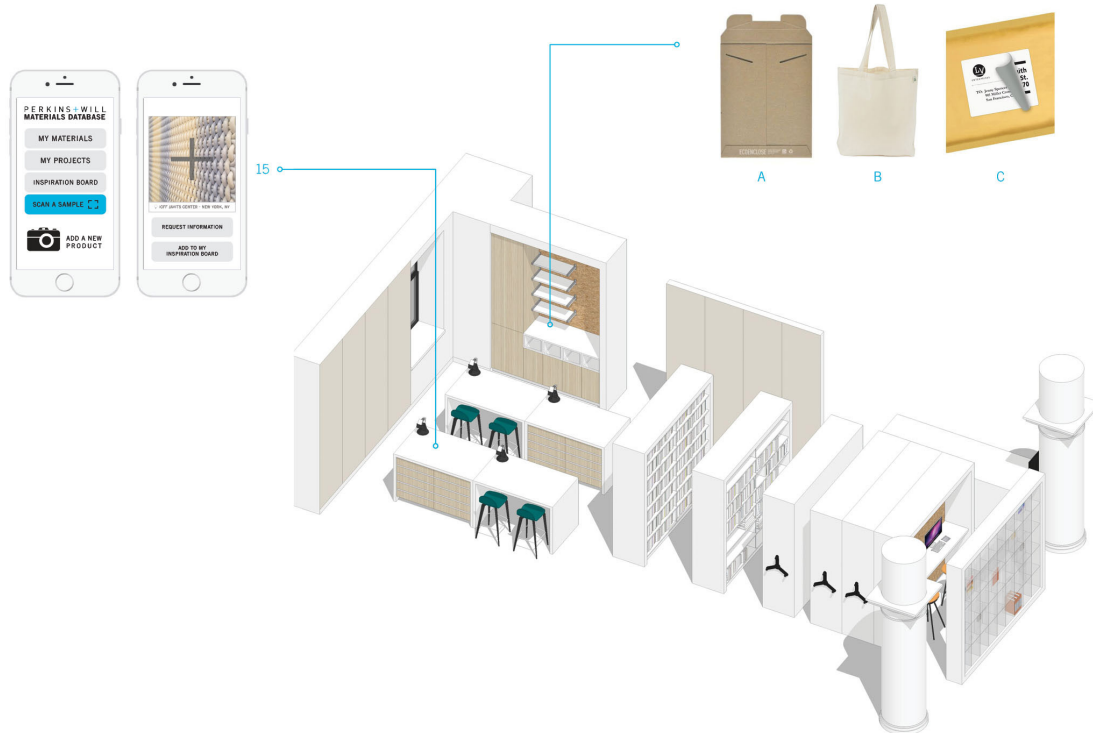


Figure 5: Another isometric view of the proposed NY office material's library design, design layout for the “Perkins+Will Materials Database” App, and suggested packing solutions.

Custom, counter height work tables with project drawers and seating would add space for laying out palettes and researching materials further. Barcode scanners would bring the product page of each of the scanned products immediately to any paired screen.

15 A Perkins+Will Materials Database App could also be used for scanning. The application would give access to each of the user's unique pages, also available in the browser version. Moreover, the app would be the main tool designers can use to add materials to the database. By taking a photograph of products not found in the catalogue, designers would be able to request the firmwide or outsourced content makers for more information about them.

An area for the disposal and storage of packaging material would be included in the re-designed library, as seen in Figure 5. New, outsourced packaging so-

lutions for mailing clients or returning samples would be tucked away in the cabinetry. Trash bins would be utilized for the overflow of wrapping paper, bubble wrap and smaller paperboard boxes that could be separated and either recycled or stored for future use

16 Instead of trying to revolutionize the packaging industry, Perkins+Will could standardize some packaging solutions through their different offices: (A) 100 percent recycled and biodegradable rigid mailers, (B) light weight company-branded eco bags for designers on the run and messengers, and (C) shipping labels with TrueBlock technology that completely block out any previous labels, can be all options to invest in and test.

Figure 6 shows a glass display that can be used to feature new materials added to the library.



Figure 6: A large and transparent glass display would be added facing the public corridor of the office. The glass case would be updated, highlighting only the latest and most exciting materials to arrive.

5.0 CONCLUSION

Material health should be a topic of conversation for everyone involved in designing our built environments. Creating the tools that will make the research of any product's transparency information easier and more intuitive can have a strong and meaningful effect in our industry.

We should plan better interfaces and a database for material research for all designers, and materials libraries that help facilitate the process and spur true collaboration. In the process, Perkins+Will can change the way that we look at healthy materials, bringing much needed clarity to the subject in a design industry that needs it.

Finally, even if the interface for researching materials and the design of our libraries both improve, education and training sessions (especially for new staff members) are needed in order to engage designers more in the process. Hiring full time librarians with a background in

material health research can be a great strategic move that will assure libraries are kept to our standards, and the educational initiatives upheld.

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03.

OUTSIDE IN:

Influences of Indoor Plants on Psychological Well-Being and Memory Task Performance in a Workplace Setting

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ABSTRACT

Although the benefits of nature exposure to human health are well documented, less is known about the psychological benefits of exposure to nature indoors. This study observed whether the addition of greenery to a workplace setting improved psychological well-being and performance of employees. A crossover study among 63 adults examined perceived psychological well-being and objective memory task performance with and without indoor greenery present in an open workplace setting. Statistical analyses indicated that there was only a marginally significant increase in memory task performance with the presence of plants. However, participants showed slightly better psychological well-being without the presence of plants when compared to performance with plants, on both floors. Study results suggest that the presence of windows, natural light, and high ratings of perceived psychological health may have confounded the effects of plant presence.

KEYWORDS: nature; indoor plants; psychological health; task performance

1.0 INTRODUCTION:

The benefits of outdoor nature exposure to human health are well-documented¹; however, less is known about the psychological benefits of exposure to nature indoors². Our hypothesis is that the addition of plants and greenery to a workplace setting will improve psychological well-being and performance on a memory task

encing stress and anxiety may benefit most from nature exposure⁴. Most research on the psychological health benefits of nature has focused on direct exposure to or views of outdoor nature and imagery; however, little research has examined the benefits of indoor plants on psychological well-being.

2.0 LITERATURE REVIEW

Research on the health benefits of indoor plants has typically focused on psychological restoration. Steve and Rachel Kaplan's Attention Restoration Theory (ART) and Roger Ulrich's Stress Reduction Theory (SRT) explain the mechanisms by which nature exposure promotes psychological restoration. ART posits that nature exposure, via direct experiences or views, attracts our indirect, effortless attention and allows our directed attention to be restored; this restoration improves our ability to concentrate³. SRT suggests that people experi-

According to Bringslimark and colleagues, just twenty-one articles about the psychological benefits of indoor plants from passive exposure (as opposed to horticulture therapy) were published in peer-reviewed journals between 1976 and 2007, in the English language⁵. Although additional articles examining benefits of indoor nature exposure have been published since 2007^{1,2,5,6,7,8,9,10,11,12,13,14,15,16,17,18}, results are inconsistent due to varying methods, measures, durations of nature exposure, and experimental settings². The most consistent results support positive associations between indoor nature presence and improved pain management in health care settings^{14,15,18,19} as well as improved psychological well-being when nature is present in controlled windowless research settings^{10,11,21,22,23,24}.

Results of studies focused on benefits of indoor plants specifically within office settings are also inconsistent. These studies monitored outcomes such as emotional states, productivity and task performance, room assessments, health and discomfort symptoms, sick leave, psychophysiological stress responses, and job satisfaction^{7,8,9,10,19,21,25}. Five studies found statistically significant improvements in room assessments, self-reported health, and job satisfaction associated with the presence of plants^{7,8,10,11,26}. However, other studies did not find significant improvements in emotional state²⁶, room assessments²⁶, or job satisfaction²⁷ associated with indoor plant presence. Evenson and colleagues' experiments found no change in directed attention capacity or self-reported restoration associated with increased plant exposure⁹, while Raanaas and colleagues found positive associations between attention capacity and plant exposure in a similar study¹⁷.

Research findings also suggest that associations between indoor plant exposure and outcomes vary by the intensity (number and size of plants)^{11,25}. Jumeno and Matsumoto's study, for example, included different numbers and sizes of plants. However, there were higher productivity results with only one small plant in the room than with three small and three medium sized plants¹¹. Larson and colleague's study on productivity tasks with plant exposure showed a similar inverse linear relationship to the number of plants in the office and productivity²⁵. Interestingly the participant's in this study perceived they performed better on tasks even though the results did not support their perceptions. Both studies indicated that an increase in the number and size of plants present was associated with an increase in mood.

The role of indoor plant exposure duration was explored in additional studies^{12,18}. Smith and colleagues measured participant responses over a six month time period and found that a reduction in stress and subjective health concerns and an increase in morale were associated with plant exposure in an office setting¹⁸. Korpela and colleagues tracked changes in questionnaire responses before and after a one-year study period to evaluate the influence of several types of nature exposure (window views, indoor plants, and outdoor physical activity)¹². Results did not show a statistically significant association between nature exposure and employee well-being with indoor plant exposure.

The majority of studies in office settings were cross-sectional and conducted in laboratories or simulated offices. While simulated settings reduce the presence of confounding variables and isolate effects of indoor plant exposure, the artificial setting and short duration of exposure limits generalizability of study results to actual office settings. A positive health benefit of indoor plants in a windowless lab setting might not be replicable in an office setting where complex physical (sound, lighting, temperature, and air quality) and psychosocial (stress level, amount of control and support) confounds are present⁷. Better understanding the effects of indoor plant exposure on employees in actual office settings is needed. Therefore, this study took advantage of an office setting with two identical floors to examine effects of indoor plant exposure on employee psychological well-being and memory task performance.

3.0 METHODS

3.1 Research Design

A crossover study design was used to evaluate employees' perceived psychological well-being and objective memory task performance on two identical floors of an office building. The two study periods were distinguished by the presence or absence of plants in the office (Table 1). The order of experimental conditions was counterbalanced. Each participant was exposed to each condition for a total of 13-15 days before data were collected. Employees participated in data collection over two, three-day periods to accommodate work schedules.

Table 1: Experimental condition.

Office level	Plants (duration)	No plants (duration)
Floor 4	Session 1 (13-15 days)	Session 2 (13-15 days)
Floor 6	Session 2 (13-15 days)	Session 1 (13-15 days)

3.2 Study Site

The early 2017 study was conducted in the office of a multi-disciplinary design firm in Atlanta, Georgia. The office's two floors have an almost identical floor layout with similar natural and artificial light levels. Floor to

ceiling glazing is present on the east, west, and north faces of the floors, with no natural light on the south face. Study participants were seated in the open office plan with rows of seating closest to the north wall (Figures 1a and 1b).

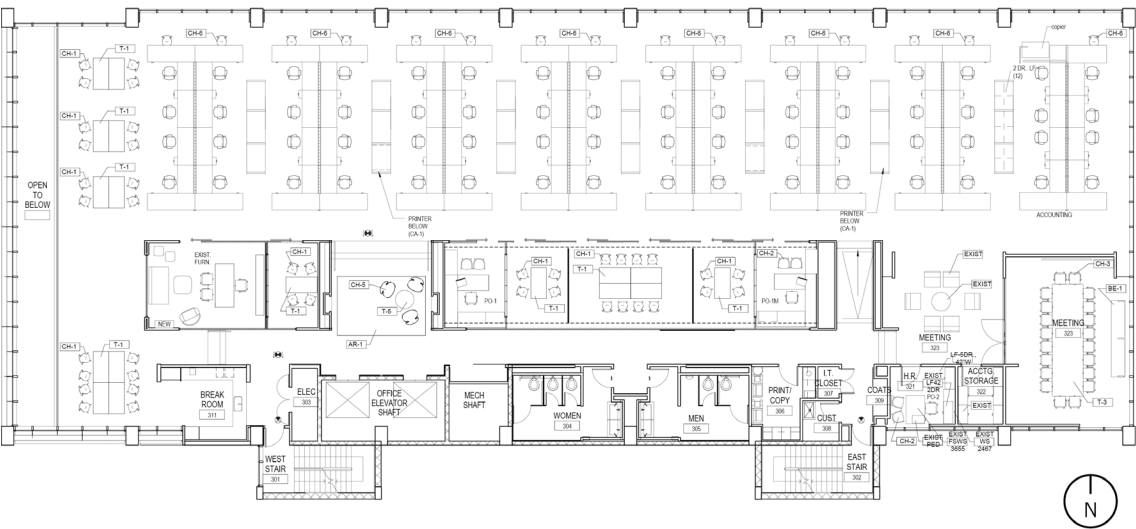


Figure 1a: Level 4 office floor plan.



Figure 1b: Level 6 office floor plan.

3.3 Participants

Eighty employees (40 per floor) seated in the open-plan areas of the two floors were eligible to participate in the study. Employees with private offices were excluded from study recruitment due to differing physical space characteristics (e.g., varying noise and privacy levels and different window views). Study participation was voluntary. A \$25 gift card was offered as compensation to participants who completed both rounds of data collection. A total of 63 adults completed both rounds of data collection. The study was approved by the University of Notre Dame Institutional Review Board and Perkins + Will research and human resources departments.

3.4 Constructs and Measures

Predictors (independent variables)

Plant presence: Exactly 129 plants were installed on each floor during the “plant” study session (Figures 2, 3a, and 3b). All study participants had a 6” pot with a *Philodendron hederaceum* (Philodendron) placed within arm’s length of their workstation. Additionally, 18 *Chamaedorea seifrizii* (Bamboo Palm) and 18 *Dracaena fragrans* (Lemon Lime Warnecki) were located on the north side of the office along the window, and a total of 24 *Sanseveria trifasciata* (Sanseveria) were located on the south side of the workstation rows. An assortment of other plants was located in the breakroom and office elevator lobby. All plants were potted plants in white plastic containers and ranged in height from 2-8” for desk plants and 2-3’ for floor plants. With the exception of one flowering orchid, all plants were green foliage plants.

caena fragrans (Lemon Lime Warnecki) were located on the north side of the office along the window, and a total of 24 *Sanseveria trifasciata* (Sanseveria) were located on the south side of the workstation rows. An assortment of other plants was located in the breakroom and office elevator lobby. All plants were potted plants in white plastic containers and ranged in height from 2-8” for desk plants and 2-3’ for floor plants. With the exception of one flowering orchid, all plants were green foliage plants.

Lighting conditions (light levels and cloudy days):

Light levels were measured from the building’s lighting system three times daily for six days. A *Leaton L830 Lux Meter* was used as the measuring device at participant seat locations throughout the floors. Each floor level was photographed to document the office lighting and views from participants’ desks (Figures 3a and 3b). Additionally, the presence of clouds was documented during the study. Overcast skies throughout most of the day occurred on two study days and partly cloudy skies (more sun than clouds) occurred on six study days. Participant data collection did not occur on cloudy days.



Figure 2: Level 4 plant layout.



Figure 3a: View of plants along the north face of Level 4.



Figure 3b: View of the south side of an employee desk row and plants on Level 6.

Demographic information: Gender, age, income, education, ethnicity, amount of time spent in the office daily (hours) and weekly (days), and exposure to interior and exterior greenery at home were collected via questions added to the end of the psychological well-being questionnaire (PERI). Seat locations were noted by row, with the row closest to the north windows given a one (most natural light) and those farthest away given a four (least natural light). Occupation type was also noted (landscape architecture, architecture/design, or administrative position).

Outcomes (dependent variables)

Psychological well-being: The Standardized Demoralization Index of the Psychiatric Epidemiology Research Instrument (PERI) for nonclinical populations measures psychological distress²⁸. Study participants indicated on a five-point scale (never to very often) whether they experienced a specific symptom (e.g., “felt lonely”) in the previous three months. Total psychological well-being scores were calculated by summing all items.

Digit span backwards (DSB): The DSB memory task measure used in this study was based on procedures outlined in the Wechsler Adult Intelligence Scale Manual²⁹. Participants listened to a sequence of numbers, starting with 3 digits, and were asked to repeat each sequence in the reverse order (e.g., 357 was repeated as 753). A participant's score is the longest number of digits repeated correctly before two consecutive trials fail. This test was used to measure short-term memory and attention of participants.

3.5 Procedures

Data collection

After completing consent forms, employees completed the PERI, demographic questions, and DSB during each of the two data collection sessions. The PERI and demographic questions were completed via computer after participants received an email with a link to a Qualtrics questionnaire. The order of completing the PERI with demographic questions and the DSB was counterbalanced. One of two trained employees at the study site administered the DSB.

Data analysis

Using the Statistical Package for the Social Sciences (SPSS, Version 23), all predictors, demographic covariates, and outcomes were subjected to a linear mixed model procedure, similar to a repeated measures analysis of variance.

4.0 RESULTS

4.1 Study participants

A description of study participants is displayed in Table 2. Participants' occupations included positions in landscape architecture, architecture and design (architecture, branded environment design, graphic design, healthcare planning, and urban design), and administration (accounting, administrative assistant, information technology, and operations). In Session 1, a total of 33 participants completed the PERI first, while 31 participants completed the DSB first (not recorded for 4 participants). In Session 2, a total of 38 participants completed the PERI first, while 28 participants completed the DSB first (not recorded for 2 participants).

Table 2: Participant Description

Variable	Levels	#	%	Variable	n	Mean (SD)	Range
Gender	Male	39	57.35	Age (years)	67	37.25 (9.14)	21-57
	Female	28	41.18				
	No answer	1	1.47				
Education level	Some/in college	1	1.47	Avg light level <i>foot candles</i>	67	26.41 (12.52)	10-59
	Undergrad degree	21	30.88		67	8.64 (0.98)	5.5-10
	Some/in grad school	2	2.94		67	4.87 (0.57)	3-7
	Graduate degree	43	63.24		67		
	No answer	1	1.47				
Ethnicity	White	50	72.53	Self-reported physical health	67	3.72 (0.78)	2-5
	Non-white	16	23.53		67	3.90(0.76)	2-5
	No answer	2	2.94				
Income	<\$30k/year	1	1.47	Home exterior greenery (1 low - 5 high)	67	2.25 (1.12)	1-5
	\$30,001-60k	11	16.18				
	\$60,001-80k	9	13.24				
	\$80,001-120k	17	25.00				
	>\$120k	24	35.29				
	No answer	6	8.82				
Floor level	4	40	58.82	Home interior greenery (1 low - 5 high)	67	4.00 (1.06)	1-5
	6	28	41.18				
Seat Row	1	16	23.53				
	2	14	20.59				
	3	15	22.06				
	4	23	33.82				
Occupation	Landscape architect	12	17.65				
	Architect/designer	42	61.76				
	Administrative	10	14.71				
	Not reported	4	5.88				

4.2 Analysis Results

Figures 4a-b display average PERI and DSB scores. Overall scores were poorer with than without plants present on both floors. However, when accounting for study order, gender, psychological health, seat location, and average daily office hours (all other covariates were eliminated due to lack of variation and non-significant

results), results indicated that there was a marginally significant effect of plants on memory task performance such that participants performed better on the memory task when plants were present (DSB, $p=.055$; Table 3). No significant effect of plant presence on psychological well-being was found (PERI, $p>.05$; Table 3). The strongest predictor of perceived psychological well-being was perceived psychological health ($p<.01$; Table 3).

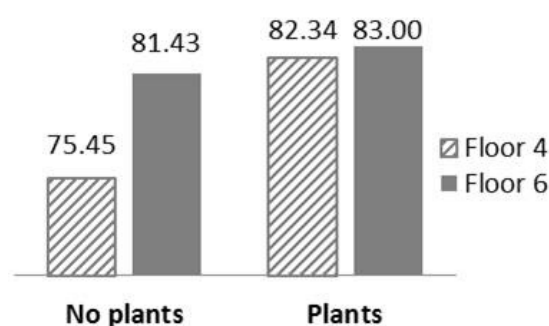


Figure 4a: Psychological Well-Being (PERI sum; higher scores indicate more distress).

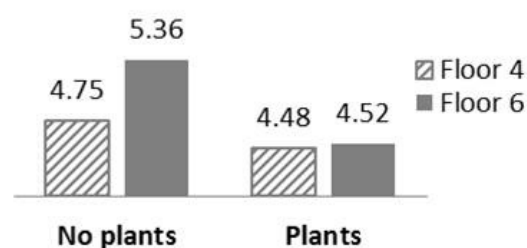


Figure 4b: Memory Task Performance (DSB; higher scores indicate better performance).

Table 3: Effects of Indoor Plants on Psychological Well-Being and Memory Task Performance.

	Psychological Well-Being (PERI)			Memory Task Performance (DSB)			
Variable (levels)	Estimate	(SE)	t-test results	Estimate	(SE)	t-test results	
Intercept	91.60	(10.93)	t(110) = 8.38, p < .001	5.23	(1.33)	t(79) = 3.93, p < .001	
Plants (no, yes)	-0.47	(1.18)	t(57) = -0.40, p = .691	0.41	(0.21)	t(62) = 1.96, p = .055	
Order (no 1st, yes 1st)	-1.87	(2.59)	t(53) = -0.72, p = .473	0.37	(0.28)	t(56) = 1.30, p = .198	
Gender (male, female)	3.15	(2.77)	t(54) = 1.14, p = .259	0.27	(0.30)	t(56) = 0.90, p = .370	
Psych. Health (0-5)	2	-30.76	(6.59)	t(104) = -4.67, p < .001	-0.77	(0.82)	t(82) = -0.94, p = .352
	3	-20.90	(2.92)	t(114) = -7.15, p < .001	-0.22	(0.39)	t(99) = -0.56, p = .575
	4	-9.96	(2.35)	t(112) = -4.23, p < .001	0.16	(0.32)	t(108) = 0.49, p = .622
Seat row (1-4)	2	2.40	(3.60)	t(58) = 0.67, p = .508	-0.40	(0.39)	t(61) = -1.03, p = .307
	3	-0.75	(3.65)	t(54) = -0.21, p = .838	-0.03	(0.39)	t(57) = -0.07, p = .948
	4	-0.76	(3.46)	t(53) = -0.22, p = .826	-0.08	(0.37)	t(55) = -0.20, p = .839
Avg. daily office hours	0.16	(1.24)	t(113) = 0.13, p = .896	0.04	(0.15)	t(82) = 0.27, p = .792	

Italicized p-value = marginally significant result (.10 > p > .05)

Bold p-value = significant result ($p < .05$)

5.0 DISCUSSION

5.1 Strengths and Limitations

This study contributes to the literature by examining the effects of indoor plants on design firm employees' psychological well-being and memory task performance. The marginally significant memory task performance and lack of statistically significant psychological well-being results in this study suggest inconclusive rather than negative results. The results allow us to state that no significant effects were found for the specific group of participants in this study, at the specific study location and time. Further studies are required to identify the reasons why significant results were not found. Possible reasons include: 1) there was no effect of plants on psychological well-being and task performance in this study; 2) that other confounding variables were present and not addressed by the research design, such as those discussed in the following paragraph; or 3) that the effect of the plants was small and a better research design is needed. A larger and more varied participant sample; longer duration of plant exposure; isolating the effect of the plants from the presence of windows, views of nature, and natural light; and randomly assigning participants to the study order will improve the research design. Furthermore, the relatively high ratings of perceived psychological health among all participants indicate that the employees in this study might not benefit from the addition of plants as much as employees who report lower levels of psychological health⁴. A more varied participant sample with employees who report both high and low levels of psychological health is needed.

Previous literature and anecdotal comments from participants offer additional plausible explanations for the study results. Prior work suggests that plants in an office setting may not be noticed by employees who are focused on required daily tasks; instead, plants may have a greater effect in spaces that are intended for restoration (e.g., hospitals)². Anecdotally, one study participant observed that there was initial excitement about the plants among participants, but after a few days, the plants seemed to fade into the background, somewhat like furniture. This comment is consistent with previous studies that find participants may habituate to the presence of plants; their beneficial effects may only be strong during an initial period after their introduction³⁰. Several studies have also shown more significant influences of plants in windowless settings^{10,19,22,23,24,26}. Furthermore, people who initially report lower levels of psychological well-being may also benefit more from the presence of plants. In other words, the effects of

indoor plants on psychological well-being might vary by environmental quality and/or psychological health, such that those who work in poorer quality environments and/or those with poorer quality psychological health may experience greater benefits from indoor plants more than participants in better quality environments and/or with better quality health.

5.2 Future Work

Future studies examining the effects of indoor plants can strengthen and expand upon the research design in four ways. First, larger and more varied participant samples are needed to detect smaller anticipated beneficial effects of indoor plants, especially when compared to effects of direct exposure to outdoor nature. Second, additional variables can be studied. It is unclear how close plants must be to participants and how "green" someone's view must be to influence psychological well-being, task performance, and other outcomes. Documenting and testing plant proximity and the amount of green visible to participants are needed. Third, quantifying the percentage of the view and room occupied by indoor plants are other relevant measures to document and test. This type of quantitative information can facilitate cross-study comparisons as well as identify specific characteristics of plant presence to inform design guidelines. Fourth, a longitudinal study that documents plant effects multiple times, including shortly after installation, a few weeks later, and months later allows for testing short- and longer-term effects of indoor plants. Finally, innovative interventions might be tested to maintain the "novelty" of indoor plant installations so that participants do not become habituated to their presence.

Practitioners who conduct research in professional office settings must also address practical considerations. Thorough and repeated training, including practice sessions and scripts, are needed for practitioners conducting data collection sessions to ensure that each measure is administered in the exactly same way to maintain study validity and reliability. This adds additional time for researchers in busy office settings. Busy office settings also require multiple proctors to administer data collection measures to accommodate busy employee participant schedules. Collecting data in a concise time period is critical to maintain equal plant exposure time among all participants. Adequate funding is needed to support a research design that not only maintains rigor and contributes to the literature, but also is practical for researchers and participants.

6.0 CONCLUSION

Although study results did not support our hypotheses, additional research is warranted to explore further the influence of plants in indoor settings on psychological well-being and task performance. Most people spend the majority of their time indoors. If plants have even a small positive influence on the well-being and performance of individuals in workplaces, it is important to better understand this influence.

Acknowledgments

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04.

LEARNING THROUGH OSMOSIS:

A Report on the Seattle Mentorship Program's Pilot Session

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ABSTRACT

Traditional mentorship can bridge the gap between industry experts and newcomers, however, time and commitment can be barriers to forming these relationships. In this article, we introduce an alternative approach to mentorship that links growing professionals with firm leaders for short-term shadowing opportunities that occur on an ongoing basis. Through observing the mentors' actions, thought processes and decisions within the context of the mentor's ongoing work, the Osmosis mentorship program sets out to determine whether an informal and low-commitment approach to mentorship can aid in career development and promote knowledge sharing within firms. The pilot session of this program paired four mentors with four mentees in two chosen areas of interest with mentees spending, on average, one hour per week partaking in related exposure opportunities. At the close of the pilot session, narrative evaluation revealed that mentees gained greater career insight and breadth of knowledge into their area of interest. Mentees also reported the success of the program in providing a platform for self-advocacy and self-direction. Mentors noted the role of the session in increasing exposure and learning at the firm, as well as preparing mentees to better contribute to their project work.

KEYWORDS: knowledge-sharing; career development; situated learning theory; legitimate peripheral participation (LLP); project-based learning

1.0 INTRODUCTION

Originating in Greek mythology, mentorship has long since been characterized by the archetype of the wise and faithful adviser sent to protect Odysseus' son while he sailed against Troy¹. In the last half century, this relationship has become a subject of study for adult development and career theorists. Early seminal studies define mentorship as the "relationship between an older, more experienced mentor and a younger, less experienced protégé for the purpose of helping and developing the protégé's career"². Since these early studies, conditions of employment, technology, organizational structure and membership have eclipsed this operational definition to embrace different types of mentorship varying in formality, intraorganizational status, and purpose. Today's career context demands that we continue to be flexible in our pursuit of mentorship. Rapid advancements in technology place increasing value on specialized knowledge that can keep pace with this

growth. Individuals must, therefore, be able to adapt and learn swiftly in order to remain competitive and innovative. This requires that we have the flexibility to learn by consulting a variety of people about our work, iteratively and frequently.

In addition to the challenges we face related to the advancement of our tools, "as organizations become fast, flat, and flexible, so too does the nature of the work individuals do, necessitating both constant reconsideration of how to develop professionally and where to look for assistance"³. Essentially, our work is happening more quickly and, as a result, our methods for how we learn new skills and obtain new knowledge in practice need to adapt. Rather than concerning ourselves with developing a shared definition of what mentorship is, practicing professionals should understand and implement different types of mentorship to expand an organization's ability to share knowledge and teach skills.

1.1 Learning Theory and Career Development

This paper explores how a situated approach to mentorship within project-based firms can promote iterative career development and knowledge sharing. The theory behind this approach is grounded in a perspective on learning and cognition that theorists within the fields of psychology, cognitive science, anthropology and sociology call the situative perspective. Discussed in relation to the behaviorist and cognitive perspectives, situated learning theory focuses on combining the “know how” and the “know what” of learning and cognition that the behaviorist and cognitive perspectives treat discretely⁴.

Brown et al. argue that “treating knowledge as an integral, self-sufficient substance, theoretically independent of the situations in which it is learned and used” ignores the activity and culture of which it is interdependent⁵. Using language as an example, they argue that all knowledge references the world and, as such, is a product of the situations and activities in which it arises and is used. Additionally, this knowledge will progressively evolve “with each new occasion of use, because new situations, negotiations and activities inevitably recast it in a new more densely textured form”⁶. In their emerging instruction model, Brown et al. conceptualize knowledge as a tool in order to emphasize the need for educators to teach students how to appropriately use abstract knowledge.

Other theorists associated with situative learning theory, and closely aligned with the knowledge-as-tool concept, often describe cognitive apprenticeship as a model for situated learning. They argue that, in order to use tools as practitioners in their field would, learners, acting as “cognitive apprentices” must be taught in context. Apprentices enter their discipline’s culture of practice, learning out of and through continuing activity within their community. This model suggests “the paradigm of situated modeling, coaching and fading, whereby teachers or coaches promote learning, first by making explicit their tacit knowledge or by modeling their strategies for students in authentic activity”⁷.

Later theorists argue that the cognitive apprenticeship model emphasizes the centrality of activity in situated learning and knowledge, and is not inclusive of sociocultural factors within the situated learning environment. As noted by Geertz, “communities of practitioners are connected by more than their ostensible tasks. They are bound by intricate, socially constructed webs of belief, which are essential to understanding

what they do”⁸. Thus, social interaction between experts and novices within communities of practice becomes critical to developing a theory of situated learning. In their monograph *Situated Learning: Legitimate Peripheral Participation*, Lave and Wenger introduce the concept of legitimate peripheral participation (LLP), whereby novices learn by observing members of their community of practice from the periphery before gradually becoming fully participating members⁹. Peripherality, in this theory, “suggests that there are multiple, varied, more- or less-engaged and –inclusive ways of being located in the fields of participation defined by a community”⁹. Illustrated through the analysis of five ethnographic studies of formal apprenticeship, Lave and Wenger discuss these differences, acknowledging that where high levels of knowledge or skill are required within U.S. organizations, concrete realizations of apprenticeship are common. In the ethnographic study of tailor shops, Hutchins problematizes the question of learners’ access to important learning resources given particular organizational structures that may locate learners in a periphery without the exposure required to more fully participate in their community of practice¹⁰. This question of access underscores the crucial need for broad LLP in increasing both understanding and identity within a community of practice.

This question of access underscores broad legitimate peripheral participation in a community of practice as crucial and central for increasing both understanding and identity.

Furthermore, Lave and Wegner stipulate that “changing locations and perspectives” within the periphery “are part of actors’ learning trajectories, developing identities, and forms of membership”⁹. Within professional contexts, this exposure to changing peripheral locations and perspectives is critical to the career development of a newcomer in their pursuit of full participation as an expert within their community of practice. In this way learning, understood as increased participation in a practice community, “implies becoming a different person with respect to the possibilities enabled” by the social-activity systems of their environment or place of work¹¹.

1.2 Learning within the Architectural Profession

In the nineteenth century, aspiring architects entered architectural offices and learned directly from experienced architects through apprenticeship. Today, the profession continues to rely on this model for teaching the practical knowledge and skills required to become

proficient in the field after formal education. This model for learning comes with the same challenges discussed in the above section related to cognitive apprenticeship and LLP: sociocultural contexts can complicate learning through direct experience and can limit exposure to the breadth of learning required to become a full participant in the community of practice.

Additionally, the project-based model for architectural firms further challenges the issues associated with organizational learning¹². Pure project-based firms are defined as firms where projects “embody most, if not all, of the business functions normally carried out within departments of functional or matrix organizations”¹³. These kinds of firms often lack the mechanisms for organizing and sharing knowledge between projects. Furthermore, the heterogeneous qualities and potentially long life-cycles can make it challenging to transfer knowledge between projects through common means that project-based firms employ: strategic positioning of firm experts and the codification of knowledge¹⁴. Mentorship within these project-based firms can be understood as an opportunity to mitigate these challenges.

1.3 Mentorship and Perkins+Will

Our firm believes that “continuous learning contributes to the success of our employees and achievement of our organizational goals, while maintaining the culture that has given us our competitive edge over three quarters of a century”¹⁵. Firmwide, this translates to programs such as the Leadership Institute, which develops the next generation of leaders, and the Innovation Incubator program that supports staff research.

Mentorship programs beyond that of the Leadership Institute are initiated at a local scale and vary by office. In Boston, each new employee has the option of pairing with a mentor within the firm after their initial 90 days. Mentors possessing a list of characteristics are encour-

aged to apply to the program in order to be considered part of the mentor pool that mentees can select from. These mentors are meant to “help guide the mentee in answering questions, providing information, and building a solid professional relationship.” 38 mentors are listed on the website, last updated in the summer of 2015¹⁶. Based on this information, the program is geared toward new staff finding their way around a new workplace. In this way the program is closely aligned with the Buddy Program carried out in several offices across the United States, though the Boston Program leaves room for the relationship to develop into one akin to traditional mentoring. Similarly, the Champion program, recently implemented in the Seattle Office, pairs a member of office leadership with a newer employee to check in and ensure that the employee is acclimating and that they have someone as an advocate for their progress. Both of these programs, however, do not call themselves mentorship programs and “mentor” assignments do not involve “mentee” input.

In the Vancouver office, the Mentorship Initiative implemented in the summer of 2016 plays a different role. Developed in response to feedback from office employees stating “a strong interest in developing better opportunities to learn, improve relationships, and shape careers in the office”, the program pairs mentors and mentees for a six month period based on surveying their interests and goals (Figure 1)¹⁷.

The key attributes of the program are its non-prescriptive nature (anyone can be a mentee or a mentor), input-based pairings, and short-time frame. At the close of the six month period, mentees have the option to renew mentor pairings or match with a new mentor. This keeps the program iterative and acknowledges the fact that not all pairings will be a long-term fit, but mentees are still able to learn, build relationships and shape their careers within the office.



Figure 1: Infographic explaining the Vancouver Initiative Program.

1.4 Situated Mentorship as an Opportunity to Broaden Legitimate Peripheral Participation

Through mentorship relationships, learners gain greater access to firm experts that may be outside of their periphery position. By gaining this access, experts can offer different perspectives or transfer inter-project knowledge within their firms. While a formal mentoring relationship can bridge the gap between office experts and mentees, office experts in mentorship positions are required to take the time to articulate their situated knowledge in transferrable ways, often abstracting what they know as a result. These traditional mentorship models may also require a time commitment that can be difficult to maintain.

Situating mentorship within the context of a mentor's ongoing work locates learning in the "increased access of learners to participating roles in expert performances"¹⁸. During this time, knowledge-building and learning occurs through being present and situated within the performances of experts. Mentees can be thoughtfully engaged as a "fly on the wall" at the periphery without being an active member of the dialogue or activity. This creates a program that facilitates opportunities for office experts to share knowledge with interested mentees without the additional time commitment of formal mentorship relationships and the resource-intensive processes required by knowledge articulation or codification. It also allows for the observation of tacit knowledge which is critical to the performances of experts as they engage with the nuances of sociocultural relationships, but difficult or impossible to explicitly transfer. In their work on mentoring and reverse mentoring, Fruchter and Lewis apply a similar approach in their "fishbowl" mentoring method, where students in the Architecture/Engineering/Construction are assigned a design problem that they later watch a professional interdisciplinary design team tackle, giving the students "sufficient distance to focus on the process the experts are modeling"¹⁹. Osmosis seeks to provide this same "fishbowl" method without the requirement that experts engage in the same problems as those that mentee's face in their ongoing project work. This provides similar benefits without added investment by the mentors or experts.

Finally, mentoring engagements with a free range scope can present an additional burden of time and emotional investment that can prevent mentors from having more than one mentee at a time. This statement identifies the second focus of the Osmosis program to narrow the scope of mentorship engagement through focusing on

an area of practice. As growing professionals, our list of learning objectives that could be well-served by mentoring relationships is likely very long. However, each of us also likely has a particular area of practice we are most curious about or would like to know more about, whether that be an associated skill, experience or body of knowledge. Osmosis seeks to leverage this curiosity to focus a short-term mentorship engagement on bridging structural gaps between office experts and young professionals.

2.0 METHODOLOGY

2.1 Purposes of the Pilot Session and Research Design

The pilot session of the Osmosis mentorship program was intended as a demonstration project meant to assess the degree to which key participants found the program favorable, engaging and relevant to their career development and learning. The purpose of this article is not to discuss statistical analysis or outcomes of the program, but rather to provide an overview of the situated mentoring program, how it can be implemented in architectural practice, and provide qualitative analysis of the outcomes by reviewing specific cases.

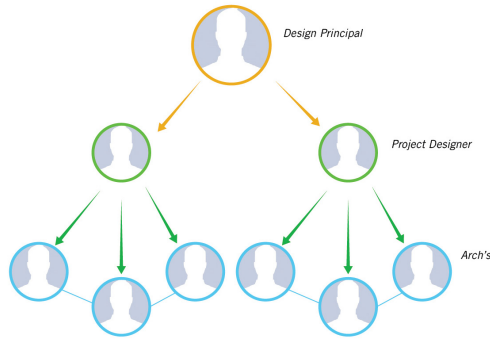
2.2 Program Structure

Osmosis works by pairing mentees that express interest in a specific area of practice with mentors that can share upcoming opportunities appropriate for the mentee to attend. Mentors are expected to go about their daily tasks with the mentee acting as a "fly on the wall" at the periphery during appropriate opportunities. Mentees are expected to work with the mentor to coordinate and schedule exposure opportunities to attend and are expected to seek permission from their project manager if the hours are outside of their billable project.

Based on the literature for legitimate peripheral participation, "the community of practice encompasses apprentices, young masters with apprentices, and masters some of whose apprentices have themselves become masters"²⁰. Therefore, two types of mentors are incorporated into the structure of the program: "A" mentors are experts in office leadership roles, such as design principal, managing principal or technical director, while "B" mentors are area experts in the office, such as a project designer, project architect or marketing coordinator (Figure 2). These mentors can be understood as the apprentices of the masters who have, themselves become masters. Mentees are upcoming profession-

Design

organization chart



Project Management

organization chart

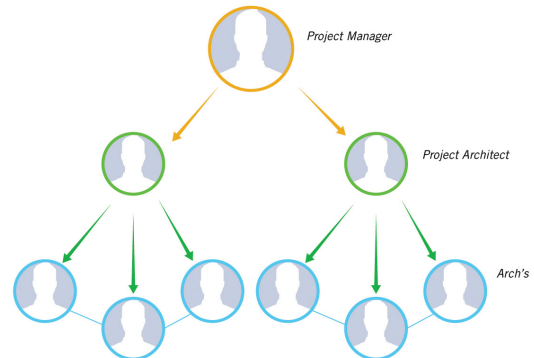


Figure 2: Infographic explaining the Intended Structure of the Design and Project Management Areas of Practice.

als who express interest in a particular area that they would like more experience in. Areas of practice identified in the pilot session included project management, design, sustainability, and marketing. The identification of these practice areas was informed by the knowledge functions within our practice that Perkins+Will already invests resources in articulating and codifying for use by the rest of the firm. As mentioned in the introduction of this paper, the relatively long life cycles and heterogeneous nature of design projects makes it difficult for young professionals to access the contextual performance of these practice areas, particularly given their application in varied phases of a project. As a result, Osmosis, seeks to be another means in which this knowledge can be shared.

Each Osmosis session lasts 10 weeks, with kick-off and debrief meetings occurring at the beginning and end of the session. The duration of the program, intended to roughly match the standard fiscal quarter in length and timing, was selected in order to provide mentees the opportunity to attend at least one weekly, monthly and quarterly opportunity type within their selected area of practice. Anyone with an interest in a particular prac-

tice area can be a mentee. Osmosis mentees bill their time to Seattle Professional Development unless Osmosis opportunities correlate with their current billable project. Osmosis mentors bill their time to their ongoing project work given that, beyond scheduled lunch meetings, the program does not require their additional time.

2.3 Implementation

At the launch of the mentorship program, the Perkins+Will Seattle office chose to run a pilot session with a small group of participants prior to making the program public to the rest of the office. As a result, a limited number of mentees were selected by the facilitators and advisors based on their understanding of who in the office would likely be interested in participating as a mentee. Each selected mentee was then asked what area of practice they would be most interested in learning more about, and the facilitators of the program worked to find mentors within the expressed areas of practice willing to participate. This convenience sample, informed by the closed nature of the pilot session, will be discussed further in Section 4 of this article, where we discuss methods for future candidacy selection.

Table 1: Mentor-Mentee Pairing.

Area of Practice	Mentee	Mentor	Approach
Design	Mentee 1	Mentor 1 / Mentor 2	Isolated
Design	Mentee 2	Mentor 1 / Mentor 2	Isolated
Project Management	Mentee 3	Mentor 4	Integrated
Project Management	Mentee 4	Mentor 4	Isolated

The pilot session ran from mid-August to the end of October 2016. Two areas of practice were selected based on the expressed interest of the mentees and the expertise of the mentors that volunteered to participate in the pilot. In the Design area of interest, Mentor 1, a project designer, expressed his interest in being involved as a “B” level mentor. Mentor 2, one of the firm’s design principles was then folded into the program as an “A” level mentor. Shortly after Mentor 1 expressed his concern in not having sufficient opportunities to offer, Mentor 3 was brought in as an additional “B” level mentor working closely with Mentor 2 on numerous design projects. Mentees 1 and 2 were then asked if they wanted to participate in the pilot session and they became the mentees in the design track. The second area of practice included in the pilot session was that of Project Management. Mentor 4, a key adviser in the genesis of the Osmosis program volunteered to be a “B” mentor with his experience in project management. Mentor 5, one of the firm’s managing principals was then asked to participate as an “A” level mentor in the pilot. Mentees 3 and 4 then joined as mentees in the program’s project management track (Table 1).

2.4 Integrated vs. Isolated Approach

Not all mentees interested in the pilot session were staffed on the same project team as their corresponding mentors. This created two different approaches to the program, one isolated and one integrated. In a format akin to job shadowing, the isolated approach would benefit mentees by providing greater access to experiences and mentors not currently available to them in their project teams and work. This approach would work to address the issues of access and breadth that we identified as crucial to the legitimate peripheral participation of learning professionals. Within the integrated approach, mentees would benefit from ongoing and applicable learning opportunities central to their project work, though their experience would be limited to the context of their current project. This approach intends to focus learners’ experience on their interests by providing access to new opportunities within their project through the established mentor-mentee relationship.

In the pilot session, three of the four mentees were isolated from the teams of their mentors, and one was integrated. Due to the selection process for mentees, not all mentees were staffed on projects within a project phase or with mentor-figures conducive to providing exposure opportunities related to their interests. This impacted program implementation in two primary ways: billing time and coordination of exposure opportunities. While mentees that were integrated in the same project as their mentor would use less professional development hours, mentees isolated from these teams would likely need to invest more of their own professional development hours. Despite these differences, program facilitators moved forward with piloting both approaches due to the unique benefits predicted for each.

2.5 Data Collection

Due to the small size of the pilot program, no statistically significant conclusions were intended at this stage in the program’s development. Therefore, a qualitative approach was used to gain insight into the strengths and weaknesses of the program. Our primary objective was to gather responses on the situated mentorship approach and its implementation. We expected that retrospective experience summaries of each exposure opportunity written by the mentees would enable us to focus our data on how the program contributed to their learning and career development. These qualitative accounts included a record of the individual opportunities each mentee attended and the information they learned from each.

At the close of the pilot session, both mentees and mentors were asked to participate in a debrief session including program facilitators and advisors, during which the program was evaluated based on participants’ narrative accounts. Our strategy was to use mentees’ retrospective experience summaries to focus group interview questions for the program’s debrief session – highlighting experiences that were most beneficial to key participants and working to identify consensus. Contradicting accounts informed further questioning in the debrief session to provide opportunity for discussion and ad-

ditional input by mentor participants. Participants were asked what worked well, what could be improved, and how they saw the program evolving in the future. This conversation was essential in understanding the unique perspective of both participant groups.

3.0 MENTEE EXPERIENCE

Design Track: Mentee 1, then assigned to Schematic Design for 3031 Western

- Week 01 – First Landmarks Board Brief for 400 Westlake, a core and shell office building in early schematic design
- Week 02 – Participated in a DLC Review meeting for UW 3.2, Waimanalo, and the K2 Office. Met with Mentor 2 to discuss focus topics and next projects
- Week 05 – EDG draft review session with Mentor 2 and Seattle land use planner for the Lennar Town Hall project, a residential high rise in schematic design
- Week 08 – Lunch meeting with Mentor 1 to discuss the Baton Rouge and K2 projects and share career insights
- Week 08 – First design presentation by the interior architect designing amenity spaces for 3031 Western
- Week 09 – Second design presentation by the interior architect designing amenity spaces for 3031 Western
- Week 10 – Second Landmarks Board Brief for 400 Westlake (reassigned to this project)

Mentee 1 spent 12 hours participating in exposure opportunities, of which nine were billed to internal professional development. Because Mentee 1 was on the same project team as his associated mentors, the intent of the program was to align him with design opportunities on his own projects. However, because their project was off and on during the duration of the 10 weeks, it afforded minimal hands-on design opportunities. Regardless, Mentee 1 was exposed to many parts of the design process, both with the public and with the client. Of the four mentees, Mentee 1 had the most frequent and diverse learning experiences.

Design Track: Mentee 2, then assigned to Construction Administration on 3rd+Harrison

- Week 01 – First Landmarks Board Brief for 400 Westlake, a core and shell office building in early schematic design
- Week 02 – Participated in a DLC Review meeting for UW 3.2, Waimanalo, and the K2 Office.

- Week 02 – Met with Mentor 2 to discuss focus topics and next projects
- Week 03 – Lunch meeting with Mentor 1 discussing K2 design concepts
- Week 08 – Reassigned to 3031 Western, a residential high rise in schematic design

Mentee 2 spent 5 hours participating in exposure opportunities through Osmosis. All five of these hours were billed to professional development. Mentee 2 summarized his experience as opportunities to make relationships with people at the firm who could help advise him on what phase his interests would be best suited to and who to connect with to gain further insights. Half-way through the pilot session, an opportunity opened up on a project where Mentee 2 could further the learning objectives he had expressed to Mentor 2, one of his Osmosis mentors. He was reassigned and withdrew his engagement in the program.

Project Management Track: Mentee 3, currently assigned to Construction Documentation for 3rd+Lenora

- Week 02 – Troy Block Punch Walk, issues related to coordination of specialty items
- Week 03 – Troy Block OAC meeting, constructability of transition between horizontal-vertical seismic joint
- Week 05 – 3rd + Lenora Client Coordination, separate contracts between owner and tenant requiring high level of communication and coordination
- Week 06 – 3rd + Lenora Design Presentation and Coordination Meeting, managing expectations early to prevent confusion

Mentee 3 spent approximately 8 hours engaged in Osmosis exposure opportunities, of which half were billed to professional development. Remaining hours were spent integrated in his assigned project team, and were therefore billed to the project. Mentee 3's experience was characterized by applying lessons he learned during exposure opportunities to his own project assignment.

Project Management Track: Mentee 4, assigned to Design Development for 3rd+Lenora TI Contract

- Week 03 – Troy Block OAC meeting, conducting a site walk of entire site and an elevator punch
- Week 05 – Troy Block OAC meeting
- Week 06 – Troy Block OAC meeting and worked to brainstorm solutions to a steel channel design issue
- Week 07 – Troy Block OAC meeting observed approval of steel channel solution and sidewalk rebuild

- Week 08 – Troy Block OAC meeting conducting a site walk with a focus on courtyard and paving

Mentee 4 spent a total of 15 hours participating in Osmosis related activities. Mentee 4 volunteered her own time to these opportunities and chose not to bill these hours to professional development. However, these opportunities helped Mentee 4 gain hours toward construction administration for the NCARB internship development program which was important to her career development.

Differences and Similarities between Tracks

For both Mentee 4 and Mentee 3 in the Project Management Track, contact with Mentor 5 did not extend past the pilot's kick-off meeting where he offered his engagement as a mentor. This meant that Mentor 4 was the only mentor available to coordinate learning opportunities with both mentees. Since neither mentee was working in the construction phase or on the same team as Mentor 4, these opportunities offered a look into management related to project delivery. Mentees saw the problem solving that occurs during construction of a new commercial building and how proper documentation can contribute to a smoother construction process. Mentee 1 and Mentee 2 had similar experiences, in that they were also offered a look into processes they were unfamiliar with before. These processes revealed the impacts that careful preparation, politics and collaboration have on the successful delivery of a design narrative. For Mentee 2 and Mentee 1, their highlights from the program were the relationships they built moreover than the lessons they learned.

4.0 DISCUSSION

4.1 Program Strengths

Mentors stressed the program's strengths related to increased exposure, while mentees expressed its contributions to their learning and career development.

4.1.1 Gaining Breadth through Situated Learning

Today, the tools, methods and skills used to deploy expertise are constantly changing. Within this context, learning from an expert is not necessarily about having them distill the lessons they have learned through decades of experience. Instead, it is about watching that mentor adapt to his or her circumstances and identifying the skills and knowledge necessary to do so successfully. Mentorship needs to focus on situated learning in real-time in order to meet the challenges posed by a rapidly evolving workplace.

Formal mentorship relies on a mentor with the time to a) reflect on their experience, b) synthesize what essential lessons relate to a mentee's career objectives and c) sit down to discuss these in conversation. Formal learning opportunities, forum discussions, and council meetings within the firm are similar in this way. Lunch + Learns, for example, require experts to package their knowledge for the use and consumption of a group of people. This knowledge articulation and codification is very important in developing the quality standards of our practice, however, the narratives associated with these teachings are not always directly experienced, nor are they always discussed. Shadowing opportunities grant practicing professionals the vantage point to watch the narrative unfold, whether or not they are involved in the project. In the Design track mentees reflected on how design ideas were communicated to different audiences ranging from the city, land use planner, and developer client. Mentees included their observations on audience feedback, noting when it surprised them and speculating as to how our firm would respond going forward. Their situated learning provided them insight into the social relationships that inform experts' behavior. In the Project Management track, mentees reflected on client-contractor relationships and lessons learned through construction. Mentees commented on the coordination required for equipment items and the careful detailing necessary to meet design intent. Both mentees felt that the site walks were an effective learning tool, and gained insight into the relationships that defined what was noted as a flawless OAC process.

4.1.2 Creating an Open Network: Fostering Relationships

Perkins+Will is a firm with incredible resources distributed over numerous areas of practice. It is also a firm that defines its most valuable resource as its people. Firms that rely on people-embedded knowledge "emphasize experience accumulation processes and knowledge transfer through people-to people communication, and are characterized by a strong and receptive culture"²¹. Across the globe we have office experts in twenty different practice areas. Bridging the gap between office experts and interested mentees requires that we connect with our people and build relationships.

Participating in a larger network contributes to career success because of the increased exposure to new ideas. In several experience summaries, mentees reported learning about processes and projects that they did not know existed prior to their exposure through the program. By starting the conversation, the pilot encouraged mentees to engage their curiosity, and mentees

reported feeling more comfortable to reach out and ask questions.

In both the isolated and integrated mentee-mentor pairings, mentors and mentees had an educational relationship, initiated through the interest of the mentees. For the integrated mentee-mentor pairing, this created a stronger working relationship. For the isolated mentee-mentor pairings, this established a resource for mentees to reach out to with questions in the future. While all the mentor-mentee relationships evolved on their own, Osmosis facilitated the relationship needed to open the conversation.

4.1.3 Brokering Information and Breeding Innovation

Visibility is incredibly important in a large firm. Knowledge sharing and collaboration are essential in advancing the firm's success.

Narrative evaluation of the pilot session proved to provide a framework for mentees and mentors to extend communication beyond the silos of their project teams. Most basically, this opened up the conversation to the sharing of information that wouldn't have happened before. The pilot benefitted the mentees in providing them insights into the context of their current work. One mentee expressed how a wider range of experience creates better informed decisions because "you're not just sitting there drawing this detail but you're thinking about how it's impacting the rest of the project – how it's being elevated and how it's going to affect the long run". The exposure opportunities of the pilot offered this mentee knowledge applicable to his current assignment. "Troy block provided insight of CA process and post occupancy issues. There were a few 'Lessons Learned' that I picked up on and was able to go back and have a discussion with my team on 3rd+Lenora."

In a field with a great deal of complexity and nuance, this transferring and application of knowledge are the greatest benefits that the Osmosis program can provide to the firm.

Most people, especially those dedicated to a specific project, will likely stay within the same project teams because it is comfortable and validating. This clustering is a basic principle of network science²². Individuals build a reputation, become efficient in coordinating with others in their group and develop an identity within their team. However, the mastery developed within these teams does not travel quickly between teams without firmwide opportunities for knowledge-sharing and peo-

ple that can act as "brokers" of information to translate "one group's knowledge into another's insight"²³. Typically, these brokers of information are relegated to leadership in the firm and people assigned to more than one project team. However, Mentee 3's experience demonstrated that this can also happen through the mentees paired with mentors not on their project team. In these circumstances mentees can act to pull information from other teams, and quickly present it to their own team in an applicable manner. Doing so gives mentees an "overall vision advantage to see, create and take advantage of opportunities for their career development and for the sharing of useful knowledge within the firm"²⁴. Sharing useful knowledge across teams in real-time is hugely important to the innovation and creative capacity of our firm – both of which are fundamental factors in economic development and prosperity in the knowledge economy²⁵.

Whether or not a mentee acts on these advantages is difficult to predict²⁶. We also cannot know whether all Osmosis opportunities will provide explicitly useful exposure opportunities within its time frame. However, mentees will be able to consider their current work within the processes of our community of practice. Critical reflection on experiences outside a mentee's regular project scope will contribute to a more comprehensive understanding of the profession and, in turn, help them engage their work in a more meaningful manner. This is essential to the mastery of knowledge and skills that moves young professionals toward more-intensive participation and, eventually, "full participation in the socio-cultural practices of a community"²⁷.

4.1.4 Self-Advocacy Platform

Exposure better prepares mentees to meaningfully contribute to the firm, and it also creates a platform for mentees to express their interests and career goals. For mentees the pilot session was a great opportunity to have face time with upper level people within the firm and to introduce themselves and their interests. For mentors, expressed interest and engagement demonstrates who is trying to get out of their comfort zone and willing to get on other tasks. This also provides leadership a better understanding of the interests, talents and strengths of mentees. In Mentee 2's case, the Osmosis pilot session closely coincided with an opportunity for him to work on a project aligned with the learning objectives he expressed through the program. Remarking on this experience, Mentor 3 pointed out that when "you get engaged in a project in some way and when a position opens up, it's an easy fit".

Additionally, by requiring mentee initiative in coordinating with senior associates and principles, the mentees practiced articulating their goals and directing their own experience. Practicing this skill is essential to defining one's identity within a community of practice and, in turn, directing one's career. The informal nature of the program demands that mentees be proactive about their experience. As noted by Mentee 4 in her experience summary, "you get out of Osmosis what you put into it". We cannot predict whether mentees will take advantage of exposure opportunities, however, the program's insistence on mentee initiative requires active engagement so that mentees exercise their agency.

4.1.5 Career Insight

Within our field, architects can engage in a variety of practice areas and roles. Regardless of a person's level of experience, there is opportunity to specialize in an area of practice or (re)direct your strengths into a particular role. However, doing so requires an investment of time and resources that may not be in the immediate interest of an organization. Making this decision is challenging without previous experience in an area of interest or previous experience in a particular role. In this way, Osmosis provides a "looking glass into the world". The program is designed to provide this exposure with minimal investment of time and resources. In this way it helps mentees direct their careers by affirming interest or revealing disinterest in an area of practice.

4.2 Program Challenges and Future Refinement

In addition to providing feedback on what participants felt was successful about the program, participants also discussed what issues there were with the program structure. These issues primarily dealt with scheduling, coordinating and selecting participants.

4.2.1 Building in Flexibility

Due to the nature of our field, projects are often put on hold or starting back up again. This is a challenging variable to track, however, scheduling was one of the main factors that impacted the mentee and mentor experience.

At the start of the pilot session, Mentor 1 was included as a "B" mentor in the design track and Mentor 5 was included as an "A" mentor in the project management track. In the final stages of development prior to the pilot session kick off, Mentor 1 noted that his project had been put on hold and that he believed his new project would have limited Osmosis opportunities. As a result, his role transformed into an advisory position during the pilot session: he met for lunch with each mentee in the

design track to discuss their interests and his experiences related to career advancement.

Mentor 5's limited engagement was also a challenge discussed by both mentees in the project management track at the close of the session. Mentee 4 and Mentee 3 were not able to make initial contact with Mentor 5 to discuss their learning objectives and, as a result, no level of investment was made by either party.

In the next pilot session, these challenges will be mitigated through a detailed survey completed by both mentors and mentees interested in participating in the program. This survey will ask all interested mentors what projects they are currently staffed on and what the working schedule is for these projects during the session's timeframe. Mentors will also be asked what specific opportunities they envision being appropriate for the goals of the Osmosis program and how many hours they work per week, on average. Mentees will be asked to identify critical insights they would like to gain during the ten week program and how they will measure their success. They will be asked to be as specific as possible in order to intentionally direct their experience. Osmosis facilitators and advisers will then go through and match mentors to mentees based on these surveys – providing more than one mentor for mentees to select from.

Due to the program being vetted through this first pilot session, participants in the next session will more clearly understand the intent of the program and how it will work. Therefore the kick-off meeting will be used as a time to field questions that participants may have after reviewing the program brief, rather than introducing the program to them. The remaining third of the hour will be used for individual mentor-mentee pairings to discuss mentee goals compatible with mentor opportunities and skills. Facilitators will immediately follow-up with any mentors or mentees unable to attend the kick-off meeting in order to ensure that pairs meet to discuss mentee goals and possible exposure opportunities within the first kick-off week.

In the future, the program may consider being run on a rolling basis, initiating pairings and kick off when exposure opportunities are most in sync with mentee goals. However, in this next session, scheduling issues will be controlled through carefully pairing participants and ensuring initial contact in the first week.

4.2.2 Streamlining Program Structure: 1 to 1

Lack of opportunities due to current work load - not enough or too much - will also be mitigated through 1:1

mentor pairings in the next pilot session. With only one mentor for each mentee, tracking and coordinating opportunities will be more straightforward. This change is not being made to shift away from the interest-based approach of the Osmosis program, but instead it is being made as a response to mentor input to simplify the program and allow mentees “a deeper dive in a narrower direction”. Allowing the program to evolve in this way will strengthen the objective of the program to provide mentees insight into a specific subject they would like to know more about. It will also eradicate the “A” and “B” mentor distinction which did not prove to significantly contribute to the experience of any mentees. Lastly, one-to-one mentoring will make it easier to provide specific clients the attendance they expect from our design team.

4.2.3 Mentor and Mentee Selection

Selection for mentor participation in the pilot session was largely determined by those who expressed interest in being involved. Mentees were folded in as young professionals in the office engaged in the conversation and showed interest in self-development. While this worked for the closed nature and small-scale of the first pilot session, the Osmosis program will benefit from an inclusive approach to both mentor and mentee participation in three ways. Allowing anyone to be a mentor acknowledges the fact that many employees, despite age or experience, have a skill to teach and can provide their applied experience. Additionally, opening up participation to the whole office increases the likelihood that compatible and productive pairings will occur. This acknowledges the fact that not every interested mentor will have an active project appropriate for the Osmosis program during any given session. Lastly, as an office we should offer everyone equal-opportunity for advancement. If we experience too much interest during planning of the next session, methods for ensuring equity will be further explored.

4.2.4 Research Design and Data Analysis

Given the demonstrative intent of this pilot session, research design and data analysis were limited to the first level of evaluation in Kirkpatrick's Model for the effectiveness of training. Kirkpatrick's model provides a standard for evaluation across four levels: reaction, learning, behavior and results. While the first easily lends itself to narrative analysis, the second - determining “the degree to which participants acquire the intended knowledge, skills, attitude, confidence and commitment based on their participation in the training” requires a more extensive research design that is more resource intensive²⁸.

Future research for this program will work toward the second level of Kirkpatrick's evaluation model, establishing measurable terms to define the intended learning and career development objectives of the initiative and the degree to which these are achieved. Implementation of prospective and retrospective surveys, as well as individual interviews will provide methods for capturing this data, while further sessions will provide a larger sample size to support statistical analysis and longitudinal tracking of learning and knowledge transfer.

The development of measurable terms to define the learning and development objectives of the program will reference existing research in the design of situated learning instruction – noting the focus on process rather than explicit knowledge in the situated approach to learning. Attention will be given to nonlinear measures of learning such as attitude, efficacy, perceptual skills and higher order thinking gained through the peripheral experience. Efforts to integrate practitioners, researchers and developers in the program's development will continue, given the strength of this interaction in informing improved methods for the program's implementation in our practice. This emphasis on an interactional approach to research will be examined in greater depth, with the shared goal that our research works to understand and articulate practitioners' activity, from their perspective and the perspective of those learning from them²⁹.

5.0 CONCLUSION

Mentorship is one of the most critical and effective components of professional development in our field, particularly due to its collaborative and nuanced nature. However, in such a fast paced work environment, the commitments required of traditional mentorship are limiting to our growth as a firm. Though not seeking to replace traditional mentorship, our culture demands an additional flexible and iterative mentorship approach. Osmosis seeks to be part of the evolution of our individual and collective professional education.

The pilot session of the Osmosis program serves to illustrate the program's strength as a tool for professionals, at any stage of their career, to gain insight into an area of practice that they have limited experience in. While mentees gain breadth in this area of practice, the program also serves to foster the exposure and relationships necessary for long-term knowledge sharing and innovation. Finally, the mentee initiated program demands the self-advocacy required for career-advancement.

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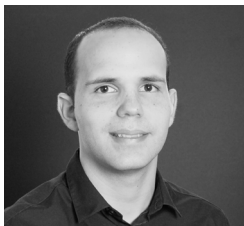
01.



MARY BAKER

Mary is a Knowledge Coordinator for Perkins+Will's Corporate Interiors practice. She earned a Master of Library and Information Science degree and a Bachelor of English and Business, both from the University of Illinois at Urbana-Champaign.

02.



ANTONIO RODRIGUEZ-ARGUELLES

Antonio is an interior designer with more than four years of experience, mostly focused in healthcare interiors. A graduate of the School of Architecture at the University of Puerto Rico and the New York School of Interior Design, he is mainly driven by the users' experience and well-being, and the creation of rich and healthy interior spaces congruent with their surroundings and time.

03.



MICAH LIPSCOMB

Micah is a Senior Landscape Architect, Associate in Perkins+Will's Atlanta office. His work focuses on the design and planning of environments that improve our connections with the natural world, including therapeutic gardens, campuses, parks, greenways, and botanical gardens. His areas of focus in research include therapeutic garden design for children with Autism Spectrum Disorders and the health benefits of nature exposure.

03.



KIMBERLY ROLLINGS

Dr. Rollings is an Assistant Professor at the University of Notre Dame School of Architecture and concurrent in Psychology. She completed her Ph.D. in Human Behavior and Design at Cornell University. Trained as an architect and environmental psychologist, Dr. Rollings systematically examines and assesses influences of built and natural environments on physical and mental health, especially among vulnerable populations. Her work aims to inform the design of healthy, socially responsible, and sustainable buildings and cities.

VERONIKA JONSSON

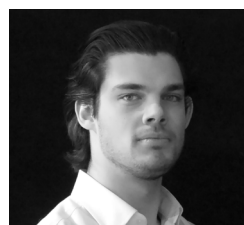
Veronika is an architectural designer in Perkins+Will's Seattle office, where she has worked on a variety of project types including healthcare, higher education, commercial and public artwork projects. Veronika co-founded a grassroots career development and situated mentorship program aimed to support young professionals in order to promote critical investigation within our profession. Through her research and volunteer work, Veronika explores the intersections between social psychology and equity within the design profession.



04.

NOAH GREEN

Noah is an architectural designer in Perkins+Will's Seattle office, where he works on progressive commercial and residential high-rise projects. He is a co-founder of a grassroots career development and situated mentoring initiative. Noah has assisted with teaching undergraduate and graduate courses in digital media, hand media, and passive daylighting strategies at the University of Oregon, served as a guest critic for undergraduate and graduate studios at the University of Oregon and University of Washington, and with urban ecology research based out of Barcelona.



04.

MOHAWK windpower 

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