EXPERIENTIAL WORKPLACE DESIGN FOR KNOWLEDGE WORK ORGANIZATIONS: A WORKER-CENTERED APPROACH

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Dedication

Dedicated to all who cared........thank you!

My unconditional love to my family, Jeff, Niles, Victor, and Dane
My undying gratitude to Milica and Ruby
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Last but not least, I would like to thank my professional colleagues who have encouraged my aspirations and believed in my search for knowledge. I hope to make a contribution to practice and scholarship in the field that will promote discovery and enhance professional relevance.
Experiential Workplace Design for Knowledge Work Organizations:
A Worker-Centered Approach

Abstract

by

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The built environment can have a significant positive (or negative) effect on our work experience. At an individual level, we intuitively understand the effects of the physical space, but when we try to demonstrate the sources and types of effects, we are often unable to do so. This lack of evidence creates a divergence of opinion between management, workforce, and design professionals as to the value that workspace design adds to organizational success and why organizational leadership should invest in more mindful design of knowledge work environments.

To address this problem of practice, an exploratory, multi-method series of three studies was conducted. The first study is qualitative in nature and explores how knowledge work organizations and design teams develop workspace design projects. The results reveal a divergence of vision, values, and vernacular amongst the actors in the initial design criteria-setting phase that obscures a unified problem definition resulting in disparate perceptions of workspace success. It also reveals that workers are not directly engaged in the process of determining the problem definition and design criteria.
The second study evaluates workers’ perceived satisfaction with components of their workspace as predictors of their emotional and behavioral response to work. This quantitative study measures workers’ cognitive assessment of satisfaction with the components of their workspace and facilities and tests their predictive value on worker job engagement, job satisfaction and performance. The results demonstrate that workers’ satisfaction with components of the work environment do not predict the effects on the emotional states of workers. Thus, the study uncovers deeper issues involved in determining the effects of workspace on emotional and behavioral outcomes. A third study assesses the workers’ affective experience of the integral work environment on their emotional response to work. The results indicate an overwhelming effect of the experiential workplace on the emotional response of workers, including engagement.

This set of three studies points towards a new paradigm for the methodology of workplace design project delivery by placing emphasis on the worker holistic, integral experience of the workplace. A new, emergent process model is proposed, which is worker centered, that establishes a clear relationship between the physical work environment and organizational performance outcomes.

**Keywords:** assimilative coherence; design problem definition; integral workplace; worker centered design
INTRODUCTION

Integration between corporate strategy and physical context not only supports business operations, but it also has the potential to enhance it. Congruence between workspace functionality and employee performance is essential to the success of knowledge work organizations. “Knowledge work” is a term coined by Peter Drucker in the 1960s and is applied to activities conducted by office workers with professional and/or formal knowledge that involves some form of process work (Drucker, 1999). Knowledge workers are one of the fastest growing categories of worker in the industrialized world (Eurostat 1995–2000). Much has been invested in office work environments in support of knowledge work that has been wasted due to the fact that knowledge workers are little understood and often underrepresented in the process of workspace design (Haynes et al., 2011). Furthermore, due to the nature and diversity of knowledge work, there is still little evidence to show the type of workspace that makes knowledge workers more engaged and productive.

Workspace is the physical context in which workers carry out their work activities. Workspace design is typically a collective effort on the part of multi-level, cross-disciplinary teams that encompass organizational management and workforce as well as a myriad of design and consulting professionals. The design process consists of an ongoing interactive exchange of information and ideas among project team members leading to an implementable solution. Although numerous studies have looked at the effects of work environment design on workers and organizations, there is little empirical evidence as to how workspace impacts performance, what adds value to knowledge work organizations, and why organizational leadership should invest in more mindful design of
work environments (Davenport, Thomas, & Cantrell, 2002; Duffy, 2005). Social science research on the relationships between office environment and worker performance has focused on “social” arenas of work such as climate and culture as well as work design but largely neglected the physical context of work (Baard, Deci, & Ryan, 2004; Posner, Kouzes, & Schmidt, 1985; Rich, Lepine, & Crawford, 2010; Staw, Stutton, & Pelled, 1994). In contrast, research in the domain of facilities planning and design has focused on the contextual influences on worker behavior, such as physical attributes and conditions of workspace that are expected to influence behavioral factors of office workers (Brand & Smith, 2005; Haynes, 2007; Lee & Brand, 2005; Sundstrom, Burt, & Kamp, 1980; Vischer, 2007a). In practice, workplace design strategies are often influenced by industry trends, design styles, and handed-down traditions of generalized guiding principles. The primary source of requirements for workspace design projects is informal observations and interpretations of employees’ work patterns carried out by managers without specialized training in that task (Duffy, Laing, & Crisp, 1992). Professionals use this information to develop standards programs and modular space allocations based on user group archetypes. This approach has shown to generate only marginal success when reported through post-occupancy evaluations of office environments by individual occupants (Vischer, 2002; Way & Bordass, 2005). These results have left organizations dubious about their return on investment.

In order to contribute to this body of research, I have implemented an exploratory, sequential, mixed methods approach that encompasses three empirical studies that begin to address the relationship between workspace design factors and worker perceptions of workspace in knowledge work organizations. Study one, a qualitative study based in
grounded theory (Corbin & Strauss, 2008), delves into the nature of workspace design project delivery as represented by project team members of nine recently constructed facilities for leading organizations in their respective industries. It defines the nature of team dynamics relative to workspace design project outcomes. Studies two and three, both quantitative, explore the effect that the worker perception of workspace has on their emotional and behavioral outcomes on the job. The quantitative studies measure the magnitude of the predictive value that worker satisfaction with components of workspace and the integral experience of workplace have on job satisfaction and job engagement factors that influence worker performance. In addition, I describe the anticipated relationships between the studies and suggest possible implications for research and practice. I conclude with limitations and suggestions for future research. It is my hope that this effort opens the door for further research that continues the exploration of this very important topic for the advancement of work environment design.

STUDY GOALS AND RESEARCH QUESTIONS

My overarching thesis for this study is quite simple. I posit that worker perception of the physical work environment affects worker behavior and, therefore, should influence workspace design criteria. The manner in which the workspace is designed by the project team and perceived by the workers in knowledge work organization ultimately affects the performance outcomes of the workforce as well as the organization. Thus, in conducting this research effort, I proposed to answer the following set of overarching questions, graphically illustrated in Figure 1: Should knowledge workers participate in problem definition and problem solution of workspace design projects? Does worker perception of knowledge workspace impact their job performance outcomes?
Based on my twenty-year consulting practice in workspace programming and design, and focused reading of key empirical studies in the fields of environmental design and organizational behavior, I conceptualized the following study model, presented in Figure 2, to guide the research in answering these important questions. The qualitative study #1 model represents the results of the interview data analysis, which raised the questions that lead to studies two and three. Studies #2 and #3 are still exploratory while using empirical data to measure the constructs and test relationships.
The first question addresses the team level of analysis using a qualitative study approach. The project team is charged with identifying the criteria for design that determines the project outcome. The study seeks to identify the gap in perception of the project problem definition within the project team. Do all team members share the same problem definition and if not, why not? The objective is to identify the roles, interactions, and results from the perspective of each team member and capture the similarities and differences in an exploratory approach. In other words, what factors explain the interactions of the structures, actors and artifacts that comprise a project team and how do they contribute to the types of outcomes that the team experiences? Does the level and type of participation of team members affect the team’s ability to produce a unified problem definition for the project as a guiding principle and metric of the project outcome? Thus, the first research question is as follows:

*How and in what way do team member interactions generate the project problem definition for the design of an organization’s physical work environment?*
The focus of this study is to assess the factors that influence the team’s ability to generate a unified problem definition that addresses the project goals and objectives and meets the needs of the workforce. If the premise is that the knowledge worker is the engine of the knowledge work organization, then the factors that influence their emotional and behaviors states are critical to organizational management. Consequently, in order for the project team to establish workplace design criteria that will produce value for the organization, it must not only understand the workers’ perception of their workspace but also how the workspace experience affects them, and what attitudinal factors of the workers’ influence their perceptions and experiences. In order to address the worker perspective, two quantitative studies are employed at an individual level of analysis. The purpose of these studies is to first establish a link between workspace and performance, and second, to make a clear distinction in the evaluative constructs of workspace effects (a) the aggregated results of user responses to the perceptions of components or attributes of space and (b) the experiential effect of the integral or holistic workspace on space occupants.

The research questions for study two is as follows:

*To what extent does workers’ perceived satisfaction with the workspace components of their workspace and facility influence their performance outcomes?*

This objective view represents the conventional method of operationalizing workspace satisfaction (Carlopio, 1996; Churchman, Stokols, Scharf, & Nishimoto, 1990; Peretti & Schiavon, 2011; Stokols & Scharf, 1990). By deconstructing the workspace into components of space, the study looks at the individual worker’s perceived satisfaction with the ambient and attributional components of the physical environment. Prior
research in facilities design and environmental psychology literature that used summative results of objective measures of workspace only studied their relationship to job satisfaction but not job engagement (Lee & Brand, 2005; Lee, 2006; Oldham, Kulik, & Stepina, 1991; Sundstrom et al., 1980).

The third study includes an affective measure of the perceived experience of workspace in order to evaluate an integral view of the physical work environment (Fischer, Tarquinio, & Vischer, 2004; Russell, Ward, & Pratt, 1981). This approach is intended to access the meaning making involved in spatial experience that involves the affective processing mechanism using an interpretivist approach. I theorize that the experiential nature of workspace perception would not only operationalize the emotional aspects of job satisfaction but also predict job engagement.

The research question for study three is as follows:

*To what extent does workers’ affective experience of the integral workplace influence performance outcomes?*

**THEORY AND LITERATURE REVIEW**

The theoretical model in Figure 3 depicts the heuristic nature of the three study progression using an explanatory, mixed methods approach. This methodology is intended to study the impact of workspace projects on worker performance and its effect on work environment design. It is important to notice that the model includes three domains of research, namely work environment design, environmental psychology, and organizational behavior. The research that is reported here lies in the intersections of these domains. The complexity involved in the integration of the studies is driven not only by the vastness of literature in each of the research disciplines but also by the diversity of methods in which the research is conducted in each domain.
Interaction of Team Members

A workspace design project is a complex multi-dimensional structure consisting of a multi-disciplinary and multi-level team that includes organizational and consulting stakeholders. This complex structure is expected to self-organize while being bounded by scope, time and cost constraints. Team members have representative roles standing in for their respective organizations and professionals.

I use Coherence Theory of Perception to explain the manner in which the team members process the data gathered from a project into visual representations. These representations are guided by their a priori knowledge and experiences or preconceptions of the subject matter. These coherent representations manifest through an object system based on attentional focus of the observer or the setting system based on the meaning or...
“gist” of the environment and the layout of objects within it (Rensink, 2002). A “gist” is a pseudo-gestalt, integral representation of the environment that is a result of a largely intuitive response. However, once these sensory representations are formed, they are maintained in a “coherence field” and used to make judgments about the environmental conditions (Rensink, 2002). In order for the coherence field to be maintained over extended periods of time, it must also engage a system based on beliefs (Merricks, 1995). Thus, the sensory representations of the atomistic and integral environments are perceptions that are influenced by individual beliefs in order to explain the phenomenon in question. This inferential process constitutes the coherence theory of explanation (Simon, Pham, Quang, & Holyoak, 2001).

The Coherence Theory of Explanation transforms perceptions into explanations using the preconceptions and beliefs of the individual. This is a recursive series of events operationalized by cognitive processing toward an ever increasing coherent explanation (Thagard & Millgram, 1995; Thagard, 1989). This creates an inference network that enables the individual to draw conclusions and derive explanations to interpret new information. The objective is to achieve greater coherence through a cyclical, bidirectional interface between perception and representation. The level of success is assessed through a parallel constraint satisfaction process mechanism, which aligns the boundary conditions for each position, until a coherent explanation is reached (Simon & Holyoak, 2002; Simon, Snow, & Read, 2004).

The coherence theory explains the information processing methodology of individual team members faced with a set of data that may be selectively collected, incomplete and subjective in nature. It also identifies a quandary in achieving a consistent
explanation across members of one team. Given the diversity of backgrounds, dispositions, and objectives of the team members, the perceptions of the objects and settings in the work environment can vary significantly. The gap in this explanatory theory suggests an assimilation method of the perceptions and representational images through a common set of foundational belief systems and nomenclature across multiple disciplinary groups and participants.

Assimilation of Coherence across Team Members

Distributed cognition is a theory in psychology introduced by Edwin Hutchins and his colleagues in the 1990s (Hollan, Hutchins, & Kirsh, 2000; Hutchins, 1990, 1995; Hutchins, 2000; Hutchins & Klausen, 1996). The central feature of the theory of distributed cognition is motivated by research on teams engaged in complex tasks where information processing is distributed across all team members. Hutchins (1995) posits that information processing is equally applicable to internal (mental) and external (environmental) structures. In this way, Hutchins redefines the unit of analysis from the individual to the team addressing the same task. Based on these assumptions, the theory can be stated such that: (1) cognitive processes are distributed across agents of a group; (2) the operation of the cognitive system entails coordination between internal and external structures; and (3) the processes are distributed through time in that results of earlier events can change the nature of later events (Hutchins, 2000).

The complexity of a project delivery process requires a common understanding among multi-disciplinary project team actors of the problem definition and project objectives. This is accomplished through iterative modes of information exchange between the team members. To the extent that the project team participants are sharing
the same vision and values, the parameters of project definition are made to coalesce; if these are misaligned, the outcome is likely to disappoint to at least some of the actors.

The effort of generating project design criteria is an integrative process that requires participation of all stakeholders. If any of the stakeholders are not sufficiently represented, it can compromise project outcome. The success of this effort is contingent upon a recursive exchange of ideas until a general understanding is reached. This language structure is derived from negotiated learning where interactive communication explains the context and is shared among agents involved in the exchange (Hutchins, 2000). Thus, paradigms that are not understood by any one individual may emerge through the interaction between multiple team members. The result is a common vernacular that enables a unified project problem definition.

In a study based on collective cognition, Hargadon and Bechky (2006) introduce the notion of collective creativity in group problem solving; the possibility that an interactive group in moments of collective effort can produce creative outcomes that an individual cannot achieve alone. This proposition is supported by the concept of collective mind (Weick & Roberts, 1993), which is defined as mindful interactions of individuals in a social system. This framework explains the interplay of interrelated individuals involved in a collective effort motivated by creative problem solving. The distinction made in the current research is specific to problem definition rather than problem solution. The emphasis in this collective effort is on defining a temporal, shared purpose through distributed cognition of the same project vision and values across all team members. This distributed cognition is facilitated by shared tools, artifacts and a
common vernacular. The proposition is that in creating this collective mindset around problem definition, a unified problem solution would emerge.

The tools and artifacts used by the team members in the performance of the work can have a significant impact on how the project is characterized and defined. The symbols, cues, and processes used in extracting and sharing the information across the project team enable the unified project definition to emerge out of a complex network of possible alternatives.

An artifact, such as a physical model or even a representation thereof, can trigger a response. Interactions with that artifact by the team members can provide a common understanding of the problem and solution (Hutchins, 2000). Agents can adapt their patterns of behavior over time to align with other members of the group or team. Their interactions with other team members and their physical context create a common bond during the project time frame. Therefore, distributed cognition offers a valid lens for understanding a complex, multi-disciplinary, multi-level team environment. A transitional project team with potentially divergent views and backgrounds can be made to coalesce around a unified project problem definition given shared vision and values, and a common vernacular using multi-modal tools and resources. The likely outcome of a unified problem definition is a successful problem solution that meets the needs of all project stakeholders.

**Emotional Response to the Physical Work Environment**

The study of workers’ emotional response in organizational research used to be a non-sequitur. The scientific management theory of F. W. Taylor (1911a) not only ignored it but dismissed it as irrational. In current literature, the theories in the domains of
psychology and organization are highly integrated, with the recognition that emotion is a dominant factor in organizations and plays a role in individual, group and firm performance (Elfenbein, 2007).

Workspace can be perceived as a context for workers’ social and professional activities and relationships. In that vein, the manner in which workers perceive their workspace could have an impact on how they feel about their work and the organization for which they work (Fischer et al., 2004). Thus, workspace becomes the stimulus that elicits meaning and feelings from the workers toward the work they do. How do workers make judgments about these perceptions that lead to emotional outcomes? The two mechanisms extensively studied in behavioral psychology are cognitive and affective processing mechanisms, and are considered to be based on qualitatively different attitudes (Brief & Weiss, 2002). Zajonc (1980) states that “affect and cognition are under the control of separate and partially independent systems that can influence each other in a variety of ways, and that both constitute independent sources of effects in information processing” (p. 151).

A common theory-based definition of emotion is that it is a response to stimulus and can manifest in an array of different ways (Frijda, 1988). In contrast to emotion, which is reactionary and temporal, mood is more dispositional and lingering (Cropanzano, Weiss, Hale, & Reb, 2003). Affect encompasses both emotion and mood (Forgas, 1995), which together interpret the meaning of stimulus. Individual dispositions are predictors of experiencing a particular affective state (Fleeson, 2001). Dispositions are predictors of schemas that individuals use to interpret their environment. Emotional dispositions influence individuals’ predictive reactions to standardized cues. In fact,
individuals possessing high positive affect are more likely to influence positive outcomes, while individuals with high negative affect are intent on preventing negative outcomes (Larsen & Ketelaar, 1989). These dispositions would produce dramatically different results in the way that a worker would respond to their physical conditions. The affective reaction to workspace is focused on understanding the characteristics of the space user and not the space features. It is based on the preferences and evaluations such as pleasure-displeasure (Zajonc, 1980).

However, the most prevalent way in which workspace is assessed in prior studies is through users’ cognitive evaluations of environmental features based on pre-existing standards established with *a priori* experiences (Stokols, 1992). A cognitive process requires that features are identified, examined, and compared prior to a judgment being made as to their value and level of perceived satisfaction. In this positivist approach, the focus is on the object being examined rather than the disposition of the individual conducting the examination. The intention is to establish an objective value judgment of each component of space.

Two emotional constructs used prevalently in the study of organizational behavior are job satisfaction and engagement. Engagement as a psychological construct has numerous definitions (Macey & Schneider, 2008). In this case, we posit that engagement is a positive emotional response to an affective state. Similarly, positive emotions are associated with job satisfaction (Staw et al., 1994; Wright & Staw, 1999). In fact, job satisfaction has been argued to be a response to both affective and cognitive processing modes (Brief & Weiss, 2002). The ongoing debate revolves around the issue of categorizing job satisfaction as an evaluative judgment and a result of cognitive
processing, or an attitude driven by affective processing. Both psychological constructs have been studied in social science as enticements to job performance outcomes (Harter, Schmidt, & Hayes, 2002; Judge & Bono, 2001). If workspace impacts the workers’ cognitive and affective states, then their ability to influence performance is contingent on their emotional responses to work, such as engagement and job satisfaction.

**Transformational Link between the Physical Environment and Behavioral Outcomes**

If context is presumed to be a socially constructed reality based on individual interpretations, does the meaning that individuals ascribe to that context influence their behavior? According to Blumer (1969) and the symbolic interaction theory, the emotional response that individuals exhibit toward their physical environment is based on the meaning they assign to it. The meaning is born out of the expectations and experiences they have as a result of their social interactions within their context. The basic premise of symbolic interactionism is that individuals behave in response to the emotional significance that their surroundings have for them. Symbolic interactionists believe that individual and their physical environment are inextricably intertwined in a reciprocal relationship with their emotions and behaviors. These changes are affected by the dispositional traits of the individuals and the resultant meanings they attribute to their surroundings.

Symbolic interactionism represents a post-positivist or constructionist lens of one's surroundings. It suggests that the meaning that individuals project on their environment is personal and subjective based on their dispositions and attitudes. It supports the premise that the experience of the holistic physical work environment plays
a significant role in worker involvement with and reaction to their job. In contrast, the positivist view assumes that there exists only one reality and the observer is only there to describe it. The observer’s positional view of that reality is not unique or relevant. Thus, the focus is on the object and not the observer. While the deterministic judgement of the components of space is a valid assessment of workspace features, it does not convey meaningful information about the worker as the workspace user. In order to apply the evaluative data in the process of decision making about the workspace, it is necessary to understand the relationship between the worker and the workspace.

**Self-identity and Sense-of-Place**

The deterministic paradigm of space evaluation using the cause–effect approach does not consider the human experience of the overall physical context (Clements-Croome, 2006). This stimulus-response approach is focused on user satisfaction with the components of space (e.g., light, temperature, views, privacy, furnishings, etc.). Little is understood about the interpretive nature of the reporting as the users are undifferentiated relative to their attitudes and dispositions as individual space occupants.

The interpretivist paradigm takes into account the affective response to the integral physical environment through an emotional reaction to the experience of space. However, it still does not differentiate the user as having a unique attitude based on their dispositional traits. The significance of the affective response suggests the importance of understanding the space user’s individual identity as a reflection of their attitudinal and dispositional traits. The presumption is that the experiential expression of the person toward their environment is bounded in their self-identity and greatly influences the perception of their surroundings. It points to the fact that the relationship between the
individual identity and affective response may be the key to understanding the variations in the emotional and behavioral responses of workers.

An identity is an aggregation of meanings towards the self as a social being behaving in a set context. This set of meanings is applied to the self that defines who one is (Burke & Tully, 1977). Identity Control Theory (ICT) explains the manner in which identities produce behaviors expressing individual dispositions and attitudes (S Stryker & Burke, 2000). The relationship between identity and behavior lies in the meanings they share (Burke & Reitzes, 1981). The principles of shared meanings are rooted in symbolic interactionism (Blumer, 1969; Mead, 1938a). One of the core principles of symbolic interactionism is the individual creation and re-creation of structure. The individual recursively balances the meanings they perceive in the environment and their self-identity meanings in order to maintain a stable structure (Burke, 1991). This approach evaluates the self-relevant meanings perceived in the environment are against the individual’s identity standard through self-verification (Burke & Tully, 1977). This process puts into perspective a common framework that accomplishes two objectives: (1) it gives agency to the individual by defining self-verification induced change as goal-directed behavior; and (2) it introduces emotional response into the process through the individual’s reaction to self-verification outcomes (Smith-Lovin, 1995; Stets & Tsushima, 1999). Affective responses, both emotion and mood, through self-verification, have shown to have impact on the individual and their behaviors. The emotional response indicates to self and others the individual’s attitudinal state, which is then followed by a behavioral outcome. It is possible for an individual to adapt their identity standards and representative emotional and behavioral outcomes to a perceived disconfirmation of meaning with their
environment; however, this is a very slow process, and people are more likely to leave the situation before that occurs. Individuals with lower levels of influence or status are more likely to change their identity standards to match the perceived meanings of the situation than are people with higher levels of power over their environment (Cast, Stets, & Burke, 1999).

The relationship between self-identity standard and emotional and behavioral responses can be assessed using the semantic differential measurement indicating the perception of meaning as bipolar responses to stimuli in the environment (Osgood, Suci, & Tannenbaum, 1957). Burke and Tully (1977) documented that reflexive response, based on self-identity, to self-in-environment, can be reliably measured using semantic differential scales (S Stryker & Burke, 2000). The way that individuals respond to their integral physical environment based on who they are and how they perceive themselves is a critical measure of their emotional and behavioral outcomes. Given that knowledge workers spend more than a third of their day at work, their affective experience of their workplace is a significant indicator of their relationship with their jobs and the organization.

**Place-identity as Sub-structure to Self-Identity**

If one accepts the premise that the definition of self and self-identity is a structure that changes throughout one’s life-cycle, then one has to recognize that it is a response to the changing physical world by which one is surrounded. A sub-component of self-identity or a meaningful overall aspect of identity is place-identity (Proshansky, Fabian, & Kaminoff, 1983). The meanings or interpretations that individuals attribute to their physical surroundings are termed sense-of-place. A sense-of-place is a condition of
human existence that is instrumental in defining the self-identity of an individual (Buttimer, 1980; Heidegger, 1962; Norberg-Schulz, 1979; Relph, 1976; Tuan, 1975a). As a sub-structure of self-identity, place-identity is cognition of the physical world in which the individual lives. The theorists most notably associated with the conception of place-identity (Buttimer, 1980; Relph, 1976; Tuan, 1975a) defined it as a sense of belonging to a place of significance, namely one’s home, which is imbued with meaning for that individual. They go further by adding the concept of “rootedness” to the definition, as an unselfconscious association with place$^1$. Fried (1963) adds to this concept the distinction between cognitive and affective responses in space attachment as fundamental to human functioning. Subsequent research has expanded this person-place relationship definition to include a wide range of physical contexts that change throughout the course of an individual’s lifetime (Lalli, 1992; Low & Altman, 1992; Proshansky et al., 1983; Seamon, 2000a; Stedman, 2002). The resulting structure of place-identity which consists of a person’s attitudes, values, beliefs, meanings and behaviors is far more complex than just place attachment. In fact, Stedman (2002) opens the door for quantitative analysis of the role of meanings in attachment and satisfaction with place. He suggests that the experience of place is not an outcome but rather a predisposing factor in the relationship between people and environment.$^1$

In the context of this workspace research, the distinction is made between place attachment and place satisfaction. Place satisfaction is defined as a multi-dimensional assessment of the perceived quality of a physical space; the ability of physical space to meet basic utilitarian needs. In fact, “it is possible to be satisfied with where one lives and

$^1$Space is defined as a person’s physical surroundings; Place is defined as space that is imbued with the person’s lived experiences and has meaning.
not be particularly attached to the place” (Mesch & Manor, 1998: 509). In phenomenological research, meaning and attachment have been considered important, but undistinguished components of sense-of-place research (Relph, 1976; Tuan, 1975a). In social psychology, place attachment is a function of symbolic meaning associated with the affective experience of the physical environment. In both domains of research, the relationship between physical settings and affective states of space users has been spars and highly varied in theoretical and methodological approaches; thus, little knowledge has been accumulated (Brief & Weiss, 2002). This study introduces an affective measure of the experience of workplace in contrast to the satisfaction of workspace components measure in a physical work environment. The outcome shows a theoretical distinction between the two measures of sense-of-place that may explain different aspects of emotional outcomes as differentiated by the place users’ self-identity.

**RESEARCH DESIGN INTEGRATION**

This research explores the emergence and effectiveness of a workspace design project problem definition and problems solution from the perspective of a project team and the subsequent impact of the design outcome on workspace users. The methodology of approach is a multi-method series of three studies using a sequential implementation starting with qualitative data collection and analysis. The results of the first study revealed gaps in perception, relevance and influence of team members, specifically the omission of direct involvement of the workspace user, or worker, in the workspace design process. These findings initiate subsequent questions regarding workspace effects on worker emotional states and behavioral outcomes in a knowledge work organization. Thus, two additional studies are conducted using a quantitative approach to measure the
level of impact of workspace factors on workers. The expectations were that this empirically derived result would have a reflexive effect on the project design team methodology in creating a unified problem definition for workspace design.

In order to accomplish this effort, it was necessary to employ multiple methods and theories (Teddlie & Tashakkori, 2009). This thesis not only integrates multiple domains of research (environmental psychology, organizational behavior, and design theory) but also addresses the research problem at duel levels of study (team, and individual). Figure 4 summarizes the three studies and illustrates the relationship between them.

Figure 4. Sequential Mixed Methods Research Approach (Teddlie & Tashakkori, 2009)
In study one (Phase One), the qualitative data collection protocol involved four sources of data representing the major groups involved in a workspace design team. The objective was to extract themes from the lived experiences of key project team members in order to understand the meanings each of them ascribes to the project (Creswell, Plano Clark, & Garrett, 2008). These themes were derived by analyzing interviews to construct grounded theory (Charmaz, 2006; Glaser, 1999). The two guiding principles of grounded theory method are constant comparison of the interview data and existing literature in order to identify patterns and relationships grounded in an empirical process. I conducted the interviews with 36 individuals who participated in project planning, design, and implementation from nine major organizations that had completed a large-scale build-out of office workspace for their workers. I used semi-structured interviews to capture the experiences, perceptions, and attitudes of respondents participating in project implementation as well as pre- and post-occupancy of knowledge work environments. Given that the participants were of different levels and backgrounds I took a more open-ended approach to allow themes to emerge. The transcripts of these interviews were coded to derive themes and generate contextual theories (Saldaña, 2015). The purpose of my query was to examine how project team member interactions generate a project problem definition for the design of a knowledge work office environment (Research Question One).

In the second study (Phase Two), I focused on the perceptions of office workers’ physical work environment and its effect on their emotional and behavioral response to their jobs. The objective was to empirically examine the question: Does workers’ satisfaction with the design features of the organization’s workspace and facility
influences their job performance (Research Question Two)? In other words, does physical work environment affect workers and should it matter to organizations? Using environmental design and psychology literature, I derived my exogenous variables as measures of workers’ perceived satisfaction with characteristics and components of workspace both individual and ambient. From organizational behavior and psychology literature, I defined my dependent variable as multiple dimensions of worker performance and the antecedents to performance as job satisfaction and job engagement. These antecedents became the mediating factors between perceived satisfaction with workspace and worker performance. The appropriate way to test these relationships is a quantitative analysis (Creswell et al., 2008). Thus, I developed a research model and stated my hypotheses to test the mediation effects between the independent and dependent variables.

I based this study on cross-sectional survey data for two reasons. First, I wanted the study to focus on space user perception of a broad range of office space types irrespective of an objective assessment of space quality or condition. Second, I felt that a diversity of workers across industries generations and workspace occupancies would make the findings more generalizable. I also collected data from the same population for other constructs to be used to answer additional research questions in subsequent studies. The most effective way to accomplish this was to use panel data. Because I am looking to study the emotional rather than behavioral responses to workspace, I concluded that a cross-sectional survey of a random population of knowledge workers would produce a more representative data set than researcher observation type of data obtained through experiments or interventions in a specific work environment. Thus, the unit of analysis is
an unidentified knowledge worker participating in a self-administered and self-reported
data collection effort using the Qualtrics on-line platform.

In the third phase of research, I wanted to explore a possible distinction in
workers’ perception of workspace between satisfaction level with features and attributes
of space and the experience-of-self in the workplace on the same conceptual model. In
essence, does the affective experience of the integral workplace impact workers’
performance in knowledge work organizations? (Research Question Three). As part of
the data collection survey instrument, I included a semantic differential scale that
measured the emotional reactions to places through space users’ internal representations
using the same office worker population. I first tested the construct as a single
independent variable to confirm that, in fact, it is a predictor of the relationship between
emotional and behavioral factors in our conceptual model. Once confirmed, I constructed
a measurement model that included all three exogenous variables (satisfaction with
components of individual workspace, satisfaction with components of facility, and
affective experience of the integral workplace). The third phase is intended to
complement and extend the findings from phase two (Klassen, Creswell, & Plano Clark,
2012).

The findings of the two quantitative studies are intended to inform the first study
relative to the significance and implication of the workspace users (workforce) in the
design problem definition and solution for knowledge work organizations’ physical work
environments. This could potentially influence the structure and methodology of the
project teams in their project delivery approach.
Intersections between the Studies

There is one common thread that links all three studies at both the team and individual levels. The significance of the knowledge worker is the shared perspective between the three studies. The role of the worker is a progression from worker-as-abstraction to worker-as-observer and, finally, worker-as-participant in the relationship between workspace and performance. This sequential, exploratory approach builds the argument that the worker is the central actor in establishing the link between environment design and organizational performance domains.

The two quantitative studies share a common theoretical foundation built upon the importance of worker perception of their physical work environment explained by the cognitive and affective processing mechanisms. It makes the claims that both types of workspace assessments are important to consider in understanding the effect of the work environment on the emotional and behavioral outcomes of knowledge workers in organizational contexts. It further reveals that the workers’ attitudes toward and relationships with their physical work environment is a critical element in constructing the workplace design problem definition that demonstrates a positive effect on performance outcomes for the organization. This links the results of the quantitative studies back to the team-level structure involved in the problem definition and problem solution activities of workplace design projects.

Sample

The qualitative sample is based on recently completed office projects (100,000 square feet or larger) for knowledge work organizations. Each of the projects was supported by a team representing the stakeholder organization and the consultants hired
to deliver the project. Even though the overall approach to project delivery was quite consistent, the executions varied dramatically. The team members representing the organization originated from different levels, backgrounds, and experiences. Some were in-house consultants hired specifically by the organization for the project. The consultant team members, while representing the lead architectural/design firm and having similar levels of scope responsibility, varied in their levels of involvement and contribution. The objective was to discern the participation, contribution, and motivations of the team members toward a project problem definition in delivering a physical work environment for workers. The sample was intended to provide four views of the same project using four different lenses. For each project, I conducted interviews with four individuals that were engaged by the organization on a permanent or consulting basis before, during and after project occupancy. The individuals fit into four categories: (a) business unit manager, (b) workspace user or worker, (c) facility manager or workplace strategist, and (d) architect and/or designer.

The sample consisted of 36 interviews across 9 projects. The unit of analysis was a project that was completed no more than one and less than seven years prior to the interview. Each project was comprised of, at minimum, 100,000 square feet of office space housing a knowledge work organization. Of the nine projects, six were standalone headquarters or on headquarters campus sites and three consisted of new construction or major renovation for specific use office type functions. Eight of the nine projects were located in California; three in Northern California, five in Southern California and one in Western Michigan. Of the nine organizations, four are global, three are national, one is public, and one is a public/private partnership.
Given the supposition, that the objective of workspace design is to provide a physical work environment that supports the workers in performing their work, I wanted to examine the workers’ perceptions of their workspace and the effect this perception has on their job performance. This called for an empirical study of construct relationships. For studies two and three, both quantitative, I used the same sample as I was able to include construct scales for both studies in the survey instrument. The study sample was created from a Qualtrics, online panel data respondent pool of 860 randomly selected office workers from a variety of occupations and organizations who completed the survey over a two-week period in November 2014. A data set was then derived using the following filters: (1) full-time employed; (2) works in an office environment; (3) has a designated workspace; and (4) comes to the office on a regular, weekly basis. The resultant data set was then checked for different types of response bias. For acquiescence bias (Baumgartner & Steenkamp, 2001), I used attention checks at multiple points in the survey, where not answering with the expected attention response ended the survey. To measure social desirability bias, I asked a series of five questions that were unrelated to the study constructs. This would allow us to control for bias in the structural model analysis (Steenkamp, de Jong, & Baumgartner, 2010). For common scale bias, I used different scale formats and response types in the online survey (Chang, 2010).

Of the 860 total responses, I utilized a final sample of n=408 fully completed surveys, of which half the participants were female; less than 1% worked in the facility less than one year and over 50% more than six years; 40% worked in a private office, 47% in a semi-private partition enclosed workstation and 13% at an open desk. The respondent pool covered five levels of job classification (administrative, clerical,
professional, managerial, consulting/contracting) and ten industry sectors (finance/banking/insurance, utilities, manufacturing office, technology, research and development, transportation, institutional/public, design, construction, and service).

The randomness of the sample was deliberate as I did not want to affect the validity of inferences with the knowledge of the actual layout or quality of the workspace the respondents occupied. However, this approach prevented me from being able to assess non-response bias as I could not ascertain the sequence or source of the data collection process (Armstrong & Overton, 1977).

**Validity of the Integration Method**

This sequential, mixed method, exploratory approach demonstrates validity and reliability through the integration of the three phases. The use of multiple methods of research and units of analysis reinforces the validity of the findings and conclusions as applicable in multiple domains of research and practice. In addition, the inferential nature of the progression from one study to the next builds the case for overarching inquiry pertaining to the design methodology in the space of user-centered problem definition and problem solution. Thus, it creates a virtuous cycle of research flow that perpetuates a feedback look of data to the project design team. By using both qualitative and quantitative methods of research, the integration of the three studies increases their combined reliability (Creswell & Plano Clark, 2011).

The focus of all three studies is on physical work environments for knowledge workers, the most difficult entity in work environment design to define and measure. The independent variables in the two quantitative studies are only measuring perception of workspace. In addition, the data was collected at one time from the same set of
respondents, controlling for variation in perception of each respondent to different types of physical settings. Thus, this research stream exhibits internal validity such that the inferences made regarding the outcome variables can be largely attributed to participants’ individual perceptions of their workspace without judgment of the quality, type, and configuration of the actual space.

INTEGRATED FINDINGS

The results summarized here are findings from the three research papers, which can be found in their entirety in the appendices of this dissertation. The three studies are exploratory in nature and the inferences from each become the motivation for subsequent research. In other words, the first study’s analysis of the project team interaction points to the need to understand more deeply the relationships between worker perceptions of the work environment and their emotional and behavioral outcomes. The results of the second study regarding the workers’ perception of the physical work environment became a reflexive input for the third study’s team level project problem definition. This is potentially a recursive activity that results in a virtuous cycle of adaption of the environment to the worker.

The first research question addresses the practices and interactions of key team members involved in the design and implementation of a large-scale project for a knowledge work organization. The intent was to explore the similarities and differences of expectations and perceptions that team members have of each other and the project requirements. This study reveals three significant findings relative to project teams involved in workplace design for knowledge work organizations: (a) conflicting views and values of team members, which I termed “perception”; (b) filtering of data and
information, which I called “influence”; and (c) sub-optimization of professional contributions, which I labeled as “relevance”. Figure 5 depicts these findings in the relationships between the team members. The perception issue was predominantly evident in the case between workforce and management. The workers’ perceptions were that the primary objectives of management were space use efficiencies to reduce facilities costs; while management insisted that they were enabling a better work environment and improving work-life balance for the employees. The in-house facilities group took on the role of interpreter between the architects/designers and executive management; thus, exerting extant influence on the decision making process. The design and consulting teams felt marginalized in the relevance of their professional contribution. These divergent relationships are depicted in Figure 5.

**Figure 5. Project Team Divergent Relationships**

![Figure 5. Project Team Divergent Relationships](image)

In a study regarding knowledge transfer among multi-disciplinary groups in a production environment (Bechky, 2003), this lack of shared understanding and common
language caused a breakdown in the production cycle. Bechky (2003) termed this phenomenon “decontextualization,” where multiple groups used different words and concepts to describe the same object. While this study clearly exemplifies the consequences of communication failure, it is representative of a linear process akin to a building construction cycle. The complications occur at the hand-off points from one group to the next. A multi-disciplinary, multi-level design team shares similar communication barriers in the conceptualization effort of project problem definition but in a contemporaneous context. All disciplines and levels must participate in a simultaneous, interactive manner in order to define one set of unified project objectives.

The findings of the qualitative, first study not only displayed a divergence of perspectives and objectives on the part of the project team members, but also exhibited a clear omission of the worker influence in the design process. In order to assess the possible significance of worker involvement, for whom the workspace was being provided, I needed to demonstrate that workers’ perception of workspace had an impact on their performance on the job. This study examined worker satisfaction with physical and ambient components of workspace components and its impact on emotional and behavioral outcomes. Existing research has not definitively shown that there is a direct link between physical settings and performance. The predominant variable used with some level of success in mediating this relationship has been job satisfaction. In organizational behavior research, much emphasis has been placed on engagement and job satisfaction as a predictor of performance. An extensive body of research substantiates this link and its value to organizations. My study’s objective was to introduce the organizational context, i.e. the physical workspace, as the antecedent to that relationship.
through the perception of the knowledge worker. The results substantiated my supposition and confirmed the hypothesis that perceived satisfaction with the individual workspace and the ambient conditions of the facility directly predicts satisfaction, which then influences engagement with one’s job and affects work performance.

Behavioral psychology research purports that human processing of information involved both cognitive and affective means. Job satisfaction has been shown to use both processing mechanisms; although engagement is predominantly an affective process (Staw et al., 1994). The independent variables I used in this study have been associated with cognitive processing by eliciting an evaluative judgment from the worker about specific properties of the components of workspace (Russell et al., 1981). This explains the chained mediation effect from satisfaction with workspace to satisfaction with job followed by engagement, which then leads to work performance. Although not hypothesized in the study, I found non-significant results in the predictive value of satisfaction with workspace and both types of engagement. Furthermore, there was no direct effect between satisfaction with workspace and performance. Figure 6 represents the results of the structural equation modeling.

Although the relationship between components of workspace and worker performance was validated in this study by using job satisfaction and job engagement as serial mediators, there was not a significant relationship between satisfaction and components of workspace and job engagement. The constructs of Perceptual Satisfaction with Workspace and Facility were based on the Satisfaction with Environmental Features scale (Stokols & Scharf, 1990). This scale is representative of the traditional, atomistic way of assessing physical work environment that is found in the literature. This approach
is based on the environmental determinism paradigm, which assumes that human behavior is elicited by the conditions of components of their workspace (Vischer, 2008a). This S-O-R (stimulus-organism-response) perspective is founded in behaviorist theories in psychology and is still dominant today in the building users’ evaluation studies, where user satisfaction is an outcome measure. This cognitive processing approach to evaluation of space components does not aggregate into a holistic assessment of space on the part of the worker.

**Figure 6. Satisfaction with Workspace Components Structural Model**

The holistic experience of workspace has an effect on how workers feel, think and act. Furthermore, these reactions are not assumed to be generalized, but instead are seen as unique to the individual attitudes of the worker. The research question for my third study extended the quantitative inquiry more fully into the relationship between workspace perception and ensuing performance by taking a deeper dive into the affective state of the worker rather than the attributional and ambient conditions of the workspace. Using the subjects from study two, I introduced their affective experience of the workplace into the model and hypothesized that the direct mediation effect of both job satisfaction and engagement to performance would be supported. The results were strong
and significant. The relationship with job satisfaction was strengthened and the predictive value to emotional engagement was strongly positive and highly significant. The surprising effect was that the influence of the two satisfaction-with-workspace components was almost entirely suppressed. Even though the explanatory effect on performance did not change between the workers’ satisfaction with workspace components and their holistic experience of the workplace, the direct influence on engagement was dramatic. Figure 7 represents the results of the structural equation model.

**Figure 7. Integral Experience of Workplace Structural Model**

This data suggests that the worker satisfaction with atomistic components of the workspace and their holistic affective experience of the workplace are both important considerations in work environment design when it comes to worker performance outcomes. However, in order to influence job engagement in knowledge workers, the important factor in work environment design is the workers’ affective integral experience of workplace. Design teams not only need to consider workers’ satisfaction with workspace features but also, and perhaps more importantly, the workers’ affective
experience of the workplace as a whole based on their attitudinal state and their perception of the work environment.

**DISCUSSION**

A well-known aphorism by Robert A. Humphrey proclaims that, “An undefined problem has an infinite number of solutions” with no criteria for judging their merit. This research makes the claims that a unified project problem definition among team members can be realized through shared vision and values, and a common vernacular around a worker-centered design methodology. If workers are, in fact, the engines of organizational performance (as stated in most mission statements), and architects/designers can deliver work environments that enable worker performance (as claimed by many marketing proposals), then workers must be the primary source of inspiration for the design problem definition. The quantitative analyses support this supposition by demonstrating that the workers’ perceptions of their work environment predict job satisfaction and job engagement, which are mediators to innovative worker performance in knowledge work. This multi-stage, mixed-method study begins to explain and validate a worker-centered approach, and proposes a new design methodology paradigm for researchers and practitioners based on an integral user psychographic metric.

**Problem Definition in Workspace Design**

In study one, it became evident that the divergence of perception, relevance and influence of team members involved in a workspace design project created a conflicted team structure. This condition can sometimes be advantageous in multi-disciplinary teams where multiple perspectives contribute towards a more robust problem resolution.
However, the success of a workplace design project is contingent upon a common set of goals and a unified problem definition; so all team members are solving the same problem. A pre-requisite for this outcome is for all team members to contribute to their best ability and level of expertise. This requires a common understanding of project objectives and free flowing communication of all the actors involved in the problem-solving process. The absence of such an environment results in an inherent conflict between the team members by virtue of uniquely different values and an absence of a shared language impeding the emergence of a common vision for the project. Given the complexity of project delivery in an organizational context, arriving at a unified project problem definition that meets the needs of all stakeholders is a challenge at best; doing so in a divergent team environment is a recipe for a sub-optimal, compromised solution.

I draw upon coherence theory to understand and explain the processing mechanism by which the individual team members are able to construct their own problem definition within a team structure. The individual’s personal world view and attitudinal state based on a priori experiences and ingrained prejudices provide a frame of reference for their view of the expected project outcomes. Each team member is able to rationalize their own problem definition using their personal boundary conditions through the recursive balancing of their perceptions and expectations. These are not necessarily made clear to the other team members if a common baseline vision of the project outcome is not defined through a shared value system that prioritizes project criteria. In the end, the criterion that is most reified and measurable, such as cost or schedule, governs the decision making. Objectives with nontangible or long term benefits are often sacrificed, which tends to marginalize objectives having to do with aesthetics,
individuality and sustainability. This creates a relevance and influence problem for architects, consultants and space users; while prioritizing the cost control objectives, which are often a priority of organizational leadership.

The distributed cognition thesis (Hutchins, 1995) explains the conditions of the team structure, processes and artifacts that can create an environment conducive to generating a common vernacular. The tools and materials used in the design domain are typically graphic and visual, potentially transcending the limitations of verbal or written communication in other professions. The extant time frame of project design and implementation enables an iterative refinement of a common vernacular that the project team can utilize to adapt the project problem definition to changing conditions and influences. The communication tools and resources can range from written and graphic documentation to interdisciplinary charrettes to planned social events that promote a free flowing exchange of ideas and information between all the actors. Utilizing the common vernacular, the team can assimilate the individual coherence constructs into a unified problem definition. Thus, I theorize that an assimilative coherence across team members can be achieved using the common vernacular in order to achieve shared vision and values around the organizational mission. Assimilative coherence of the integrated project team can be used to arrive at a unified project problem definition that enables the entire team to work toward the same goal, which is ultimately to enable organizational success by enabling worker performance.

**Workspace vs. Workplace**

The qualitative study defined the boundaries of the problem of practice in workspace design by establishing the lack of substantive involvement of the
organizational workforce in the problem definition and problem solution efforts. This omission limits the design team’s ability to deliver a workspace that provides a responsive solution to worker needs in the physical work environment. If workspace is the intended facilitator of work performance for the workforce, then the workers’ perception of that workspace should be a driver of its effectiveness.

However, the more traditional workspace design approach of measuring worker satisfaction with the individual components of workspace does not capture the totality of possible influence of workspace on workers. A relationship was established with job satisfaction but no relation was found with job engagement. This was explained using environmental psychology literature and its combination of cognitive and affective processing mechanisms. Job satisfaction is defined as both a cognitive and affective measurement construct perceived as more of an attitude than an emotional experience (Weiss & Cropanzano, 1996). Job engagement is predominantly an affective construct. The objective approach to evaluating the workspace components requires cognitive judgment on the part of the worker. Therefore, it could only predict job satisfaction. The focus of this positivist approach is strictly on the object of the physical attributes of the workspace. The observer, in this instance the worker, remains undifferentiated and, thus, removed from direct influence. Thus, the workspace is viewed as a transactional object that is independent of and distinctly separate from the worker, instead of being recognized as the perception of an experienced reality.

The second quantitative study examined the effect of the workers’ affective experience of the integral workspace by adding this additional measure to the model. The results demonstrated this experiential workplace measure to possess overwhelming
predictive power and suppress the effect of workspace component based satisfaction measures. The ultimate impact on worker performance as an innovator did not change between the two exogenous construct types, however, the effect on the mediators; in particular, emotional engagement was significant. Given that the latest Gallup poll (2015) shows that engagement level in the US workforce is only 32%, and that is only an increase of 2% from 2013 in spite of exorbitant resources invested by many organizations, this is an important result for organizations and design teams. Figure 8 suggests that organization management should pay attention to worker participation in work environment design and monitor worker perception of their work environment in order to affect the desired outcomes of knowledge work performance.

**Figure 8. Implications for Organization Management**

This affective measure of worker experience shifts the emphasis from workspace to worker by introducing the notion of workplace. A space becomes a place when it is imbued with lived experiences of the individual (Lalli, 1992). A sense-of-place is defined in three parts: (a) the physical space; (b) human behavior in the space; and (c) the socio-
cultural meanings derived from it (Relph, 1976, 1997). In order to produce worker performance through engagement, it is necessary for design teams to determine and measure the magnitude of workers’ affective experience of workplace. According to Vischer (2008a), workers’ dispositions, prejudices and preferences play a role in their assessment of workplace experience.

**Figure 9. Antecedent to Experiential Workplace- Psychographic Construct**

![Antecedent to Experiential Workplace- Psychographic Construct](image)

**Attitudes towards the Physical Work Environment**

Self-identity is based on the perception of one’s surroundings and the objects found therein (Proshansky et al., 1983). Conversely, self-identity can be assumed to be an indicator of the way in which a person experiences their surroundings. The individual perception of self-identity guides the verification process in seeking balance between the individual expectations of structure and their experience of the actual environment (Burke, 1991). If these discrepancies are substantial, it can result in stress and discomfort for the individual (Burke & Harrod, 2005). This can affect the emotions the person is feeling and the behaviors that result from them.

Understanding how the workers perceive themselves in the context of the physical work environment can provide insight into the type of workplace they would need in order to perform well on the job. The state of the individual worker’s self-identity is
affected by the perceptions and experiences they internalize from their workplace. The dimensions of the attitudinal states represent the contribution that the worker can make toward the problem definition of a workplace design project. The dimensions are manifestations of the worker population in a given organization. Thus, these are not necessarily static descriptors, but rather, a dynamic result of the perceptions and experience of the worker population in a changing physical environment. The commonalities found to exist among a worker population are defined on the basis of worker attitudinal states and not their job categories, cultural norms, organizational strategies or workspace trends. Hence, the foundational source of the problem definition for workplace design becomes the worker.

**Relationship with the Physical Work Environment**

Relph (1976) describes an individual’s interpretation of place in terms of an authentic-inauthentic dichotomy. The authentic experience of place is based on one’s identity with it, where an inauthentic experience is predetermined, artificial and disassociated from its user. Place-identity is a broadly conceived cognitive structure representative of an individual’s memories, values, attitudes, and conceptions of behavior (Proshansky et al., 1983). The relationships that individuals have with their surroundings are not static. They are subject to on-going cognitive interpretations and subjective meanings that result in personal constructions and are manifest in emotions and behaviors.

The interaction of these attitudinal and relational manifestations creates a person-place relationship that is perpetually evolving as the person adapts to their changing surroundings. This emergent state results in worker responsiveness to their job and
affects performance. The ability of the workplace design team to obtain and interpret these manifestations in the worker population is critical in defining the problem of workplace design to be adaptable to the changing conditions of worker demographic and psychographic needs.

**IMPLICATION FOR SCALE DEVELOPMENT**

This research has demonstrated justification for a paradigm shift in the methodology of workplace design that is worker-centered. Further research is required to conceptualize the construct dimensions and measures that best capture the relationship between self- and place- identity of workers as it relates to workplace in knowledge work organization. In Figure 10, I am proposing an intersecting, bipolar model that addresses the attitudinal and relational convergence of indicators. In this model, it is necessary to transform the workers’ self- and place-identities into a nominal scale that represent work styles preferences (attitude toward workplace) and space types preferences (relationship with workplace) of the worker based on his attitudinal and relational states.

One possible representation of the end points of the two bi-polar dimensions is independent versus interdependent work style preference juxtaposed against the concentrative versus collaborative space type preferences of knowledge workers for their work environment. The work style preference, in this example, is an indication of the level of comfort that the individual worker experiences in interacting with co-workers while performing his or her daily activities. This indicator provides many design criteria influencing individual privacy and distance between workspaces as well as size and quantity of meeting rooms to name a few. The space type preference ranging from concentrative to collaborative is a possible indicator of the preponderance of time the
worker would spend working alone in a quiet space versus working in teams or groups, which would translate into ratios of office space that could be allocated to individual and collaborative workspace types. These intersections can be plotted to identify relationships resulting in spatial implications that can be translated into workplace design criteria. By surveying each individual worker, rather than a representative manager of a department or unit, it is feasible to establish the preferential indicators of the entire group and not one person’s perceptions of that group. This approach would not only address the preferences and needs of each individual that makes up the composite, but it would also identify the outliers and anomalies in the group that may require additional attention in order to optimize their performance levels.

The bipolar spectrum measures and ranges can vary depending on the organizational context and worker population characteristics exhibited during the early phases of project problem definition. The initial team effort necessary to arrive at a shared vision and common set of values for workplace design would reveal the priorities and critical factors that the team members, including the workers, hold in order to reach the individual and organizational performance goals. Thus, the dimensions and bi-polar indicators are customized for the specific organization and worker population involved in the project rather than a predetermined set of criteria defined by a priori evidence.
IMPLICATION FOR DESIGN PRACTICE

In the words of Richard J. Boland (1978), “Differences in structural relations to problem solving may prove insignificant to the more fundamental relations of problem finding” (p. 897). Defining and prioritizing the criteria for design using the worker-centered psychographic measures not only enables different approaches to problem finding in design projects, but it also provides a new metric for evaluation of project success. As a result of the research described herein, I am proposing an alternative model of workplace design methodology that is space user-centered (Figure 11). This approach not only embeds the worker into the process of problem definition during a workplace design project but also empowers organizational management with a deeper understanding of ways to engage workers and effect performance.

In this model, assimilative coherence is used to arrive at a unified problem definition through shared vision and values established in early phases of project criteria setting. The assimilation of team member distinct experiences is achieved through the
iterative coherence cycle of perception and interpretation of project data (Holoyak & Simon, 1999; Rensink, 2002). A protocol is then established to arrive at a common vernacular for communication across disciplines and levels using visual tools such as drawings, models, mocks-ups, and diagrams. This enables the team to generate a unified problem definition prior to commencement of project conceptualization.

Figure 11. Worker-Centered Workplace Design Paradigm

To paraphrase Snodgrass and Coyne (1991), designing can be perceived as a dialogue with the design problem. In order for the workers to actively participate in the design process, a level of understanding has to be reached. Hermeneutical analysis is a way to achieve understanding through language, thought, and action. Gadamer (1975) states that interpretation is derived from a foundation of prejudices that are formed from past experiences. Understanding is reached through interpretation on the part of the individual that is based in the experiences of the interpreter, which create expectations.
When the conditions do not match expectations, a dialogue is necessary to resolve the conflict. The dialogue facilitates evaluation and reinterpretation of the conditions creating new expectations embedded in the nature of the hermeneutic circle. This cycle creates a mechanism that allows the project team to continuously monitor and balance the design activities against the space user criteria through on-going dialogue. Given that work environment design projects take years to complete, this recursive cycle is essential in order to prevent obsolescence of the design solution at occupancy. Realistically, this cycle does not stop at the time of project completion. The dynamic nature of organizational change coupled with the complexity of both people and workplace management, demands a virtuous cycle of problem definition and team assimilation in order to maintain a balanced state that continually adapts to worker and organizational performance outcomes.

The hermeneutic circle (Gadamer, 1975) is representative of a way of understanding and communicating the details as understood within a larger structure. The source of data that operationalizes the structure of work environment in this proposed model is the space user. In order to generate a solution that best responds to the problem definition, it is necessary to differentiate the space user’s specific psychographic characteristics. This requires a discernment of the space user’s attitudinal and relational states that affect the manner in which they make their work environment meaningful. Symbolic interactionism and Herbert Blumer’s classic definition thereof provides an explanation for this perspective. Blumer (1969: 2) states that (a) we know things by their meanings, (b) we create meaning by interacting with our surroundings, and (c) meaning changes through interaction. Given this premise, the knowledge worker in our process
model selects the things that are meaningful to them in their work environment, which impact their emotional and behavioral states. In order to predict and inform the workplace design problem definition and problem solution with criteria that will have a positive impact on the performance outcomes of the worker, the team must understand who the worker is and what factors influence the meaning making of their work environment. This approach places the knowledge worker in the central role of defining the design problem, as well as influencing the performance outcomes of projects and organizations.

**IMPLICATIONS FOR EXTENDED RESEARCH**

In his theory of instrumentalism, Dewey (1986) declared that an individual interacts with his environment, solving problems encountered while doing things, by using theories and ideas as tools of inquiry. For Dewey, this on-going, interactive search for solutions to problems defines the human experience. A similar interactive dynamic is also fundamental to structuration theory (Giddens, 1984), where agency and structure simultaneously influence each other while an individual produces a skilled accomplishment. Gadamer (1975), a student of Heidegger, considered the interactive dynamic of hermeneutic circle, or the continuous tacking back and forth of the parts and whole of a situation, to be the ontological structure of human understanding. In this tacking back and forth, one initially attends to certain details and uses them to develop one’s sense of the whole.

The hermeneutic circle is thus a personal cycle of having an initial expectation (or prejudice), experiencing a situation, interpreting it, and developing a revised expectation based on individual consciousness. In “Art as Experience” (Dewey, 1934), Dewey defined ‘an experience’ or ‘integral experience’ as an individualized process of
interacting with one’s environment to achieve an objective. For Dewey (1934), life consists of an accumulation of unique experiences each, each with their own inception, movement and conclusion. The structure of ‘an experience’ consists of a person undergoing something, which prompts him/her to do something. This undergoing/doing cycle continues until the self and the situation are mutually adapted and form a conceptual whole.

Dewey’s pragmatist perspective is based on a phenomenological, holistic view of a person-in-environment, which calls for considering the individual’s integral experience if we are to understand the relationship between the worker and their workplace. The perception that the worker brings to his work environment represents his unique worldview (self-identity) and subsumes an integral experience (place-identity), which motivates him to respond in a certain way and enables the achievement of his/her performance objectives. In contrast, theories that focus on the aggregated components of workspace only consider the “objective” attributes and conditions of the work context (such as lumens, heating and cooling, privacy, furnishings, etc.) ignore the holistic experiences of the worker. The worker is reduced to an abstraction in the form of a job classification or skill set rather than being acknowledged as a unique, individual contributor.

Dewey’s pragmatist perspective suggests that only when the worker’s unique presence is introduced into the workspace does it become an experiential workplace. In fact, for the workplace to continue to exist as an integral or experiential environment, it must respond to a dynamic worker participatory cycle. This suggests a hermeneutical approach of continually updating the understanding of “the way things appear” in a
dynamic cycle of knowing. Deterministic models, processes and strategies only capture a cross section of time in a cycle of perpetual change and are not a suitable basis for designing an effective workspace.

In “Art as Experience”, Dewey refers to this integration of self-in-environment as an *aesthetic* experience, which involves continuous interaction, thereby creating a ‘rhythm’. Rhythm is a function of an individual’s perceptions and not merely an act of repetition; therefore, it is a reflection of the self. *Aesthetic* experiences are a function of both perception and appreciation. Perception involves active consciousness, or a participatory engagement of self with the environment. According to Dewey, active consciousness requires an emotional involvement with the object of interest. During this involvement, the individual is selectively gathering impressions until an integral experience is achieved, which manifests in a ‘qualitative whole’ or an overall mood. The result is an integral experience of the holistic object. Only after this state has been achieved can the object be segmented into component parts that can be individually examined and replaced into a whole without compromising its overall integrity.

The experiential workplace is a result of the worker’s ability to respond to the workspace in an affective manner (with emotion and mood) thereby creating an aesthetic experience of the person-place relationship or a place-identity. This requires an understanding of the worker’s inner consciousness manifesting as purpose, meaning and relatedness (Ashmos & Duchon, 2000). Using a multi-dimensional scale to measure the attitudinal and relational factors of workers, it is possible to assess the worker-workplace relationships over time. This knowledge leads to a recursive cycle that informs the workplace conditions. It builds a knowledge base about the workforce that can be used in
a cyclical evaluation of the work environment to support informed design decisions by both management and the workplace strategy teams in knowledge work organizations. The result is an integral workplace that possesses aesthetic qualities, which respond to the worker’s experience of their workplace that positively influence emotional and behavioral outcomes of workers.

The pragmatist’s view of ‘an experience’ is that of a process of solving problems while interacting with our surroundings, collecting information that enable us to satisfy our intentions. What we experience is shaped by who we are and how we see the world around us. The emphasis is placed on the person in the environment, not only as an observer, but also as an active participant. Historically, there have been two fundamental approaches to design thinking. Coyne and Snodgrass (1991) termed it the “dual knowledge thesis.” The distinction between the two approaches is, at a basic level, objective versus subjective. This dichotomy has often been explained in the design theories as science versus art. The confounding result in this discourse is that design thinking, especially in the case of design for the built environment, is both. While the design process can be mapped into logical, sequential steps (Newell & Simon, 1972), these do not account for the idiosyncratic nature of human beings participating in the design process or interacting with the product.

Models and schemas are often used in a reductionist attempt to create deterministic categories and classifications, in order to establish boundaries for design problem definitions and solutions. In design research, the dichotomous distinction is typically in the atomistic versus holistic selection of factors that define specific components or attributes that can be measured and correlated. Because the human factor,
as a variable, is difficult to predict and quantify, it is often left out of the equation. Although the results that are produced through an "objective" approach can seem relevant and valid, my research argues that the atomistic approach is limited in application and inference. In order to fully understand the effects of a built environment on its users, one must include the “integral experience” of the person–place relationship. The meaning of a workspace environment must first be found in the worker’s perception of the integral workplace, which involves defining the organizational aesthetic, or the sensory experience of its work environment (Taylor & Hansen, 2005). Only then can components be identified that could be studied as parts of a whole, and could be aggregated as such.

Knowledge of our environments is self-knowledge (Snodgrass & Coyne, 2013). Only a space user gives place its purpose and meaning, its reason for being. In turn, the place is both a reflection of and the enabler for its user’s existences. Norberg-Schulz (1979) defined the spirit that connects the two as ‘genius loci’ and described its relevance in the built environment as follows:

“When we treat architecture analytically, we miss the concrete environmental character, that is, the vary quality which is the object of man’s identification, and which may give him a sense of existential foothold” (Norberg-Schulz, 1979: 1).

Worker-centered design of workplace is based on who the workers are rather than what they do. This design approach is a continuous cycle and not an episodic event. The criteria for design problem definition and solution are an on-going dialogue between workers and organization with the design team as the facilitators of adaptive change. Only then can the workplace motivate the workers to be satisfied, engaged and performing in their jobs at optimal levels. This alternative paradigm of work environment perception demands a people-centered methodology in both research and practice that
touches multiple domains: organizational behavior, environmental psychology, and design studies. Design thinking is less about mapping the process and more about understanding the human experience. The findings of this dissertation suggest that motivation for extending its research going forward should shift to the human-centered approach and incorporate the integral experience of one’s surroundings.

LIMITATIONS

This research has a very specific purpose in the intended contribution to scholarship and practice described herein. However, it has several limitations worth mentioning. First, the studies are all specific to knowledge and information workers in office environments. This population choice is by design, as I believe it to be the most confounding and underdeveloped research area in work environment design. This study focuses on the knowledge worker perspective, which is a specific yet difficult to define and quantify population. Second, the data for the two quantitative studies is cross-sectional. Thus, it does not take into account the temporal changes in the affective states of the respondents. However, I am positing that their affective traits as manifested in their attitudinal and relational preferences as well as their cognitive judgments is offset by the variability in population sample (Zajonc & Markus, 1982). In other words, the size and random selection of the sample would account for the diversity of possible traits and states in a population of office workers in knowledge work organizations. Third, the dependent variable is measured only with self-reported data. This approach may place doubt in the validity of the conclusion, although, I did control for both social desirability and common method bias in the measurement model. Never the less, multivariate analysis methods present unique limitations in achieving accuracy of measurement, as
there are not objective ways of determining if the items selected capture the core meaning of the construct. Fourth, the exploratory, mixed methods approach of this research leaves open the possibility that other factors may be contributing to the stated outcomes, which are not being considered here. These may include aesthetic quality of the workspace, the spiritual disposition that the respondents may have toward their work environment and their work as well as generational and gender differences that have not been included in this analysis.

CONCLUSION

This research claims that workplace perception through the lens of the worker is the key to workspace design project success and organizational performance outcomes. It is a bold statement to make within the current structure of physical work environment setting in which the space user is often the object of consideration but seldom the central focus (Vischer, 2008a). Shifting the paradigm of work environment design to include the influence of the experienced workplace through worker psychographics, would open the door to understanding the workers’ meaning making of their surroundings, which influences their emotional and behavior responses to work. Even though this research specifically addresses the influences and effects of workers-in-workplace phenomenon, I believe that the methodological change in the approach to design can be generalizable to any situation where problem definition and problem solution directed at a specific user group is necessary in order to achieve a desired performance result.

In my 20-plus years consulting practice in architectural criteria setting space, it has often occurred to me that the human experience of the built environment is a virtuous cycle that is counter intuitive to the project delivery method driven by schedule and
budget with a beginning, middle and end. Changing a complex structure that is multi-
disciplinary, multi-level, and multidimensional requires extant evidence and
overwhelming motivation. It is my hope that this thesis is sufficiently compelling to raise
awareness and interest in this topic in order to carry this research forward.
Appendix A: The Dialectic of Workspace Design: Team Coherence Effects On Project Outcomes (Phase 1 – Qualitative)

Abstract

Integration between corporate strategy and workplace design not only supports business operations, but it also has the potential to enhance it. Congruence between workplace functionality and employee performance is essential to an organization’s success. Workplace design requires a multi-level, cross-disciplinary approach that results in an integrated problem definition and leads to an implementable solution. Establishing a common set of project goals and objectives that represent the interests of the stakeholders are fundamental to a successful project outcome. This paper reports on a qualitative study of nine workplace design projects in knowledge work organizations based on interviews conducted with the design and facilities teams and respective leadership and user groups. The findings indicate a fundamental contrast in vision, values, and vernacular among the professional groups conducting these projects as well as the organizational stakeholders that inhibit a holistic project success. A recursive process between the organization and the design team built around relatedness, identity and trust is suggested in order to clearly characterize the nature of the design problem and define the terms of an implementable solution that can be operationalized over time.

Keywords: team coherence; problem definition; common vernacular; shared vision, shared values
Introduction

Managing an organization’s real estate portfolio requires a balance between optimizing performance while minimizing cost, and increasing return on investment and the value real estate delivers to core business functions (Krumm, 2001). Real estate is not just about brick and mortar, cubes and offices, it is about the work context that carefully balances space, technology, resources, and protocols that support the nature of work (Rice & Mitchell-Ketzes, 2003). These measures must go beyond costs of capital investment and operations into human resource data of employee attraction, retention, and absenteeism as well as business units measurements of employee effectiveness and customer satisfaction (Rice & Mitchell-Ketzes, 2003). Facilities are the physical realizations of the work context for knowledge work organizations.

Substantive research links workplace to employee productivity and well-being (Brill, Margulis, & Konar, 1984; Haynes & Price, 2004; Heerwagen, Kampschroer, Powell, & Loftness, 2004; Rice & Mitchell-Ketzes, 2003; Vischer, 2007b). Research also shows that managerial control of decision making regarding workspace negatively impact employee engagement and well-being (Knight & Haslam, 2010). Employees are not given a substantial voice in determining the design of their workspace as most facilities decisions are made by administrative and facilities management based on cost control (Bon, McMahan, & Carder, 1998; Duffy & Tanis, 1993).

One manifestation of this situation is the effort of many large US and global organizations to initiate distributed work models resulting in substantial reduction of real estate holdings and operations and maintenance costs. Companies like IBM, Microsoft, Best Buy, Proctor and Gamble, Yahoo and Cisco have fully invested in this effort. For
example, nearly half of IBM employees telework and the company claims $50 million in annual savings of real estate costs (Ruth & Chaudhry, 2008). However, virtual work environments are not appropriate for all jobs or all workers. To understand the nature of the work and characteristics of individual workers requires a careful examination of roles, responsibilities, and interactions of employees (Cascio, 2000). Yahoo’s management decision in 2013 to call all employees back into the office and Best Buy’s subsequent move to substantially limit telecommuting options may be strong indicators that decisions made for the wrong reasons tend to backfire. What is the impact of this course correction on the company’s bottom line? Are the priorities of operational decision making regarding employee workspace misaligned with the strategic goals of the organization?

The pressures of the changing nature of work, the cost of real estate, and the need for continuous innovation place increasing demands on management decisions. Even in organizations where the work environment is recognized as a facilitator for transformation and an enabler of innovation, its significance to business strategy is still not fully acknowledged (Levin, 2005). Organizational leadership needs to recognize that business success is a function of a high-performing workforce (Nourse & Roulac, 1993; Pfeffer, 1995), which is enabled by a highly effective workplace. In other words, employees are the organization and management would not need to exist without them. In turn, the workplace has the potential to operationalize the workforce at its highest and best performance level. So, what is the underlying cause of this gap in understanding and appreciation of the value of workplace in organizational performance?

*Design* is, by definition, interdisciplinary and integrative. Workplace design entails solving problems by transforming less desirable physical space into a preferred
work environment (Friedman, 2003; Simon, 1996). Uncovering and defining the problem is the key to a successful solution. To accomplish this, a workplace design team must know how the organization works and why: What are the drivers, facilitators, and protocols of the organization? Two key characteristics of design are that it is a process, and it is goal-oriented. So, what occurs when the processes and goals of the design team members are not aligned? In the words of Robert A. Humphrey: “An undefined problem has an infinite number of solutions” with no criteria for judging their merit.

In the context of workplace design teams, communication typically entails an ongoing exchange of information, data, and concepts between organizational leadership and workforce and the architects and designers (A&D) as well as real estate (RE), facilities management (FM,) and workplace strategy (WPS) staff. If it is assumed that the workforce is the key driver of organizational performance, then the design team should first and foremost meet the needs of the user groups, who should be an integral part of the problem definition process (Duffy, 2000). Unfortunately, this is often not the case. Design priorities are established on the basis of image, trends, cost, and efficiency. When deciding to lease or purchase new office space, organizational management will do so even prior to establishing the criteria for occupancy just on the basis of a good business deal (Nourse & Roulac, 1993). This is not the case when procuring new manufacturing or warehousing facilities, where functionality is recognized as the top priority in the decision-making process (Tranfield & Akhlaghi, 1995). However, the same standards are not perceived as critical for office environments (Nourse & Roulac, 1993). The housing of machines and equipment is held to a higher standard than the housing of workers. If
organizational leadership really believes that “employees are our biggest asset,” should the goals and objectives for workplace design not be to enable the workers?

Our research provides new insight into how knowledge-based organizations perceive, design, and manage their physical workspace environments. Specifically, this paper addresses the literature gap regarding problem understanding and definition of workplace design projects. In order to add to the knowledge on this subject, I conducted interviews with multidisciplinary project teams from nine major organizations that were involved before, during, and after the design and implementation of an organizational workplace. The interviews explored the interactions and perceptions between (a) organizational management and workforce; (b) the in-house real estate, facilities, and workplace strategy staff and the organization; (c) architecture and design community and the real estate, facilities, and workplace strategy staff as well as the organization. I explored the potential implicit and explicit consequences of a multi-disciplinary model of project team interaction within a workspace design project. I also propose actionable insights into an assimilation model that could establish a cohesive structure of the workplace design process, which could, in turn, lead to a more effective approach to workplace design.

**Research Question**

What is the interaction and experience of architects and designers, real estate managers, facilities planners, and workplace strategists and organizational management and workforce on a workplace design project team? How do team member perceptions and interactions define the design and outcome of the workplace for knowledge work organizations?
Literature Review

The Dialectic of Organizational Change

In a project delivery process, the goals of the actors participating in setting the criteria for the project are revealed in an effort to define the expected scope of work. The contradictions in expectations and perceptions quickly become apparent in the pre-design data gathering phase when the problem definition and project objectives are reified. A hierarchy of decision making is then defined that allows the project criteria to be prioritized. The project drivers are set accordingly. This effort begins the process of establishing the project baseline.

This dynamic process is explained by dialectical theory. In the area of organizational change, dialectical theory has been used in the context of C.W. Churchman’s (1966, 1968, 1971) thesis-antithesis-synthesis (Van de Ven & Poole, 1995). Change occurs when opposing values are sufficiently intensified to challenge the status quo; i.e. the thesis and antithesis. The result of the conflict is synthesis, which becomes the new thesis as the dialectical process continues (Van de Ven & Poole, 1995).

Dialectical theory posits that “the organizational entity exists in a pluralistic world of colliding events, forces, or contradictory values that compete with each other for domination and control” (Van de Ven & Poole, 1995: 517). This putative state typically maintains the status quo. Change becomes inevitable when opposing values are sufficiently motivating to cause the entities to want to change the status quo (Van de Ven & Poole, 1995), which, over time becomes the “new normal”. Ideally, the struggle between maintaining the status quo and changing to a new state will produce an outcome
that would result in a win-win for both sides. In organizational change, it is often difficult to discern if the change is for the better or for worse until after implementation.

**Interactive Nature of Multi-disciplinary Project Teams**

The complexity of a project delivery process requires a common understanding among the project team actors of the problem definition and project objectives. This is accomplished through an exchange of information between the team members. To the extent that the project team participants are sharing the same vernacular and vision, the parameters of project understanding are unified; if these are misaligned, the outcome is likely to be disappointing to at least some of the actors. The tools and artifacts used by the participants in the performance of the work can have a significant impact on how the workspace is characterized and defined. The project implementation timeline is critical in anticipating the workplace criteria. Given that the project requires years to implement, the lack of the project team’s ability to accurately predict the needs of the organization at the time of project completion can render the workplace ineffective at the time of occupancy. The effort of generating the project criteria is an integrative process that requires the participation of all stakeholders. If any of the stakeholders are not sufficiently represented, it can change the outcome, thus, compromising project success.

**Distributed Cognition Theory** defines the work environment as a synchronized relationship between individuals, resources and the physical space. Distributed cognition is a theory in psychology introduced by Edwin Hutchins in the 1980s. The theory assumes that: (1) cognitive processes are distributed across agents of a social group; (2) the operation of the cognitive system entails coordination between internal and external
structures; and (3) the processes are distributed through time in that results of earlier events can change the nature of later events (Hutchins, 2000).

A significant characteristic of an aggregate system is that it cannot exist in atomistic component parts. A common language could be the result of the necessity to integrate the parts into a system by sharing a linguistic code (Freyd, 1983). The conventional sequences of language structure come about in the situation of negotiated learning where the communication must explain the context and be shared among agents involved in the exchange (Hutchins, 2000). Paradigms that are not understood by any one individual may evolve through the interaction between multiple individuals or groups of individuals. This exemplifies the team dynamic in a multi-disciplinary structure.

Cognition is also influenced by the physical context or artifact. A context of artifact is influential in triggering a functional cognitive reaction. Furthermore, the interaction or manipulation of an artifact or activity within a specific context can augment the skill level and performance of an agent (Hutchins, 2000). The sharing of models and drawings to communicate with the members of a project team enables a shared understanding.

Humans adapt their patterns of behavior over time. Their interactions with other individuals and their surroundings develop their cognitive powers in that time frame for that specific environment. By definition, distributed cognition does not account for what is in the heads of human actors alone but how those individuals interact with others and their surroundings over time (Hutchins, 2000).
Values Congruence of Project Team Actors

A number of studies have been conducted that demonstrate the impact of values on organizational and individual effectiveness such as job satisfaction (O’Reilly, Chatman, & Caldwell, 1991), positive worker attitudes (Posner et al., 1985), performance of teams or groups (Enz & Schwenk, 1989). In general, consistent support was found that alignment between organizational and employee value systems resulted in strong favorable perceptions among workforce and organization while ambiguity in personal and/or organizational value systems resulted in negative attitudes in the organizational work environment (Posner & Schmidt, 1993).

A duality in perceptions, attitudes, and values between the organizational leadership and workforce can lead to divergence in project goals and objectives, whether stated or unstated. Regardless of the effort invested in the design and implementation of the project, the outcome is set up for failure.

The value congruence model devised by Liedtka (1989) posits that the success of decision outcomes is based on the fit between the management actions (organizational values) and the employee self-image (personal values). Thus, the moral responsibility of organizations can be viewed as an interplay between organizational and employee values. “Values dominate the selection of organizational goals which, in turn, form the criteria through which all decisions are evaluated” (Liedtka, 1989: 806). Liedtka contends that the traditional theories of “rational” (Allison & Zelikow, 1971) and “satisficing” (Cyert & March, 1963) processes of decision-making are valid when the values of principal and agent are more or less in alignment. In cases when these values are in conflict, the stronger value systems will prevail. A value system is defined by Milton Rokeach (1973)
as “an enduring organization of beliefs concerning preferable modes of conduct or end-states of existence…” (p. 5).

**Sub-optimization of Professional Contribution**

Rueschemeyer (1983) states that, “the professions strike a bargain with society in which they exchange competence and integrity against the trust of client and community, relative freedom from lay supervision and interference, protection against unqualified competition as well as substantial remuneration and higher social status” (p. 41).

In the context of the project design team, “the architect”, by definition, is deemed to be the professional agent. To that end, the presumption would be that the professional has power over the lay principal by virtue of expertise and intrinsic knowledge that creates information asymmetry. However, the principal (organizational leadership), limits or constrains the accessibility and influence of the professional (architect); thus, commoditizing the services provided by the professional, this greatly diminishes the level and value of the contribution the architect can make toward the problem definition and project outcome.

Principal-professional theory, as defined by Sharma (1997), is rooted in the classic agency theory but, with the nature of professional work, characterized by “knowledge power and social embeddedness.” While agency theory is based on three fundamental principles of agent opportunism, information, and risk, professional agents differ in that their constraints to opportunism are due to altruistic inclination, oversight by professional organizations, bureaucratic and legal controls and principal efforts to avoid knowledge asymmetry (Sharma, 1997). The definition of a profession is that it is based in abstract bodies of knowledge that can redefine problems and tasks (Abbott, 1988).
Research Design

Methodology

The construction and implementation of this qualitative study were guided by Glaser and Strauss’ (1999) grounded theory method. This approach is a way to effectively arrive at a theory that is most suited for its purpose. It is a method of discovery using qualitative data that is collected through person-to-person interviews. The data is then coded and analyzed in order to generate a theory. I used semi-structured interviews to capture the experiences, perceptions, and attitudes of respondents participating in project implementation, as well as pre- and post-occupancy of knowledge work environments. Given that the participants were of different levels and backgrounds, I took a more open-ended approach to allow themes to emerge. The guiding principle of grounded theory method is constant comparison of the interview data and theoretical sampling of existing literature in order to identify patterns and relationships grounded in an empirical process.

Sample

Our sample consisted of 36 interviews across 9 projects. Our unit of analysis was a project that was completed no more than one and less than seven years prior to the interview. Each project was comprised of, at a minimum, 100,000 square feet of office space housing a knowledge work organization. Of the nine projects, six were standalone headquarters or on headquarters campus sites, and three consisted of new construction or major renovation for specific use office type functions. Eight of the nine projects were located in California; three in Northern California; five in Southern California; and one in Western Michigan. For each project, I conducted interviews with four individuals that
were engaged by the organization on a permanent consulting basis before, during and after project occupancy. The individuals fit into four categories: (a) manager; (b) employee; (c) real estate, facilities manager, workplace strategist; and (d) architect and designer. Of the nine organizations, four were global, three were national, one was public and one a public/private partnership.

Table A1. Project Sector and Demographic

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Projects in Each Sector</th>
<th>Manager</th>
<th>Employee</th>
<th>Real Estate/Facilities/Workplace Strategy</th>
<th>Architect/Designer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Communication</td>
<td>4</td>
<td>3M/1F</td>
<td>2M/2F</td>
<td>3M/1F</td>
<td>3M/1F</td>
<td>9</td>
</tr>
<tr>
<td>Design Research &amp; Development</td>
<td>2</td>
<td>2M</td>
<td>2M</td>
<td>1M/1F</td>
<td>2F</td>
<td>9</td>
</tr>
<tr>
<td>Finance/Banking</td>
<td>1</td>
<td>1M</td>
<td>1F</td>
<td>1F</td>
<td>1M</td>
<td>9</td>
</tr>
<tr>
<td>Public/Quasi-public Sector</td>
<td>2</td>
<td>1M/1F</td>
<td>1M/1F</td>
<td>2M</td>
<td>2M</td>
<td>9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>9</td>
<td>7M/2F</td>
<td>5M/4F</td>
<td>6M/3F</td>
<td>6M/3F</td>
<td>36</td>
</tr>
</tbody>
</table>

Table A2. Organization and Project Size (Rounded Estimates)

<table>
<thead>
<tr>
<th>Organization</th>
<th>Total Employees</th>
<th>Project Employees</th>
<th>Project Size (S.F.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75,000</td>
<td>720</td>
<td>180,000</td>
</tr>
<tr>
<td>2</td>
<td>3,200</td>
<td>400</td>
<td>130,000</td>
</tr>
<tr>
<td>3</td>
<td>19,000</td>
<td>380</td>
<td>105,000</td>
</tr>
<tr>
<td>4</td>
<td>260,000</td>
<td>420</td>
<td>125,000</td>
</tr>
<tr>
<td>5</td>
<td>25,000</td>
<td>125</td>
<td>102,000</td>
</tr>
<tr>
<td>6</td>
<td>7,000</td>
<td>800</td>
<td>300,000</td>
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<tr>
<td>7</td>
<td>4,500</td>
<td>1,100</td>
<td>350,000</td>
</tr>
<tr>
<td>8</td>
<td>5,000</td>
<td>450</td>
<td>175,000</td>
</tr>
<tr>
<td>9</td>
<td>22,000</td>
<td>320</td>
<td>120,000</td>
</tr>
</tbody>
</table>
Data Collection

The interviews were all conducted face-to-face either in person or via a video conference. A brief tour of the facility was conducted either before or after the on-site interviews. The interviews with the organizational respondents: manager, employee, and RE/FM/WPS all occurred at their place of business. The interviews with the architect/designer occurred at their respective offices or at another pre-arranged location.

The interviews lasted approximately 60 minutes. The participants were asked to describe their roles and responsibilities on the project and their position in their respective organization. Depending on their level of involvement, they were queried about their impressions of the organization’s work environment before, during, and after the project completion. In addition, each respondent was questioned about their lived experience relative to the implementation of the project and their interactions with the project participants. A closing question pertaining to their perception and understanding of the meaning of workplace concluded the interview.

Data Analysis

A process of open coding was utilized across all the interview transcripts. This effort resulted in approximately 180 codes of both ‘in vivo’ and interpretive nature. I proceeded to segment the codes by grouping them across disciplines and projects in order to determine if any prominence emerged of code types. It quickly became clear that the patterns were much stronger within the disciplines or respondent classifications.

After listening to the recordings of the interviews and reviewing the transcripts for a second time, I was able to combine the codes into common themes within each
discipline to a total of 30 codes. It also became clear that the manager and employee codes shared many common themes although with opposing interpretations.

By the third round of coding, the emerging themes began to blur the lines of discipline distinctions into contradictions of constructs, objectives, and views. Although some of the themes could clearly be associated with a specific discipline, others crossed disciplines and even exhibited contradictions within the same discipline.

Figure A1. Codes Summary

Findings

“It is not about productivity; it is about the bottom line.” (Facility Manager)

The research revealed three significant findings relative to project teams involved in workplace design for knowledge work organizations: (a) conflicting views and values
of team members; (b) filtering of data and information; and (c) sub-optimization of professional contributions.

Finding #1: Perception

Contradictory views and values were exhibited among the team members both in regard to the project goals and objectives, as well as, perceptions of the roles and responsibilities of other team members. There was a perception that organizational leadership makes decisions regarding workspace that is predominantly based on cost considerations. This appeared to be the result of a perception that organizational management’s directives focus on maximizing efficiency of space use while compromising functionality for the employees.

“They [management] sometimes ... they want a standard that is less than optimal for their workers and I think that’s an oversight. They also don’t like the design people having interaction with the user groups because they feel like they’re getting infected and they [designers] won’t do what they were being expected to do which is cram more people into less square footage.” (Designer)

The in-house facility planners and workplace strategists seemed preoccupied with the metrics of space utilization and operating costs and not the more difficult to quantify performance factors. The data showed little sharing of information between the in-house administrative and operations groups relative to the work environment and performance or productivity measures.

“We get asked the question [about performance and productivity] all the time, so people do think it’s our job to know that and the answer is no [we don’t]. We do not have the ability to measure productivity. We don’t actually believe that the groups we are changing [from consolidated to distributed work environment] know what their productivity is.” (Workplace strategist)

Employees expressed a diminished commitment with regard to the hours worked due to the perception that organizational leadership made decisions that were not
supporting their efforts or cared about their functional requirements. Senior
management’s unwillingness to participate in the workplace change initiatives that were
promoted by the organization was also a significant factor in employee’ resistance to
change.

“Well, I know I don’t do as good of a [job], I don’t put in all the extra time that I
used to. The odds of me running past work [hours] or after hours are much lower
than I used to. You know, I used to run in to check something, fix something on a
weekend or after meetings, and I don’t do that unless I have to... And it does
disconnect you from work a little bit more because I’m not there as much.”
(Employee)

“Collaborative space” was a frequently used term by all the study participants in a
variety of contexts. Collaboration was introduced as a highly desirable construct
representative of the manner in which work gets done by employees. “Collaborative
space” was used to describe conference rooms and areas, tables in an open workspace,
clusters of low panel workstations and unassigned workspace. The implicit understanding
seemed to be that collaboration is a desirable activity by employees and management but
with no clear definition how or why it occurs.

“Collaboration...the difference is I have to define how that improves my process
or is this just a gimmick that someone tells me [so that] I have to be innovative.
Someone says, well, innovative means a casual meeting space. That doesn’t mean
anything to you if that's not your process.” (Designer)

“I'm speaking purely from this experience here... I do believe that those that truly
collaborate understand the value, and I just use that word, of spending time face
to face with people. I think I know enough and have worked enough with people
here to know that they're quite like-minded in that way. It's like, yeah, you can go
along and rely on the WebEx or the distance conversation, but there comes that
point, where it's like okay, this is no longer working. We really need to be
together.” (Employee)

In the high and low technology organizations, reliance on technology as a means
of communication and interaction appeared to have changed the definition of how work
was done and the type of workplace necessary to support it. Four of the six technology/communication and research and development organizations had implemented distributed work policies with free addressing and full mobility programs. The other two had instituted an extensive telecommuting program. The remaining three organizations had implemented varying degrees of telecommuting and flex time policies. The policies were received with varying levels of enthusiasm. The senior management and workplace strategists saw the change as an opportunity to improve organizational space utilization efficiencies through flexible, multi-use space allocation concepts; thus, reducing the amount of real estate. The line management and workforce spoke about the negative impacts on their ability to perform and the impediments the situation created to their operational success but accepted the conditions as a given.

Finding #2: Influence

On each of the projects, the in-house group representing the real estate, facilities, and workplace functions was perceived to have extant influence over the information flow and interpretation of design data that the other members of the design team needed in order to contribute to the project outcome. Six of the nine respondents who filled the role of real estate, facility manager and workplace strategist did not come from the architecture, design or construction background. They originated from administration, finance, or operations and maintenance with strong organizational and interpersonal skills and a predisposition for problem-solving. The diversity in training, background, and experience amongst the project team members allowed them to act as the ‘middle-man’ in a complex team structure.
In-house real estate and facilities managers and workplace strategists were perceived to be in a command and control position in the delivery process of workplace design, planning, and management. The perception on the part of the architects and designers was that the in-house facilities group had a strong hold on project information flow.

“They [Facilities] had a structure of what they wanted to accomplish. It was being driven by the facilities department. It wasn’t driven by the corporate structure at all. The facilities [group] were running the whole thing.” (Designer)

The real estate, facilities, and workplace strategy staff frequently found themselves in a position of filtering, interpreting and presenting the design concepts to the C-suite and taking the role of translator between the user groups and the architects/designers; thus, by default, controlling the direction, process and outcome of the projects. They saw themselves as filling a void and ensuring the success of the project.

“The architect spoke a different language, than our CEO, than I did, and so I kind of found myself in that position of trying to be the interpreter between all parties in a lot of cases, to try to take the design language and what our CEO was saying and help interpret that. Otherwise, it could have been completely misconstrued in the design in a way that didn’t make sense with what they were saying.” (RE/WPS)

The facilities managers were typically charged with evaluating and selecting the consultants, communicating the project goals and objectives to the design team as well as editing the program data solicited from the user groups. Since they were representing the organization and being held accountable for the project success by both the organizational leadership and the user groups, they felt compelled to take control of the
direction of the design. However, this was perceived to have a limiting effect and curtailing the potential contribution by the consultant team.

**Finding #3: Relevance**

_The perception on the part of architects and designers was that the value of their professional contribution was marginalized; thus, the delivery team received a sub-optimal benefit of their expertise and knowledge._ The perspective of the architects and designers was that their contribution was not perceived as essential to the success of the project. This was the sentiment of all but one of the architects and designers interviewed for the nine projects. The common perception was that architects and designers are relegated to specialized or support roles to project management consultants, general contractors and in-house facility planners. Their services were obtained through bids or competitions, and the solutions were treated as menu items to be value engineered or modified at will prior to implementation. A&D participation in project delivery and decision making was often distanced through layers of intermediaries. The data obtained through the interaction with the organizational workforce during the course of a project was generalized or even dismissed; thus, diminishing the role and contribution of A&D in both problem definition and problem solution. The perceptions on the part of architects and designers were that their role on the project is marginalized and commoditized. More than half of the respondents felt their contributions were unappreciated, undervalued or compromised during the course of the project.

“Somehow I think there is a real critical learning curve that our design folks and architects need to get into. There is a resistance to that because this profession is not seen as a discipline of necessity, but with everybody in the world becoming a designer people are going to figure it out; so if our profession doesn’t get on it and do it, we are out.” (Designer)
All of the architects and designers interviewed expressed some level of frustration with a lack of shared vision and common values with organizational decision makers. There was recognition on the part of the architecture/design professions that different tools and resources were needed to communicate with organizational management, which was heavily entrenched in the profit-loss cycle.

“But there is a genuine lack; it just doesn’t exist, of empirical information in our profession that can communicate a cause and effect relationship between good design and business success.” (Architect)

The A&D professionals saw themselves as committed to creative problem solving in response to criteria generated from the user/occupant of the workspace, in this case, the employees. However, when shared goals for the project were not clearly defined or stated conflicting objectives would result in compromises, cost and schedule overruns.

“I think it’s [work place design] missing in our process today because corporations have gone so far in a different direction of trying to get the most use out of their real estate. I think they’ve overlooked the real requirements of the workspace for workers. They do not provide them space that facilitates their job.” (Architect)

The dismissive perceptions of the team members of each other’s roles and contributions to the problem-solving process and the design solution magnified the lack of shared values and common vision. A predominant theme amongst all categories of respondents indicated an adverse perception or experience in dealing with other members of the project team.

Discussion

The dialectical nature of a project team suggests that the intensity and significance of information flow among the actors is critical to project success. The conceptual model
(Figure A2) illustrates the perception, relevance and influence between the four key actors involved in a project delivery system of workplace design based on our findings. The findings reflect the centralized control assumed by the in-house real estate, facility management, and workplace strategy staff during the course of project delivery. As a central hub through which all information flows, this in-house team filters and interprets the directives, priorities, and decisions that impact project outcomes. They bridge the gap in the divergent vernacular and vision between the organization and the A&D community, as well as mitigate the duality of values between management and the workforce in the stated and actual goals and objectives. However, since real estate, facilities, and workplace strategy staff allegiance typically lies with organizational management, the perceptions are not always balanced. Although the A&D is charged with obtaining the relevant functional and operational data from the workforce user groups, this data is frequently generalized or even disregarded in order to meet the directives provided by the real estate, facilities and workplace strategy staff in the interest of efficiency, cost control and prioritization of management’s concern.
This divergence of purpose among project delivery team actors precludes a unified problem definition; therefore, the project goals and objectives lack clarity, and the project outcome is compromised. This insight is generalizable to many industries where multidisciplinary teams solve multi-level problems involving group interactions. “Differences in structural relations to problem solving may prove insignificant to the more fundamental relations to problem finding” (Boland, 1978: 897). A unified problem definition is essential in order to streamline project team interaction toward the highest and best use of team resources in achieving an optimal solution.
The Dialectic of Project Problem Definition

The organization is a knowledge-creating entity. Knowledge creation is a dialectical process dynamically generated out of contradiction (Nonaka & Toyama, 2002). However, this requires an open dialog between the actors with clearly stated positions of interest. The duality of purpose between organizational leadership and the workforce in the stated and actual goals and objectives relative to workplace context is the foundational basis for the underlying problem in the divergent decision-making of the project team. This conflict encourages facilities management to reduce operating costs in order to meet management goals, which gives the workplace strategy team incentive to maximize space utilization efficiencies. Given that the impetus for this decision cycle appears to be financially driven, the in-house real estate, facilities, and workplace strategy contingent (which typically reports to administration, finance or even legal) aligns their objectives with the organizational leadership goals. It follows that the greater the real estate revenues and the lower the facilities operation and maintenance costs, the more influence and control is placed in the positions of real estate, facilities, and/or workplace strategy staff. The expected outcome is that the change management cycle of thesis-antithesis-synthesis (Schweiger, Sandberg, & Rechner, 1989; Van de Ven & Poole, 1995) creates a new baseline vision for the organization. However, this vision is bifurcated between the two stakeholders of leadership and workforce and is mediated by the real estate, facilities, and workplace strategy staff.

The “new normal” resulting from a divergent dialectical model of team structure reflected in our findings translates into telecommuting, free-addressing, distributed work, and hot-desking workplace concepts. Numerous studies on both sides of the issue
elaborate on the pros and cons of this office design strategy (Cascio, 2000; Duffy & Tanis, 1993; Tranfield & Akhlaghi, 1995). And even though there is acceptance of this workplace concept by the employees who need or want the autonomy and flexibility in their work schedule, there is a general consensus among both line management and workforce that the approach is detrimental for operational, social, and emotional reasons. This work environment ultimately has a negative effect on performance and productivity of the workforce and, in turn, the organization (Bradner & Mark, 2002; Cascio, 2000). In cases where these concepts are indiscriminately implemented, without regard for the type of work or level of employee, the consequences can be significant. In the estimation of employees, even at senior levels, the perception is that the leadership does not care or understand: “We are a product design organization. Nothing in this workspace design reflects that this is where engineering got done. These cubicles were all designed for non-engineers” (Operations Manager).

Another workplace construct that emerged from our data is utilized in hybrid office design concept organizations where dedicated workspace is provided while the churn rate is managed through telecommuting and free-addressing practices. This approach is described as “universal planning”, which translates into generic planning grids, one-size-fits-all workstations and box moves for employees. This approach streamlines space allocation and minimizes the cost of occupancy. Although, this strategy may fit a large segment of the organization’s workforce it still leaves some portion of employees in inappropriate accommodations. Knowledge and information organizations expect innovation, creativity and commitment from employees; however, the context in which they are expected to perform may not incentivize this response. In fact, the study
results convey that the reaction from the workforce is one of resignation, a “fend for yourself” attitude that projects acceptance as long as there is sufficient leeway to find an alternative work environment. This lack of shared vision among the organization’s stakeholders creates a divergence of conceptions of knowledge work context.

**Perceptions of Project Team Identity**

Values are the impetus of an organization’s goals which form the criteria for organizational decision making (Liedtka, 1989). Shared values or “value congruence” between the organization and the workforce have shown direct positive relationships with work attitudes, job satisfaction, and organizational commitment (Balazs, 1990; O’Reilly et al., 1991). The professional identity that employees form over time is directly linked to the positive or negative feedback they receive from their work environment via the perception of the environmental characteristics or the space they have been assigned (Fischer et al., 2004; Knight & Haslam, 2010). Given that productivity and innovation are the primary goals of knowledge work organizations, management’s concern should be to optimize the work environment to achieve the greatest return on investment from employees. Shared values form a basis for shared vision, which translate into shared goals and objectives.

From the perspective of distributed cognition, a successful project team is a shifting alliance of agent-environment boundaries and resources set on a time line (Kirsh, 1999). The workplace team is comprised of organizational management and user groups, the in-house real estate, facilities and workplace strategy staff, and the architecture and design consultants. A knowledge-workplace design team is assembled for a period of months, sometimes years, and experiences a close, interactive relationship within a set
array of resources and technologies. The team is characterized by multi-disciplinary expertise and specialized knowledge domains. Based on the distributed cognition approach, this environment has the potential to generate a shared linguistic code and common behavioral protocols. Although this phenomenon occurs on a bounded basis, it does not transcend the lack of common vision and values. The barriers of conflicting purpose and negative perception do not allow a common vernacular to emerge.

**Relevance and Influence in Project Team Relations**

Historically, facilities management and architecture/design were more closely aligned with a common vocabulary by virtue of shared background in the construction industry. Facility managers acknowledged the expertise and vision offered by the A&D community and recognized the intentions to provide the organization with an optimized solution grounded in analysis and design (Duffy, 2000). More recently, facilities managers originated within the organization with operations and maintenance or finance backgrounds in order to more closely align with the organization’s financial goals.

Workplace strategist is a relatively new discipline and a service intended to integrate the mission and vision of the organizational leadership with the operational and functional needs of the workforce to realize that desired outcome (Levin, 2005). However, when the strategic planning of an organization is based on a short-term goal of minimizing overhead and expenses, it is in direct conflict with the long-term nature of real estate and facilities planning. This puts the workplace strategists in a no-win predicament satisfying the organizational leadership goals or the workforce goals, but not both.
Architects and designers essentially become an extension of the in-house real estate, facilities and workplace strategy staff as their scope of work is typically defined and monitored through this entity. The A&D influence is limited during design by virtue of the interpreted directives they receive from real estate and facilities managers and workplace strategists, or in the implementation phase as a result of value engineering and cost control. Given the fees and schedule limitations typically found on projects, the universal planning approach is an excellent way to manage these constraints while satisfying the expectations of organizational management. For a workplace design project to be successful all the service providers should be working in the best interests of the employees with the support and encouragement from the organizational leadership; however, in the end, it appears that no one does. The conventional idiom found in many organizations’ mission statements of “people are our most important asset” is compromised in the face of short-term financial decisions.

Under the principal-professional agency theory, the architect should have an advantage in the relationship due to knowledge asymmetry, peer group support, and production of an intangible service (Sharma, 1997). However, the dilemma for the architecture and design professions is an often an ethical one. Their allegiance and professional responsibility lie with the workspace user groups. Workplace design is intended to be a manifestation of the functional and operational needs of the occupants. Problem definition should be a result of user group interaction and careful analysis of activity patterns and evidence-based criteria that influence the work environment of knowledge workers.
In addition, there is the inherent desire to make the design statement. Embedded in that fundamental belief system is the conflict between “the calling to serve and the imperative of doing business” (Sharma, 1997: 766). The inherent knowledge and power asymmetries make the principal-professional relationship difficult for the principal to monitor creating concerns of trust. This is particularly true when the parties have conflicting goals relative to the expectations of bottom-line performance (Sharma, 1997).

**Conclusion**

The divergence of values, vision and vernacular amongst the project team creates an oppositional environment. This condition can sometimes be advantageous in multi-disciplinary teams where each team member’s participation can contribute towards a more holistic solution. However, the success of the outcome is based on a common set of goals and a unified problem definition; all the team members solving the same problem. A pre-requisite is the opportunity for all the team participants to be able to contribute to their best ability and level of expertise. This requires a level of acknowledgment and recognition for all the actors involved in the problem-solving process. The divergence model (Figure A3) illustrates the inherent conflict between the team members by virtue of uniquely different and individualized values and an absence of a shared language impeding the emergence of a common vision. Given the dynamic nature extrinsic factors acting upon the organizational context, defining a workplace design problem at any given point in time is a challenge at best, doing so in a divergent team state is a recipe for the least common denominator design solution.
Implications

Work environments are a complex juxtaposition of social, cultural, cognitive and physical constraints (Kirsh, 1999). The office workplace is a complex knowledge environment in which exist a myriad of evolving technologies, changing resources, and shifting teams. Workplace design in a changing organization cannot represent just a moment in time; it must be deal with as a complex system in perpetual search of the next stasis- a dynamic process of rebalancing. In order to successfully undertake such a process, a multi-disciplinary workplace design team must act as a multi-agent system (MAS).
A multi-agent system is defined as a network of problem solvers (agents) that interact to address problems that they could not solve individually (Durfee, Lesser, & Corkill, 1989). The most impactful approaches to handling complexity are modularity and abstraction (Sycara, 1998). Modularity allows each team member to use their expertise to define and solve a specific part of the problem. The key is therefore not to define the problem but to identify the contributing factors. The abstraction then occurs within each discipline as expert data. This is contingent on defining the problem not at the workspace level but at the organizational context level.

This interdependence of agents around the organizational context would require coordination of problem definition based on each appropriate paradigm through negotiation of the team until an assimilative coherence is reached (Sycara, 1998). This methodology would allow for a more balanced approach to problem definition that would integrate the workplace significance into the operational strategy. For optimal organizational performance, the assimilative coherence state would need to be maintained through continuous dialogue over the course of the project time frame.

This team construct would broaden the base of responsibility and accountability starting in the earliest phases of project delivery and continue the effort through an interactive cycle. In current design process structure, only 10% of activity takes place in the problem definition space and the remaining 90% in the solution space (Stempfle & Badke-Schaub, 2002). This process curtails the participation of critical team members. The participation of the organizational leadership and workforce should be strengthened as they are key contributors from the organizational paradigm perspective.
Intelligent design is less about the right answer than the right question. The assimilative coherence model (Figure A4) is illustrative of the necessity to make the design process participatory rather than representative. It suggests that identity and trust of each team member must be taken into account as it relates to every other component in the structure of the organizational context. Future research needs to be conducted that simulates the model in a project team environment. This should be an exploration of a cyclical process performed by self-organizing agents that expand the problem definition phase in a recursive pattern over the course of the project timeline.

**Figure A4. Assimilative Coherence Model**
For the practitioner, given the extended length of typical project delivery of twelve to twenty-four months, the implication is the continuity of participation of team members and a cyclical assessment of relational factors that drive a design project in a dynamic work environment. Rather than segmenting the project delivery process into phases, each with a beginning, middle and end, the metric of success that is defined in pre-design, needs to be validated throughout the process so that the design solution does not become obsolete before completion is declared.

For the researcher, the dynamic, short-term nature of strategic management in today’s organizations, suggests that a new dialectical approach to thesis–antithesis–synthesis methodology is necessary that could evaluate case studies of multi-agent teams employing a linear vs. cyclical approach to problem definition and problem solution over an extended time period. The focus on the commonalities and differences between these agents relative to perceptions and interpretations of vision, values and vernacular require further study.
Appendix B: Does Workspace Matter? Perceived Satisfaction with Physical Workspace as Influencer of Worker Performance Outcomes (Phase 2 – Quantitative)

Abstract

If there is a causal relationship between perceived satisfaction with the physical workspace and performance outcomes, organizations may be missing important opportunities to influence workers’ job satisfaction, engagement and, ultimately, organizational performance. Although current research contributes greatly toward a better understanding of the impact of physical workspace on knowledge workers’ emotional and behavioral outcomes, it does not fully explain the relationship between the physical work environment and performance. I surveyed 408 randomly selected office workers in an effort to understand the relationship between their perceived satisfaction of workspace components and worker performance as innovator. This study demonstrates empirically that workers’ perceived satisfaction with the features and attributes of workspace when mediated by emotional factors, such as job satisfaction and engagement, greatly influence performance outcomes. I believe that it is accurate to conclude that the physical environment that organizations provide for their workers plays an important role in the emotional and behavioral outcomes of workers on the job. However, the convincing argument to be made to organizational leadership is not that a “well-designed” workspace delivers “improved” performance, as many design teams claim in their project proposals, but rather to understand the emotional and cognitive factors which motivate workers to achieve the desired outcome, that are influenced by their physical work environment.

Keywords: space perception; work environment; worker engagement; worker performance; knowledge worker
Introduction

The workspace, as an organizational context, is the environment in which managers and workers produce value by performing knowledge and information work. Substantive research links workspace to job satisfaction and well-being of workers (Brill et al., 1984; Haynes & Price, 2004; Heerwagen et al., 2004; Rice & Mitchell-Ketzes, 2003; Vischer, 2007b). Research also shows that managerial control of decision making regarding workspace negatively impacts worker engagement (Knight & Haslam, 2010). Moreover, workers are rarely given a substantial voice in determining the design of their workspace as most facilities decisions are made by administrative and facilities management based on cost control (Bon, McManan, & Carder, 1998; Duffy & Tanis, 1993). In fact, for most organizations, minimizing the fixed overhead and lease costs of office space are often of higher priority in defining the objectives of facility planning and office design than worker preferences or performance related data. This contradicts the often espoused management mantra that workers are the organization's most valued asset. If there is a relation between perceived satisfaction with the physical workspace and performance outcomes, organizations may be missing important opportunities to influence workers’ job satisfaction, engagement and, ultimately, organizational performance.

Although numerous studies have looked at different conditions and attributes of workspace and its effects, there is a lack of definitive information as to how and why worker’s perceptions of workspace influence performance, what adds value to knowledge work organizations, and why organizational leadership should invest in more mindful design of workspace environments. Social science research on the relationships between
office environment and worker performance has focused on ‘social’ arenas of work such as climate, culture, and design but largely neglected the physical context of work (Baard, Deci, & Ryan, 2004; Posner, Kouzes, & Schmidt, 1985; Rich, Lepine, & Crawford, 2010; Staw, Stutton & Pelled, 1994). Research in the domain of facilities management and design, in contrast, focuses on the antecedents, such as physical features and characteristics of a workspace components that influence perceived satisfaction of office workers (Brand & Smith, 2005; Haynes, 2007; Lee & Brand, 2005; Sundstrom et al., 1980; Vischer, 2007b). In practice, workspace design strategies are often influenced by industry trends, design styles, and guiding principles based on anecdotal or observational evidence. The primary sources of requirements for workspace design projects are interpretations and expectations of worker behavior conveyed by managers without specialized training in that task (Duffy, Laing, & Crisp, 1992). Professionals then use this information to develop standards programs and modular space allocations based on user group archetypes. This approach has been shown to generate only marginal success when reported through post-occupancy evaluations of office environments by individual occupants (Preiser & Vischer, 2006; Way & Bordass, 2005). This leaves organizations’ leadership dubious about their return on investment.

At a time when overall engagement of the workforce in knowledge and information organizations is reported to be 30% and of the 70% who are not engaged, 42% are actively disengaged (Gallup-Healthways, 2012), I must ask the all-important question: Is there a relationship between workers’ perceptions of workspace and worker performance? Does this relationship affect workers’ ability to contribute as innovators in a knowledge work organization? The primary focus of this study is to measure the effects
of workers’ emotional response to the features of individual workspace and attributes of ambient environmental conditions and their performance as innovators in knowledge work organizations. I will specifically evaluate job satisfaction as well as emotional and cognitive engagement as mediators between perceived satisfaction with the physical workspace components and performance outcomes.

This paper is organized as follows: I will present a theoretical basis and supporting literature addressing the underlying rationale for the interaction between features of the physical environment and emotional and behavioral responses of workers. Subsequently, I will present the research model and state the hypotheses associated with the constructs in this study. I will describe the analyses conducted through factor analysis and structural equation modeling and report out findings. Finally, I will discuss the relevance of this research and possible limitations to the study. I will conclude by stating implications for practitioner generalizability and possibilities for future research.

**Theory and Literature Review**

The relationship between job satisfaction, engagement and performance has been studied extensively in social science research (Judge, Thoresen, Bono, & Patton, 2001; Macey & Schneider, 2008; Petty, McGee, & Cavender, 1984; Saks, 2006; Thoresen, Kaplan, Barsky, Warren, & de Chermont, 2003). However, the physical work environment as an antecedent of these relationships has been tenuously linked to this body of research. Thus, my primary focus of this study is to explore the effects of the exogenous variables of perceived satisfaction with the features of workspace and facility on the relationship between workers’ satisfaction and engagement with their jobs and performance outcomes. In other words, can the perceived satisfaction with the features of
workspace influence this all important relationship in organizational literature, and if so, what is the magnitude of this impact?

The most prevalent way in which workspace has been typically assessed in prior studies is through workers’ cognitive evaluations of environmental features based on pre-existing standards established with *a priori* experiences (Stokols, 1992). This cognitive process requires that features are identified, examined ad compare prior to a judgment being made as to their value and level of perceived satisfaction to the individual. In this approach, the focus is on the object being examined rather than the state of the individual conducting the examination. The intention is to establish an objective value judgment of each component in the environment.

Kaplan and Aronoff (1996) state that the “common understanding of an office building as a work[space] is that it holds the information and knowledge processing activities of an organization, including filing, planning, designing, supervising, analyzing deciding, and communicating. Office buildings develop from the need to plan, coordinate and administer these activities” (p. 6). The need to consider workers in planning and designing of workspace originated in the early nineties (Becker & Steele, 1995; Becker, 1991). Claims that office environments can predict worker productivity have been made ever since then (Clements-Croome, 2006; Kamarulzaman, Saleh, & Hashim, 2011; Newsham, Brand, & Donnelly, 2009; Veitch, 2008). Satisfaction with the work environment has been related to job perception, attitude, and job satisfaction (Sundstrom, Town, Rice, Osborn, & Brill, 1994). Early studies indicated that workers’ satisfaction with their workspace affects their job satisfaction and indirectly relates to organizational commitment and turnover intention (Carlopio, 1996). More recent studies have sought to
determine the components of work environments that influence office productivity such as open-plan or full-height walls (Haynes, 2007), design features (Brand & Smith, 2005; Smith & Orfield, 2007), ergonomics (Attaran & Wargo, 1999; Springer, 2007); as well as, factors such as flexibility and adjustability of furniture (Lee & Brand, 2005). The perception and experience of the office workspace is not only impacted by their immediate space but also by the ambient conditions of the facility. Depending on the disposition of the individual worker, the perceptions of the facility lighting (Boyce & Akashi, 2003; Chaudhury, 2009; Veitch, Timperio, & Crawford, 2011), ventilation and temperature (Hancock, Ross, & Szalma, 2007; Seppanen, Fisk, & Lei, 2006; Sundell, Levin, Nazaroff, & Cain, 2011), and noise (Rashid & Zimring, 2008; Salonen & Lahtinen, 2013) can impact the person’s mood, attention level, and biological functioning (Carlopio, 1996; Vischer, 2007b). While extant research has found significant effects of environmental features on behavior and productivity; as well as, indirectly on attitudes, health, and well-being of workers, other studies have failed to validate these relationships.

Worker performance in knowledge work environments is difficult to define and even more difficult to measure. Research studies linking office performance and work environment are either dealing with physical conditions in the domain of environmental studies or behavioral factors in social psychology. The findings lead to conclusions that certain attributes of work environments result in better or worse self-reported performance (Bordass & Leaman, 2004; Oseland, 2004). In fact, while specific outcomes of any particular measure are uncertain, claims that environmental factors can increase productivity by up to 15% have been made (Oseland & Bartlett, 1999). These cause and
effect relationships seemingly established a link between environmental conditions and knowledge work productivity. For the most part, this approach only establishes a relationship between specific attributes of workspace and expected outcomes. It does not explain the emotional effects that workspace has on workers, which influence their attitudinal response and manifests in behaviors.

Although these studies contribute to a greater understanding of the impact of workspace on workers, I posit that they do not fully explore the relationship between the physical workspace and worker performance for two reasons. First, I argue that workers do not associate workspace and performance without intervening cognitive and emotional factors, which act as mediators of behavioral outcomes. In other words, the perception of one’s surroundings, based on one’s sensory experience, has an impact on how one feels toward one’s work and, in turn, how one performs on the job. Thus, in order to address the relationship between workspace and performance, it is necessary to discern whether the worker internalizes the perceptions of these physical features and manifests them into emotional states, such as job satisfaction and engagement. Second, the workers’ perceptions of workspace attributes and features involve predominantly cognitive processes of workspace assessment. This would suggest a limited potential that satisfaction with workspace features would predict workers’ emotional response to their job. Thus, I theorize that it is not the worker’s cognitive assessment of the specific characteristics of the workspace that elicit a behavioral response but the influence that the physical environment has on the emotional states of the individual that affects the performance of workers. The ability on the part of the worker to experience their work environment in ways that sustain their level of emotional experience is necessary to
achieve the desired state that contributes to job satisfaction, as well as, cognitive and emotional engagement and influences performance outcomes.

**Research Model and Hypotheses**

The conceptual model shown in Figure B1 reflects the notion that perceived satisfaction with the individual workspace features and the ambient conditions of the facility evokes emotional reactions, such as satisfaction and engagement with one’s job and lead to worker performance as innovator.

**Figure B1. Conceptual Model**

![Conceptual Model Diagram]

**Job Satisfaction as Mediator to Performance**

The relationship between job satisfaction and performance outcomes has been studied extensively in social psychology. Judge, Thoresen, Bono, and Patton (2001) define seven types of models that explain the linkages between worker attitudes, including job satisfaction, and performance that have been considered dating back to the 1930s. Locke (1976) formulated the current understanding of job satisfaction as “a pleasurable or positive emotional state resulting from the appraisal of one’s job of job...
experiences” (p. 1300). Motowidlo (1996) defined job satisfaction further as “judgments about the favorability of the work environment” (p. 176). Weiss (2002) introduced into the definition an evaluative mechanism but defining job satisfaction as “an internal state that is expressed by effectively and/or cognitively evaluating an experienced job…” (p. 1).

Researchers have considered job satisfaction as both a cognitive and an affective construction (George & Brief, 1996; Staw, Stutton & Pelled, 1994). A study by Isen and Baron (1991) showed that positive affect is related to worker motivation, which in turn influences performance (Cropanzano, 1993; Wright & Bonnett, 1993). Researchers have argued that affective measures of job satisfaction are stronger in predicting performance than cognitive ones (Brief & Roberson, 1989; Wright & Staw, 1999). However, both cognitive and affective measures have been used to predict job satisfaction as influencers of performance (Brief & Weiss, 2002).

Engagement as Mediator to Performance

According to Kahn (1990), engagement is a motivational concept that employs physical, cognitive and emotional aspects of workers toward work role performance. He further states that the three antecedents of engagement are (a) value congruence, (b) perceived organizational support, and (c) core self-evaluation. An even broader definition of engagement as a multi-dimensional construct includes trait (individual characteristics), state (feelings of energy and absorption) and behaviors (extra-role behaviors) (Macey & Schneider, 2008). Rich et al. (2010) found that engaged workers consistently show evidence of higher levels of job performance. A commonly shared result in these studies is that engaged workers are intrinsically self-motivated and perform better on the job.
I also suggest that two of Kahn’s (1990) antecedents to engagement (value congruence and perceived organizational support) can be used to explain workers’ perception of physical work environments as contributing factors to engagement and job satisfaction. The physical work context is a manifestation of the attitudes the organization has toward employees. The *Global Workforce Survey* (Perrin, 2006), found that engaged workers have greater confidence in their knowledge, skills, and abilities, which are powerful predictors of effective behaviors and strong performance. A perception of a poor workspace on the part of workers could suggest that management does not care and is not supportive.

This is supported by the recent shift in attention in research around worker engagement to extrinsic factors found in the work environment. In fact, Crawford et al. (2010) state that common among the predictors of worker engagement are the perceived working conditions.

**Workspace as Antecedent to Emotional and Behavioral Response of Workers**

The relationships between organizations, workers and space are changing (Grimshaw, 1999). Office workspace has been redefined from static, familiar and predictable to transitional, flexible and even virtual. Since the advent of *burolandschaft* (office landscape) in the 1960s office workspace has transitioned from individual, cellular office to open-plan workstations. This opened up a myriad of possibilities in office layout design as well as many concerns with individual workspace such as noise, privacy, and distraction, which have been extensively studied both from behavioral and design perspectives (Evans & Johnson, 2000; Sundstrom, Bell, Busby, & Asmus, 1996). According to the U.S. Department of Labor, Bureau of Labor Statistics (2012,
American workers spend 8.7 hours per day in work related activity. For an office worker, this could mean sitting at a desk, in a workstation or around a conference table. The impact of their perceived satisfaction with their immediate workspace, as well as, the general ambient conditions of the facility could have a dramatic effect on how they feel, think and act. Furthermore, these reactions cannot assume to be generalizable but rather unique to the individual worker’s perceptions. These personal characteristics cannot be assumed to be correlated to the worker’s job description of classification, which is typically how workspace is designated in the knowledge work environment. Thus, in the context of workspace design, the unit of analysis in understanding these relationships needs to shift from the archetype of a group to individual level.

A number of studies have concluded that satisfaction with specific attributes of workspace are directly associated with job satisfaction (Carlopio, 1996; Lee, 2006; Oldham, 1988; Sundstrom et al., 1994; Zalesny, Farace, & Kurchner-Hawkins, 1985). To my knowledge, no research has been conducted to link perceived satisfaction of the features and attributes of workspace and facility to job engagement. I theorize in this study that the reason why perception of satisfaction with workspace components cannot predict job engagement is because of the evaluative differences of the constructs. Perception of satisfaction of workspace components is cognitive measurement where job engagement is an emotionally assessed construct. In contrast, job satisfaction is considered both a cognitive and affective construct and is evaluated as a cognitive construct. With that assumption, I hypothesize that the perceived satisfaction with
features and attributes of workspace can only predict job satisfaction but will reinforce engagement in a chained effect before impacting performance.

Thus, I hypothesize the following:

Hypothesis 1. Perception of satisfaction with individual workspace mediated through first job satisfaction and then emotional engagement positively impacts performance.

Hypothesis 2. Perception of satisfaction with individual workspace mediation through first job satisfaction and then cognitive engagement positively impacts performance.

Hypothesis 3. Perception of satisfaction with facility mediated through first job satisfaction and then emotional engagement positively impacts performance.

Hypothesis 4. Perception of satisfaction with facility mediated through first job satisfaction and then cognitive engagement positively impacts performance.

Research Method

To validate the research model (Figure B1), I conducted an electronically disseminated cross-sectional survey. The survey was constructed to measure the influence of perceived satisfaction of knowledge workers in an office environment on the extensively studied relationships of job satisfaction and engagement on performance of workers as innovators. My unit of analysis was the individual knowledge worker participating in a self-administered and self-reported data collection effort. Because I am looking to study the perceptual rather than behavioral response to workspace, I concluded that a cross-sectional survey of a random population of knowledge workers would result in more representative data than researcher observation type of data obtained through experiments or interventions in an actual work environment.
**Construct Operationalization**

In order to test my conceptual model, I adapted previously validated scales from existing literature. The selected scales were all Likert-type measures on a five-point distribution defined as reflective (Jarvis, MacKenzie, & Podsakoff, 2003). Table 1 lists the constructs and corresponding items used in the study model.

**Scales Adaption and Refinement**

The survey instrument was developed from review of relevant literature from both the organizational behavior and the workspace environment domains. I assessed reliability and construct validity using Q-sort (Thomas & Watson, 2002), Bolton’s (1993) method to identify respondents’ cognitive difficulty among office workers in my professional network. Both exercises resulted in minor scale revisions. First, I updated the terminology of the questions to fit the current definition of workspace types and technological advances in office environments. Second, I adjusted the phrasing of the questions pertaining to the perception of workspace to specifically elicit the individual’s affective response. I solicited consensus from the test subjects that each construct was uniquely defined, and all the questions were specific to that construct. The final survey instrument consisted of 35 items covering the constructs described below. My control variable was workspace type, given the ongoing discussion in the workspace arena relative to the benefits of open-plan versus enclosed office accommodation of workers (Brennan, Chugh, & Kline, 2002; Brookes & Kaplan, 1972; Zalesny et al., 1985).

**Perception of Satisfaction with Workspace (Independent Variables)**

In reviewing previous studies on the perception of physical office environments on worker attitudes, I found two distinct approaches: (a) emotion (perceptions or
feelings) and (b) judgment (qualities, conditions). I selected the 18 item Satisfaction with Environmental Features (SEF) scale as modified by Veitch et al. (2007), which focused participants on their satisfaction with their current physical space. I modified the wording to a general description of ‘work space’ from a more restrictive definition of ‘office’ or ‘workstation’. In addition, I created two dimensions of workspace definition, namely individual workspace and facility related items in order to focus the respondent on the contextual aspects of space rather than the physical conditions. The individual items are intended to triggers emotional responses to noise, distraction, and privacy. While the facility items address the ambient triggers related to temperature, ventilation, and lighting. Based on my pre-test, I also slightly modified the wording of questions that appeared to use jargon specific to the workspace design industry. Participants responded on a 5-point Likert scale ranging from (1) ‘extremely dissatisfied’ to (5) ‘extremely satisfied’. The original scale had three dimensions, namely privacy/acoustics, ventilation/temperature, and lighting with a reliability scores ranging from 0.76 to 0.88.

**Job Satisfaction (Mediator)**

The job satisfaction scale was adapted from a study conducted on aspects of psychological well-being (Warr, Cook, & Wall, 1979). The study assimilated a robust instrument of eight constructs dealing with the quality of work life, job satisfaction being one of the scales. I utilized 14 of the 15 items in the job satisfaction scale, excluding only the question pertaining to rate of pay as I did not consider the question relevant for my study of randomly selected participants. The remaining items asked about the satisfaction with intrinsic and extrinsic features of the job on a 5-point Likert scale ranging from (1)
‘very dissatisfied’ to (5) ‘very satisfied’. The alpha reliability for the original scale was 0.85.

**Engagement (Mediator)**

I used two dimensions of the engagement scale compiled to reflect Kahn’s (1990, 1992) definition of engagement (Rich et al., 2010). The two dimensions were emotional (six items) and cognitive (four items). I chose not to utilize the physical engagement scale given that my intent was to compare the positive affect of the emotional measures with the intellectual aspects of the cognitive construct, which focused on levels of attention and absorption on the job. The question pertained to the extent of agreement/disagreement with the items relative to the respondent’s job on a 5-point Likert scale. The alpha reliability of the overall scale was 0.95.

**Performance (Dependent Variable)**

In order to measure my performance outcomes construct, I used the Role-Based Performance Scale (RBPS) (Welbourne, Johnson, & Erez, 1998). While most scales measuring performance focus on worker behavior on the job, I wanted to assess performance that meets broader organizational objectives. The RBPS covers five dimensions of performance: job, career, innovator, team, and organization. In order to provide evidence to organizational leadership of the importance of the relationship between workspace and performance outcomes, I focused on the innovator dimension of performance as a metric in knowledge work environments. The respondents were asked to address each item using a 5-point Likert scale ranging from (1) ‘need much improvement’ to (5) ‘excellent’. The alpha reliability for all the dimensions of the scale ranged from 0.76 to 0.90.
Sample

The study sample was created from a Qualtrics, on-line panel data respondent’s pool of 860 randomly selected office workers from a variety of occupations and organizations who completed the survey over a two-week period in November 2014. A data set was then derived using the following filters: (1) full-time employed; (2) works in an office environment; (3) has a designated workspace; and (4) comes to the office on a regular, weekly basis. The resultant data set was then checked for response bias by looking at the mean and standard deviation for each respondent. Of that total, I utilized a random sample of n=408 fully completed surveys, of which half the participants were female; less than 1% worked in the facility less than one year and over 50% more than six years; 40% worked in a private office, 47% in a semi-private partition enclosed workstation and 13% at an open desk. The respondents pool covered five levels of job classification (administrative, clerical, professional, managerial, consulting/contracting) and ten industry sectors (finance/banking/insurance, utilities, manufacturing office, technology, research and development, transportation, institutional/public, design, construction, and service).

The randomness of my sample was deliberate as I did not want to affect the validity inferences with the knowledge of the actual layout or quality of the workspace the respondents occupied. However, this approach prevented us from being able to assess non-response bias as I could not ascertain the sequence or source of the data collection process (Armstrong & Overton, 1977).
Data Analyses

I used SPSS (v. 22.0) software to perform several data screening procedures detailed in the analysis sections below to ensure a clean data set prior to analysis. I then conducted an exploratory factor analysis (EFA) to determine how well the questions in my survey measured the intended constructs. I used AMOS (Analysis of Moment Structures) software to conduct a confirmatory factor analysis (CFA) on the solution developed during EFA to test my measurement model for invariance, reliability, convergent and discriminant validity, common method bias and model fit. Finally, I created a structural equation model (SEM) based on my research model using the composite factors developed during CFA. To test for chained, serial mediation, I followed the Shrout and Bolger (2002) approach using bootstrapping.

Because my dataset was selected from a much larger pool of panel data, I was able to screen out all surveys with incomplete responses. I further checked the standard deviation for each respondent to check for unengaged responses and eliminated the ones with scores less than 0.5. The test for kurtoses revealed no issues as all the items well with the range of -1 to +1. Due to the fact that I used a 5-point Likert scale for all my items, I did not see it necessary to test for skewness of data. All items indicated adequate variance. An analysis of multicollinearity exhibited tolerances and VIF values within acceptable limits (tolerances greater than 0.5 and VIF values <3.0). From this, I concluded that the statistical standards were sufficiently met for structural equation modeling (Hair, Black, Babin, & Anderson, 2010). The descriptive statistics are summarized in Table B1.
Measurement Model

The dataset was screened using univariate assumptions. I followed the two-step modeling approach whereby all measures were analyzed for validity and reliability before I continued on to the structural model to test the strength of my construct relationships (Anderson & Gerbing, 1988). Exploratory factor analysis was run to identify and name emergent factors and to measure factor validity and reliability. Confirmatory factor analysis was conducted to further establish validity and model fit prior to imputing the data to create composites. Multivariate data screening assumptions were completed prior to creating the structural model measuring mediating relationships.

An exploratory factor analysis (EFA) was conducted in order to determine how well my survey instrument measured the constructs. I used Promax rotation and Maximum Likelihood to extract the six factors in my conceptual model. The Satisfaction with Workstation and Satisfaction with Facility factors converged with different items than assumed in the original scale development. After resolving cross loading and low loading items, my final pattern matrix resulted in a Kaiser-Meyer-Olkin (KMO) value of 0.94 ($\chi^2=10700.611$, df=496, $p<0.001$). The significance was expected due to the large data sample, n=408. The communalities were 0.5 or higher. A six-factor structure explained 67.22% of variance extracted with the first factor explaining the most variance (40.29%). Non-redundant residuals were at 3%, well below the 5% cut-off (Hair et al., 2010). At the completion of the EFA, the six factors were comprised of 32 items. Factor loadings corresponding to each construct were significant at $p<0.001$ level (see Table B1). All items were adequately correlated with causality flowing from construct to
measure; thus, I could conclude that the constructs are, in fact, reflective (MacKenzie, 2005).

Table B1. Results of the Confirmatory Factor Analysis

<table>
<thead>
<tr>
<th>Constructs and Items</th>
<th>Unstandard Estimates</th>
<th>Standard Estimate</th>
<th>S.E.</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE- INNOVATOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERFINO1 Come up with new ideas</td>
<td>1.122</td>
<td>0.869</td>
<td>0.066</td>
<td>17.012</td>
<td>***</td>
</tr>
<tr>
<td>PERFINO2 Work to implement new ideas</td>
<td>1.082</td>
<td>0.938</td>
<td>0.038</td>
<td>28.226</td>
<td>***</td>
</tr>
<tr>
<td>PERFINO3 Find improved ways to do things</td>
<td>0.966</td>
<td>0.85</td>
<td>0.041</td>
<td>23.665</td>
<td>***</td>
</tr>
<tr>
<td>PERFINO4 Create better processes and routines</td>
<td>0.892</td>
<td>0.775</td>
<td>0.045</td>
<td>19.846</td>
<td>***</td>
</tr>
<tr>
<td>PERCEIVED SATISFACTION- WITH -WORKSPACE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SATWS1 Degree of enclosure</td>
<td>1.109</td>
<td>0.756</td>
<td>0.076</td>
<td>14.665</td>
<td>***</td>
</tr>
<tr>
<td>SATWS2 Distance between workspaces</td>
<td>1.066</td>
<td>0.794</td>
<td>0.051</td>
<td>20.701</td>
<td>***</td>
</tr>
<tr>
<td>SATWS3 Amount of background noise</td>
<td>1.031</td>
<td>0.754</td>
<td>0.07</td>
<td>14.742</td>
<td>***</td>
</tr>
<tr>
<td>SATWS4 Amount of noise from others</td>
<td>1.133</td>
<td>0.767</td>
<td>0.075</td>
<td>15.012</td>
<td>***</td>
</tr>
<tr>
<td>SATFAC2 Frequency of distractions</td>
<td>0.828</td>
<td>0.699</td>
<td>0.061</td>
<td>13.655</td>
<td>***</td>
</tr>
<tr>
<td>SATFAC3 Level of visual privacy</td>
<td>0.788</td>
<td>0.71</td>
<td>0.057</td>
<td>13.887</td>
<td>***</td>
</tr>
<tr>
<td>SATFAC6 Level of conversations privacy</td>
<td>0.902</td>
<td>0.744</td>
<td>0.062</td>
<td>14.655</td>
<td>***</td>
</tr>
<tr>
<td>PERCEIVED SATISFACTION- FACILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SATWS5 Quality of lighting</td>
<td>0.926</td>
<td>0.664</td>
<td>0.071</td>
<td>12.958</td>
<td>***</td>
</tr>
<tr>
<td>SATWS6 Overall air quality</td>
<td>0.932</td>
<td>0.582</td>
<td>0.068</td>
<td>13.703</td>
<td>***</td>
</tr>
<tr>
<td>SATWS7 Ventilation in workspace</td>
<td>0.997</td>
<td>0.775</td>
<td>0.076</td>
<td>13.191</td>
<td>***</td>
</tr>
<tr>
<td>SATWS8 Temperature in workspace</td>
<td>0.904</td>
<td>0.702</td>
<td>0.074</td>
<td>12.176</td>
<td>***</td>
</tr>
<tr>
<td>SATFAC8 Amount of light for computer work</td>
<td>1.035</td>
<td>0.785</td>
<td>0.078</td>
<td>13.324</td>
<td>***</td>
</tr>
<tr>
<td>SATFAC9 Amount of reflected light or glare</td>
<td>1.079</td>
<td>0.757</td>
<td>0.083</td>
<td>12.958</td>
<td>***</td>
</tr>
<tr>
<td>COGNITIVE ENGAGEMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COGENG1 My mind is focused on my job</td>
<td>1.057</td>
<td>0.897</td>
<td>0.038</td>
<td>27.75</td>
<td>***</td>
</tr>
<tr>
<td>COGENG2 I pay a lot of attention to my job</td>
<td>0.947</td>
<td>0.917</td>
<td>0.033</td>
<td>28.987</td>
<td>***</td>
</tr>
<tr>
<td>COGENG3 I am absorbed by my job</td>
<td>0.979</td>
<td>0.858</td>
<td>0.039</td>
<td>24.902</td>
<td>***</td>
</tr>
<tr>
<td>COGENG4 I concentrate on my job</td>
<td>0.946</td>
<td>0.901</td>
<td>0.034</td>
<td>27.75</td>
<td>***</td>
</tr>
<tr>
<td>EMOTIONAL ENGAGEMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMOENG1 I am enthusiastic in my job</td>
<td>0.947</td>
<td>0.907</td>
<td>0.032</td>
<td>29.825</td>
<td>***</td>
</tr>
<tr>
<td>EMOENG2 I feel energetic in my job</td>
<td>1.043</td>
<td>0.889</td>
<td>0.037</td>
<td>28.045</td>
<td>***</td>
</tr>
<tr>
<td>EMOENG3 I am interested in my job</td>
<td>0.866</td>
<td>0.857</td>
<td>0.034</td>
<td>25.62</td>
<td>***</td>
</tr>
<tr>
<td>EMOENG4 I am proud of my job</td>
<td>0.832</td>
<td>0.83</td>
<td>0.035</td>
<td>23.851</td>
<td>***</td>
</tr>
<tr>
<td>EMOENG5 I am positive a out my job</td>
<td>0.932</td>
<td>0.866</td>
<td>0.035</td>
<td>26.261</td>
<td>***</td>
</tr>
<tr>
<td>EMOENG6 I am excited bout my job</td>
<td>1.055</td>
<td>0.911</td>
<td>0.035</td>
<td>29.825</td>
<td>***</td>
</tr>
<tr>
<td>JOB SATISFACTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOBSAT4 Recognition from good work</td>
<td>1.13</td>
<td>0.857</td>
<td>0.066</td>
<td>17.012</td>
<td>***</td>
</tr>
<tr>
<td>JOBSAT5 Immediate boss</td>
<td>0.845</td>
<td>0.753</td>
<td>0.048</td>
<td>17.5</td>
<td>***</td>
</tr>
<tr>
<td>JOBSAT6 Amount of responsibility</td>
<td>0.716</td>
<td>0.709</td>
<td>0.045</td>
<td>16.075</td>
<td>***</td>
</tr>
<tr>
<td>JOBSAT8 Relationship between mgt &amp; employe</td>
<td>0.895</td>
<td>0.792</td>
<td>0.047</td>
<td>18.861</td>
<td>***</td>
</tr>
<tr>
<td>JOBSAT9 Chance of promotion</td>
<td>0.885</td>
<td>0.738</td>
<td>0.052</td>
<td>17.012</td>
<td>***</td>
</tr>
</tbody>
</table>

Model fit statistics: x²=837.89 (df=442)
CMIN/df=1.89; CFI=.962; TLI=.958;
GFI=.885; RMSEA=.047; PCLOSE=.85
Convergent validity was achieved as all the factor loadings were above 0.5 with the exception of JobSat6 (0.482). I decided to keep the item as the average loadings on the factor were above 0.7. Discriminant validity was evident as no cross loading were above 0.2. In addition, correlations between the factors were all below 0.7. Reliability was examined using Cronbach’s alpha for each factor (Fornell & Larcker, 1981). All the results were well above the designated cut-off of 0.7 (Hair et al., 2010) as shown on the diagonal in Table B2.

Table B2. Means, Standard Deviations and Correlations Reliability

<table>
<thead>
<tr>
<th>Factor</th>
<th>MEAN</th>
<th>S.D.</th>
<th>SatWS</th>
<th>SatFac</th>
<th>JobSat</th>
<th>EmoEng</th>
<th>CogEng</th>
<th>PerfInno</th>
</tr>
</thead>
<tbody>
<tr>
<td>SatWS</td>
<td>2.917</td>
<td>0.680</td>
<td>.906*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SatFac</td>
<td>3.178</td>
<td>0.620</td>
<td>0.599</td>
<td>.864*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JobSat</td>
<td>2.787</td>
<td>0.639</td>
<td>0.521</td>
<td>0.444</td>
<td>.920*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EmoEng</td>
<td>3.866</td>
<td>0.857</td>
<td>0.49</td>
<td>0.455</td>
<td>0.693</td>
<td>.954*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CogEng</td>
<td>4.055</td>
<td>0.806</td>
<td>0.381</td>
<td>0.39</td>
<td>0.503</td>
<td>0.683</td>
<td>.930*</td>
<td></td>
</tr>
<tr>
<td>PerfInno</td>
<td>3.530</td>
<td>0.700</td>
<td>0.369</td>
<td>0.325</td>
<td>0.464</td>
<td>0.587</td>
<td>0.511</td>
<td>.930*</td>
</tr>
</tbody>
</table>

*Cronbach alphas are along the diagonal

A confirmatory factor analysis (CFA) was conducted in order to evaluate the correspondence between the theoretical model and the data (Hair et al., 2010: 671) in terms of model fit, validity, reliability and invariance and in order to test for common method bias. I created a measurement model by using each construct and its associated items. The model was further refined through appropriate covariance relationships using modification indices (Byrne & Ragin, 2009). The overall fit for the model was good (CMIN/df = 1.89, RMSR = 0.04, TLI = 0.958, CFI = 0.962, GFI = 0.885, RMSEA = 0.047, PCLOSE = 0.85). The composite reliability exceeded the acceptable threshold level (>0.7) and the average variance explained (AVE) for all factors was greater than 0.5
(Hair et al., 2010). To test for discriminate validity I compared the square root of the average variance explained (AVE) to the inter-factor correlations and related average variance explained (AVE) to average shared variance (ASV) and maximum shared variance (MSV). To provide evidence for convergent validity of the measures, each factor’s average variance extracted (AVE) was examined, as recommended by Fornell and Larcker (1981). The results demonstrated adequate discriminate and convergent validity, as shown in Table B3.

Table B3. Discriminant and Convergent Validity during CFA

<table>
<thead>
<tr>
<th></th>
<th>CR</th>
<th>AVE</th>
<th>MSV</th>
<th>ASV</th>
<th>PerfInno</th>
<th>EmoEng</th>
<th>SatWS</th>
<th>SatFac</th>
<th>ConEng</th>
<th>JobSat</th>
</tr>
</thead>
<tbody>
<tr>
<td>PerfInno</td>
<td>0.922</td>
<td>0.748</td>
<td>0.381</td>
<td>0.240</td>
<td>0.865</td>
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</tr>
<tr>
<td>EmoEng</td>
<td>0.952</td>
<td>0.769</td>
<td>0.567</td>
<td>0.390</td>
<td>0.617</td>
<td>0.877</td>
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<td></td>
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</tr>
<tr>
<td>SatWS</td>
<td>0.898</td>
<td>0.558</td>
<td>0.416</td>
<td>0.265</td>
<td>0.389</td>
<td>0.524</td>
<td>0.747</td>
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</tr>
<tr>
<td>SatFac</td>
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<td>0.510</td>
<td>0.416</td>
<td>0.221</td>
<td>0.345</td>
<td>0.453</td>
<td>0.645</td>
<td>0.714</td>
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<td>0.565</td>
<td>0.461</td>
<td>0.551</td>
<td>0.771</td>
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</table>

Square root of AVE along the diagonal

Since my data collection effort was solely based on a self-reported survey, I wanted to guard against social desirability bias, the tendency for respondents to answer questions that make them look more favorable to others. For that reason, I included a five-item social desirability scale (Hays, Hayashi, & Stewart, 1989) unrelated to my constructs. The items converged on a single factor and only explained 1.4% of the variance.

The data collection method used for the study (i.e., mono-method, single-source, survey-based, self-reporting) raised the possibility of common method bias (CMB) (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In order to evaluate this possibility, I first conducted the Harman’s single factor test to ensure that a single factor did not
explain the majority of the variance. The results indicated less than 50% of variance explained on a single factor indicating no evidence of CMB. I next took the multi-method approach to testing for CMB (Doty & Glick, 1998; Podsakoff et al., 2003) by adding an unmeasured Common Latent Factor (CLF). I compared the standardized regression weights before and after adding the CLF to the CFA model and calculated the difference. None of the deltas were above the limit (.>20). Thus, I concluded that no method bias was present. Composite variables were created using regression imputation without the CMB adjusted latent factor.

**Structural Equation Model**

Structural Equation Modeling (SEM) is especially suited for hypotheses testing since *a priori* hypotheses can be directly specified for estimation. The hypothesized relationships stated earlier in this paper were tested in the structural model in Figure B2. Best fit was achieved prior to testing for mediation. The initial model had to be modified in two ways: (a) by releasing the direct effects between the independent and dependent variables, which seemed to be theoretically logical as an indicator of full rather than partial mediation effects; (b) by co-varying the error terms of emotional and cognitive engagement, which confirmed that the variables measure common trait of engagement. The model fit statistics were all quite good (CMIN/df = 1.99, RMSR = 0.018, TLI = 0.990, CFI = 0.995, RMSEA = 0.049, PCLOSE = 0.467). The final results of the path analyses are reflected in Figure B2. All the paths reached statistical significance at p=<0.001 level.

I tested for mediation by using Mathieu and Taylor’s (2006) recommended bootstrap method using 2000 bias-corrected (BC) bootstrapping samples at 95 BC
confidence level, while applying the Shrout and Bolger (2002) approach for determining the chain mediation effects. This approach was tested and validated by Carlo, Lyytinen, and Rose (2012).

**Figure B2. Structural Equation Model**

![Structural Equation Model](image)

**Results and Findings**

The standardized path coefficients with associated significance (p-value) and coefficients of determination ($r^2$) of the endogenous variables are reflected in Figure B2. The perceived satisfaction with workspace and facility mediated by job satisfaction and engagement explain 47% of the variance in performance as innovator in knowledge workers who work in an office ($r^2 = 0.47$). In the fully saturated model, the direct effects (not shown) proved to be weak and non-significant indicating that full mediation is highly likely. The notable results of the overall model indicate that the effect of perceived satisfaction with individual workspace has a much greater impact on job satisfaction than do perceived satisfaction with facility. Also important to note is the fact that emotional
engagement factors account for a much greater portion of the explained variance than
does cognitive engagement on performance of workers as innovators. These results lead
us to conclude that individual worker perceptions of their physical work environment
plays a notable and important role in worker behavior and attitude, as well as, their ability
to participate in innovator performance outcomes. These results are not based on the type
of workspace the worker is occupying as I controlled for three types of accommodations
(private office, panel enclosed workstation, and open desk). The path coefficients of these
controls were low and non-significant. A detailed discussion on mediation results is
summarized in Table B4 and is discussed below.

**Mediation Findings**

Two paths were hypothesized to affect performance as innovator, both originating
with the individual knowledge worker’s perception of satisfaction with the physical work
environment. One pertained to individual workspace (H1 and H2) and the second with
the overall facility (H3 and H4). Each path was mediated by two variables, namely job
satisfaction and engagement, in a serial configuration. Engagement has two directions for
each path in order to test the effects of emotional versus cognitive engagement, which
proved to be two distinct factors in my pattern matrix during EFA. All hypotheses were
supported based on the Shrout and Bolger (2002) interpretation of complete mediation.
For complete mediation, the independent to dependent variable direct effect is significant,
but significance is eliminated in the presence of mediators indicating that all the influence
of IV to DV is through the mediators. The mediated paths are summarized in Table B4.

Using the perception of satisfaction with individual workspace as the exogenous
variable, I found multiple mediation to be fully supported (H1 and H2) based on the
Shrout and Bolger (2002) method. While the direct effect from independent to dependent variables was significant, it became nonsignificant when the mediators were introduced. On that basis, I can conclude that perceiving my workspace as satisfactory leads to greater job satisfaction \( \text{unstd. } \beta = 0.610; \ p < 0.001 \). This in turn leads to increased engagement with emotional engagement playing a stronger role than cognitive engagement (emotional engagement unstd. \( \beta = 0.967, p < 0.001 \), \( r^2 \) of the overall model=0.62; cognitive engagement unstd. \( \beta = 0.667, p <0.001 \), \( r^2 \) of the overall model=0.35). Finally, both emotional and cognitive engagement positively predicts worker performance as innovator (unstd. \( \beta = 0.381, p <0.001 \); unstd. \( \beta = 0.303, p <0.001 \)).

For both paths, emotional (c’=0.032, ns) and cognitive (c’=0.044, ns), the direct effects are low and non-significant, while they were significant without the mediators. This confirms the relationship between perception of satisfaction with individual workspace and performance of workers as innovators, if completely mediated by job satisfaction and worker engagement. Furthermore, the indirect effects \( \text{abc+af+ec} \) between perceived satisfaction with individual workspace and performance through job satisfaction and both paths of engagement are significant (unstd. \( \beta = 0.419, p < 0.001 \); unstd. \( \beta = 0.407, p<0.001 \)) further supporting the hypothesized complete mediation.

Similarly with perception of satisfaction with the facility, the hypothesized serial mediation is fully supported (H3 and H4) according to Shrout and Bolger (2002). While the direct effect from independent to dependent variables was significant, it became non-significant when the mediators were introduced. Based on that interpretation, experiencing the ambient conditions of the facility as satisfactory leads to greater job satisfaction (unstd. \( \beta = 0.619; \ p < 0.001 \)). This, in turn, leads to increased engagement with
emotional engagement playing a stronger role than cognitive engagement (emotional engagement unstd. $\beta=0.963$, $p<0.001$, $r^2$ of the overall model=0.62; cognitive engagement unstd. $\beta=0.613$, $p<0.001$, $r^2$ of the overall model=0.35). Finally, both emotional and cognitive engagement positively predicts worker performance as innovator (unstd. $\beta=0.381$, $p<0.001$; usntd. $\beta=0.303$, $p<0.001$). For both paths, emotional ($c'=0.032$, ns) and cognitive ($c'=0.021$, ns), the direct effects are low and non-significant, while they were significant without the mediators. This confirms the relationship between perception of satisfaction with individual workspace and performance of workers as innovators, if completely mediated by job satisfaction and worker engagement in a chained effect. Furthermore, the indirect effects ($abc+af+ec$) between perceived satisfaction with individual workspace and performance through job satisfaction and both paths of engagement are significant (unstd. $\beta=0.438$, $p<0.001$; unstd. $\beta=0.449$, $p<0.001$) further supporting the hypotheses of complete mediation.

However, based on the Carlo et al. (2012) definition of complete mediation, in addition to the $X \rightarrow Y$ path ($c'$) becoming non-significant, the cross paths ($e$ and $f$) also need to be non-significant to establish complete mediation. Thus, I have to assume that additional mediating paths exist in the model, such as single mediation through job satisfaction, which are not being hypothesized in this study. Never the less, these alternative mediation paths in no way discredit the findings or dissuade from my conclusions regarding the impact of perception of satisfaction with workspace on the performance outcome.
<table>
<thead>
<tr>
<th>MEDIATION (See Appendix for detailed results)</th>
<th>EVIDENCE</th>
<th>SUPPORTED?</th>
</tr>
</thead>
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<tr>
<td></td>
<td>β and p-value</td>
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<tr>
<td>H1 SatWS--&gt;JobSat--&gt;EmoEng--&gt;InnoPerf</td>
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</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>c M2--&gt;Y 0.381***</td>
<td>MEDIATION</td>
<td></td>
</tr>
<tr>
<td>e X--&gt;M2 0.12**</td>
<td></td>
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</tr>
<tr>
<td>f M1--&gt;Y 0.239***</td>
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</tr>
<tr>
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<td></td>
<td></td>
</tr>
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</tr>
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<td>C X--&gt;Y(T) 0.451***</td>
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<td></td>
</tr>
<tr>
<td>H2 SatWs--&gt;JobSat--&gt;CogEng--&gt;InnoPerf</td>
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</tr>
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<td>a X--&gt;M1 0.61***</td>
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<tr>
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<td>c M2--&gt;Y 0.303***</td>
<td>MEDIATION</td>
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<td></td>
</tr>
<tr>
<td>H3 SatFac--&gt;JobSat--&gt;EmoEng--&gt;InnoPerf</td>
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<tr>
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<td>a X--&gt;M1 0.619***</td>
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<tr>
<td>b M1--&gt;M2 0.613***</td>
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<td></td>
</tr>
<tr>
<td>c M2--&gt;Y 0.303***</td>
<td>MEDIATION</td>
<td></td>
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<tr>
<td>C X--&gt;Y(T) 0.47***</td>
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</table>

***P<.001; **P<.05; P<.01; ns=Not Significant; β are unstandardized values

**Discussion**

This study examines the effect of the physical work environment on worker performance, specifically the ability to innovate, in knowledge work organizations. The notion that worker attitudes and behaviors contribute to performance outcomes is commonly discussed in many organizations’ human resources departments and accepted...
by organizational leadership. Nevertheless, even in organizations where the physical work environment is acknowledged as a facilitator of transformation and an enabler of innovation, its significance on business strategy is still not fully understood or considered (Levin, 2005). For example, under the most recent trends, some large technology companies approach workspace as a commodity to be sold off by employing distributed work models and only providing non-dedicated or communal workplaces in a shared office context. This approach encourages workers to work anywhere, except the office, under the auspices of work-life balance. In some instances, this has proven to be counter-productive, as in the case of Yahoo. Conversely, other organizations promote workspace as a home-away-from-home by providing all the necessary amenities to keep workers at work for as many hours as possible in hopes of promoting innovation and productivity through face-to-face interaction. In a preceding qualitative study on this topic, I found that an underrepresented voice in this workspace strategies dilemma is the individual worker’s preferences.

Human resource analysts in knowledge work organizations regularly assess workers’ job satisfaction and engagement metrics around the organization’s core mission but do not necessarily consider the influence of the physical work environment on these results. This study demonstrates empirically that workers’ perceived satisfaction with the features and attributes of workspace when mediated by emotional factors, such as job satisfaction and engagement greatly influence innovation performance outcomes. The most recent Gallup (2015) statistic on office worker engagement indicates only a 2% increase since the last survey in 2012 (from 30% to 32%) despite the vast investments
corporations have made to improve these results. Workspace matters to workers. Perhaps the question organizational leadership should be asking is *how* and not *how much*?

Two additional conclusions can be derived from these results: (a) worker satisfaction with components of workspace does not have a direct causal relationship with innovator performance; (b) perceived satisfaction with components of workspace does not predict job engagement, only job satisfaction.

I believe that it is accurate to conclude that the physical environment that organizations provide for their workers plays an important role in the emotional and behavioral outcomes of workers on the job. However, the convincing argument to be made to organizational leadership is not that “well designed” workspace delivers “improved” performance, as many design teams claim in their project proposals, but rather to understand the emotional and cognitive factors, which motivate workers to achieve the desired outcome, that are influenced by their workspace and facility. I have demonstrated that perceived satisfaction of workspace components directly and significantly affects workers’ job satisfaction but not engagement. I would suggest that this could be a function of construct measurement rather than construct relationship. It raises the question whether an affective measure of workspace could act as a predictor of cognitive and emotional engagement. However, this would require a shift in emphasis from assessing workspace components to a deeper understanding of the workers.

I would also suggest that a prescriptive or predetermined workspace type based on a priori evidence or archetypal principles under the auspices of “good design” cannot substitute for foundational knowledge derived from the individual worker population of the singular organization. I believe this conclusion to be supported by the fact that the
data for this study was collected from a diverse and random sample of office workers in a self-reported survey. Thus, the specific type or quality of workspace is not known in this analysis, but rather the perception the individual worker has of their workspace that affects the results. This can be considered both a limitation of the study as we cannot exclude workspace quality as a contributing factor in the results; as well as, an indicator that objective design quality is less significant than the perception of the workspace user.

**Limitations and Implications for Future Research**

Multivariate analysis methods present unique limitations in achieving sufficiency of measurement. There are no objective ways of determining if the items selected capture the core meaning of the variables. Although the focus of this study was to ascertain the perceptions of satisfaction of office occupants with the exogenous factors of satisfaction with workspace and satisfaction with facility, I defined the measures using physical and ambient conditions. I believe to have satisfied my intent by phrasing the question to address the satisfaction of respondents and administering the survey to a random sample eliciting self-reported data, which supported my efforts in capturing the individual’s emotional response to their surroundings. However, in order to further contribute to theory development in this area of study, researchers may be well served to select an emotional response scale to the respondent’s internal representations of workspace rather than components of workspace. This would strengthen the findings that the individual’s perception of the holistic physical workspace based on individual work patterns and mental models impacts their job satisfaction and engagement rather than specific characteristics or attributes of workspace deemed to be universally effective.
Conclusions

Organizational leadership should involve their workers in real estate and facilities decision making in order to affect job satisfaction and engagement. Architects and designers must include the individual, as well as, the aggregated needs of workers in their workspace planning and design solutions. Programmatic criteria that are based on standardization and stereotyping of functional groups do not address the perceptions of individual needs of employees. A coordinated partnership with real estate, facility management, human resources, information/communication specialists, as well as, architects, planner, and designers should arise in all knowledge and information work organizations that focus on the individual flourishing of each worker. This may sound like a monumental task given the sheer numbers of workers and the churn rate of any given organization; however, I posit that the information already exists in most organization’s personnel and payroll files, and the survey data collected from workers on a regular basis. The challenge lies in the integration of data and assimilation of decision making on the part of the workspace strategy and design team.
Appendix B1

Table B1.1. EFA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
<th>Factor 6</th>
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Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 7 iterations.
Figure B1.1. Scree Plot

Scree Plot

Eigenvalue

Factor Number
Figure B1.2. CFA
Figure B1.3. SEM Model
Appendix B2

Mediation is tested using Shrout and Bolger (2002) method, which refers to indirect effects as distal mediation. Below are listed the definitions used to categorize the results in accordance with distal mediation, partial mediation and complete mediation.

**Distal Mediation** = $X \rightarrow Y$ is not significant (Total Effect $C=ns$); Indirect Effect ($a \times b$) is significant when mediator is present or $X \rightarrow Y$ under Indirect Effect is significant.

Based on Carlo, Lyytinen, and Rose (2012): $X \rightarrow Y$ (Total Effect $C$) is not significant but Total Indirect Effect ($abc+ef+ec$) is significant.

**Partial Mediation** = $X \rightarrow Y$ is significant and remains significant when the mediator ($c'$) is introduced; ratio $(a \times b/C)<100\%$ indicates only a portion of the effect is explained through the mediator.

Based on Carlo, Lyytinen, and Rose (2012): If $e$, $f$ and $c'$ are significant = partial mediation.

**Complete Mediation** = $X \rightarrow Y$ is significant (Direct Effect=ns); significance is eliminated in the presence of mediator ($c'$) indicates that all the influence of $X \rightarrow Y$ is mediated.

Based on Carlo, Lyytinen, and Rose (2012): If $e$, $f$, and $c'$ is each non-significant = complete mediation.
### Table B2.1. Mediation Analysis

**DIRECT EFFECT**

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<th>Path</th>
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**Hypothesis MEDIATION**

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<tr>
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**COMPLETE MEDIATION**

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<tr>
<td>c X--&gt;Y(T) SatWS--&gt;PerfInno</td>
<td>0.458</td>
<td>0.001</td>
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***P<.001; **P<.05; P<.01; ns=Not Significant; β are unstandardized values
Figure B2.1. Direct Effect Mediation Model

Figure B2.2. H1 Mediation Model

Figure B2.3. H2 Mediation Model
Figure B2.4. H3 Mediation Model

Figure B2.5. H4 Mediation Model
Appendix C: The Experiential Workplace:
The Convergence of Worker-Workplace Identity
(Phase 3 – Quantitative)

Abstract

Does workers’ affective experience of their workplace influence performance in knowledge work organizations? This quantitative study merges constructs from environmental psychology and organizational behavior research to explain the relationship between the perception of the physical office environment and workers’ emotional and behavioral outcomes. This research demonstrates that the workplace experience of workers predicts job satisfaction and job engagement, which mediate workers’ performance as innovators. The findings from this study have the potential to unify the often divergent views of organizational managers and workplace design teams as to the influence of the physical work environment on knowledge workers. In addition, the study informs operations and human resource managers of ways to employ the physical work environment to improve job engagement and job satisfaction in the knowledge workforce. It impresses upon workplace designers the importance of a worker-centered approach in workspace design projects. Finally, the study result conveys to leaders of knowledge work organizations the value that the workers’ perceived experience of their workplace holds in the performance of the workforce and the organization and why investment in the physical work environment can have a substantial return over time.

Keywords: experiential workplace; worker engagement; worker-centered design; workspace vs. workplace
Glossary of Terms

**Space vs. Place:** Space, or one’s physical surroundings, becomes a Place when it is imbued with lived experiences of the individual. “The relationship with one’s physical surroundings is essentially viewed as bound up with concrete experiences” (Lalli, 1992). A place has the ability to affect human relationships, thoughts, and actions (Seamon & Sowers, 2008). In that vein, I am defining an individual’s workspace as the aggregation of perceived attributes of atomistic physical components in the work environment. In contrast, workplace is defined by the infusion of the worker’s lived experiences, which are subjectively meaningful to them, into the holistic experience of the physical surroundings defined here as the Integral Workplace.

**Organization’s Workspace:** An organization’s workspace is the physical environment an organization provides for its workers to carry out their work activities (Davis, Leach, & Clegg, 2011). It constitutes the second largest financial cost for most organizations (after human resources and just ahead of information and communication technology) (McCoy, 2005). Workspace is the context in which the information and knowledge processing activities of an organization are conducted, including filing, planning, designing, supervising, analyzing, deciding, and communicating. Office workspace is developed from the need to plan, coordinate and administer these activities (Kaplan & Aronoff, 1996).

**Knowledge Work:** Knowledge work applies to activities conducted by office workers with formal knowledge involving a process in an office workspace (Drucker, 1993).

**Introduction**

Do workers generate performance outcomes in knowledge work organizations? Most corporate mission statements suggest that workers are the organization’s most valued asset in achieving the organization’s objectives. Can an organization’s physical environment impact worker performance? Designers of built-environments would insist that it can; while managers are likely to say, “How much would it cost?” What might the workers say?

This study suggests that workers’ experience of their physical work environment can affect their emotional states and performance outcomes in knowledge work organizations. The paper is a quantitative study of the explanatory power of the worker perception of their physical workspace on the relationship between their job satisfaction, emotional and cognitive engagement, and their innovator performance. This research
suggests that understanding how an organization’s physical environment affects knowledge workers’ performance outcomes has less to do with the measurable features and attributes of the components of workspace and more to do with the way that the workers experiences the integral workplace that is a unique reflection of their own attitudinal states. Thus, the emphasis of the workspace design problem definition should be grounded in the space users’ experience and not the workspace features.

The theoretical significance of workspace properties relative to human behavior has been well established in environmental psychology literature. The phenomenological approach in the study of environment–behavior research has demonstrated that “people and environment compose an indivisible whole” (Seamon, 2000b: 1). A space becomes a place or a ‘field of care’ when it is imbued with meanings from the person in the space (Tuan, 1977). A sense-of-place is defined in three parts: (1) the physical space; (2) human behavior in the space; and (3) the socio-cultural meanings derived from it (Relph, 1976, 1997). Place attachment is highly significant to self-definitional approaches starting at a very young age and extending throughout the life of the person (Low & Altman, 1992). The psychological and social implications of place identity are embedded in the feelings, attitudes, values, and meanings of a person’s self-identity (Proshansky et al., 1983). Self-identity is not limited to the distinction between self and others but, just as importantly, includes the perceptions of one’s surroundings and the objects found therein (Proshansky et al., 1983). Relph (1976) describes an individual’s interpretation of place in terms of an authentic–inauthentic dichotomy. The authentic experience of place is based in one’s identity with it; an inauthentic experience with place is predetermined, artificial and disassociated from its user.
Theory and research having to do with sense-of-place are primarily focused on the natural environment and are more often studied using a phenomenological paradigm (e.g. Relph, Tuan). Even in using this interpretivist approach, researchers have studied unique components of place and have lost sight of more holistic place concepts. The deterministic approach has generated more concrete results in hypothesis testing but failed to capture the symbolic sense-of-place meanings of the individual (Jorgensen & Stedman, 2001; Shamai, 1991; Stedman, 2002). Research in the built environment has undergone a parallel path. Studies of the built environment are focused on means and methods of delivery or materials and systems performance. The building user is employed as a measurement instrument in the assessment but is seldom the target of the evaluation (Vischer, 2008b). The practitioner-driven notion that the physical environment can change space user behavior guides most research toward methods that measure workspace components. The built environment is thereby deconstructed into atomistic features with each component evaluated on a relative scale and subsequently aggregated into a set of guiding principles for space design. However, humans react to the built environment in response to the meaning that these places have for them (Blumer, 1969). In fact, environmental assessment is based on the overall affective response more so than the analysis of specific details (Rapoport, 1982). It is important to recognize that design professionals and space users respond to physical environments quite differently (Jencks, 1980).

This paper defines the worker’s sense-of-place in a knowledge work organization as the experiential workplace. As a result, this study focuses on the psychological and
social theories that emphasize the perceptions of workers rather than the measurable components of the workspace. The objective of the study is three-fold:

a) To empirically demonstrate the magnitude of influence that the experience of organizational workplace has on workers’ emotional and behavioral responses;

b) To contrast workers’ satisfaction with workspace components with the experience of workplace that is integrally assessed based on workers’ self-identity;

c) To lay the groundwork for the development of a predictive ‘experiential workplace’ scale that takes into account the workers’ self-assessed preferences for a physical work environment based on their unique self- and place-identity interaction.

Theoretical Background

Worker Experience of the Physical Work Environment

The study of workers’ emotional response in organizational research used to be a non-sequitur. The scientific management theory of F. W. Taylor (1911b) not only ignored it but dismissed it as irrational. In current literature, theories in the domains of psychology and organizational studies are highly integrated, with recognition that emotion is a dominant factor in organizations and plays a role in individual, group, and firm performance (Elfenbein, 2007).

Workspace can be perceived as a context for workers’ social and professional activities and relationships. In that vein, the manner in which workers experience their workspace has an impact on how they feel about their work and the organization for which they work (Fischer et al., 2004). Thus, workspace becomes the stimulus that elicits meaning and feelings from the workers toward the work they do. How do workers make judgments about these perceptions that lead to emotional outcomes? Two mechanisms
that have been extensively studied in behavioral psychology are cognitive and affective processing mechanisms, which are considered to be based on qualitatively different attitudes (Brief & Weiss, 2002). Zajonc (1980) states that “affect and cognition are under the control of separate and partially independent systems that can influence each other in a variety of ways, and that both constitute independent sources of effects in information processing” (p. 151).

A common theory-based definition of emotion is that of a response to a stimulus that can manifest in an array of different behaviors (Frijda, 1988). In contrast to emotion, which is reactionary and temporal, mood is more dispositional and lingering (Cropanzano et al., 2003). Affect encompasses both emotion and mood (Forgas, 1995), which together are used to interpret the meaning of stimulus in the environment. Dispositions are predictors of the way that individuals experience a particular affective state (Fleeson, 2001). Dispositions form schemas that individuals use to interpret their environment. Emotional dispositions influence individuals’ predictive reactions to standardized cues. In fact, individuals possessing high positive affect are more likely to influence positive outcomes, while individuals with high negative affect are intent on preventing negative outcomes (Larsen & Ketelaar, 1989). These different dispositions produce different results in the way that workers respond to their physical surroundings.

The affective reaction to workspace is a function of the attitudes of the space user and not just a response to spatial features. Using a semantic differential scale, such as pleasure–displeasure, the space user reaction can be used to determine the affective state of the individual and provides insight into their dispositional traits (Zajonc, 1980). This
data may be used to predict workers’ response to the workplace rather than just assessing the conditions of workspace components after the fact.

In contrast, the most prevalent way in which workspace had been assessed in prior studies is through users’ rational decision-making processes of environmental factors based on pre-existing standards established with a priori experiences (Stokols, 1992). A cognitive process requires that features are identified, examined and compared prior to a judgment being made as to their value and level of perceived satisfaction. In this interpretivist approach, the focus is on the object being examined rather than the disposition of the individual conducting the examination. The intention is to establish an objective value judgment of each component of space rather than differentiating the attitudinal state of the person experiencing the integral workplace.

**Self-identity and the Experiential Workplace**

The deterministic paradigm of space evaluation using the cause–effect approach does not consider the human experience of the overall physical context (Clements-Croome, 2006). This stimulus–response approach is focused on user satisfaction with the components of space (e.g. light, temperature, views, privacy, furnishings, etc.). Little is understood about the interpretive nature of the reporting as the users are undifferentiated relative to their attitudes and dispositions as individual space occupants.

The interpretivist paradigm takes into account the affective response to the integral physical environment through an emotional reaction to the experience of space. However, it still does not differentiate the user as having a unique attitude based on their dispositional traits. The significance of the affective response suggests the importance of understanding the space user’s individual identity. It points to the fact that the
relationship between the individual identity and affective response may be the key to understanding the variations in the emotional and behavioral responses of workers.

An identity is an aggregation of meanings towards the self as a social being behaving in a set context. This set of meanings is applied to the self that defines who one is (Burke & Tully, 1977). Identity Control Theory (ICT) explains the manner in which identities produce behaviors expressing individual dispositions and attitudes (Sheldon Stryker & Burke, 2000). The relationship between identity and behavior lies in the meanings they share (Burke & Reitzes, 1981). The principles of shared meanings are rooted in symbolic interactionism (Blumer, 1969; Mead, 1938a, 1938b). One of the core principles of symbolic interactionism is the individual creation and re-creation of structure. The individual recursively balances the meanings they perceive in the environment and their self-identity meanings in order to maintain a stable structure (Burke, 1991). This approach evaluates the self-relevant meanings perceived in the environment are against the individual’s identity standard through self-verification (Burke & Tully, 1977). This process puts into perspective a common framework that accomplishes two objectives: (1) it gives agency to the individual by defining self-verification induced change as goal-directed behavior; and (2) it introduces emotional response into the process through the individual’s reaction to self-verification outcomes (Smith-Lovin, 1995; Stets & Tsushima, 1999). Affective responses, both emotion and mood, through self-verification, have shown to have an impact on the individual and their behaviors. The emotional response indicates to self and others the individual’s attitudinal state, which is then followed by a behavioral outcome. It is possible for an individual to adapt their identity standards and representative emotional and behavioral outcomes to a
perceived disconfirmation of meaning with their environment; however, this is a very slow process and people are more likely to leave the situation before that occurs. Individuals with lower levels of influence or status are more likely to change their identity standards to match the perceived meanings of the situation than are people with higher levels of power over their environment (Cast et al., 1999).

The relationship between self-identity standard and emotional and behavioral responses can be assessed using the semantic differential measurement indicating the perception of meaning as bipolar responses to stimuli in the environment (Osgood et al., 1957). Burke and Tully (1977) documented that reflexive response, based on self-identity, to self-in-environment, can be reliably measured using semantic differential scales (Sheldon Stryker & Burke, 2000). The way that individuals respond to their integral physical environment based on who they are and how they perceive themselves is a critical measure of their emotional and behavioral outcomes. Given that knowledge workers spend more than a third of their day at work, their affective experience of their workplace is a significant indicator of their relationship with their jobs and the organization.

**Place-identity and the Experiential Workplace**

If one accepts the premise that the definition of self and self-identity is a structure that changes throughout one’s life-cycle, then one has to recognize that it is a response to the changing physical world by which one is surrounded or place-identity (Proshansky et al., 1983). The meanings or interpretations that individuals attribute to their physical surroundings are termed sense-of-place. A sense-of-place is a condition of human existence that is instrumental in defining the self-identity of an individual (Buttimer,
1980; Heidegger, 1962; Norberg-Schulz, 1979; Relph, 1976; Tuan, 1977). As a sub-structure of self-identity, place-identity is a cognition of the physical world in which the individual lives. The theorists most notably associated with the conception of place-identity (Buttimer, 1980; Relph, 1976; Tuan, 1977) defined it as a sense of belonging to a place of significance, namely one’s home, which is imbued with meaning for that individual. They go further by adding the concept of “rootedness” to the definition, as an unselfconscious association with place. Fried (1963) adds to this concept the distinction between cognitive and affective responses in space attachment as fundamental to human functioning. Subsequent research has expanded this person–place relationship definition to include a wide range of physical contexts that change throughout the course of an individual’s life time (Lalli, 1992; Low & Altman, 1992; Proshansky et al., 1983; Seamon, 2000b; Stedman, 2002). The resulting structure of place–identity which consists of a person’s attitudes, values, beliefs, meanings, and behaviors is far more complex than just place attachment. In fact, Stedman (2002) opens the door to quantitative analysis of the role of meanings in attachment and satisfaction with place. He suggests that the experience of place is not an outcome but rather a “predisposing factor” in the relationship between people and environment.

In the context of this workplace research, the distinction is made between place attachment and place satisfaction. Place satisfaction is defined as a multi-dimensional assessment of the perceived quality of a physical space; the ability of physical space to meet basic utilitarian needs. In fact, “it is possible to be satisfied with where one lives and not be particularly attached to the place” (Mesch & Manor, 1998: 509). In phenomenological research, meaning and attachment have been considered important but
undistinguished components of sense-of-place research (Relph, 1976; Tuan, 1975a, 1975b). In social psychology, place attachment is a function of symbolic meaning associated with the affective experience of the physical environment. In both domains of research, the relationship between physical settings and affective states of space users has been sparse and highly varied in theoretical and methodological approaches; thus, little knowledge has been accumulated (Brief & Weiss, 2002). This study introduces an affective measure of the experience of workplace in contrast to the satisfaction of workspace components measure of the physical work environment. The outcome shows a theoretical distinction between the two measures that may explain different aspects of emotional outcomes as differentiated by the users’ cognitive versus affective perceptions grounded in their self-identity.

Conceptual Model and Hypotheses

Workplace as a Predictor of Emotional Response and Behavioral Outcomes

If the physical environment impacts the workers’ cognitive and affective states, then their ability to influence performance is contingent on their emotional response to work. Both psychological constructs, job engagement, and job satisfaction, have been studied in social science as antecedents to job performance outcomes (Harter et al., 2002; Judge et al., 2001). The objective of this study is to extend the prior research reported by Olson (2015) that demonstrated a significant relationship in a chained mediation effect between satisfaction with workspace components, and worker performance when serially mediated by job satisfaction and engagement. The serial mediation effects between the measures of satisfaction with workspace and facility and innovator performance were highly significant and strong. However, the paths between perceived satisfaction with
atomistic components of workspace and facility, and either forms of engagement were non-significant. The mediated effect through job satisfaction almost doubled the explanatory power of emotional engagement as compared to cognitive engagement onto worker performance. The explanation I propose is that the positivist approach to measuring the satisfaction of the components of workspace does not trigger an affective emotional response on the part of the workers but rather the cognitive aspect of job satisfaction, which elicits judgment through the cognitive processing mechanism.

In order to involve the affective process and establish a relationship with engagement, it is necessary to measure the holistic or integral experience of workspace. This integral view of workspace begins to establish the need to understand the workers attitudinal and dispositional traits in order to interpret the meanings given to the workplace. This opens the door to the importance of understanding worker self-identity as a factor in the interpretation of integral workplace meaning. In their study of job engagement, Rich et al. (2010) identified core self-evolution as one of the antecedents to engagement. Core self-evaluation was defined as an individual’s appraisals of self-worth, effectiveness, and capacity (Judge, Locke, & Durham, 1997) and belief in one’s own agency (Judge, Erez, Bono, & Thoreson, 2003). I believe that it is self-identity, as defined in the Identity Control Theory (ICT), which operationalizes the experiential workplace construct as an exogenous variable in the conceptual model. ICT defines identity as a set of meanings applied to the self in a social role that defines who one is (Burke & Tully, 1977) and the meaning they attribute to their environment. This suggests that in order to establish a link between the affective experience of workplace and engagement of workers, it is necessary to understand the way in which the workers see themselves,
which, in turn, impacts their experience of the surroundings and manifests into place-
identity.

The fully saturated conceptual model (Figure C1) includes the exogenous variables of the Olson (2015) study in order to test the comparative effect of the cognitively processed independent variables (perception of workspace and facility) against the added affective construct (integral experience of workplace) on the mediators (job satisfaction, emotional, and cognitive engagement) and dependent variable (innovator performance). The intent of this integrated model is to determine if the integral experience of workplace will establish a significant relationship with emotional and cognitive engagement without the intervening variable of job satisfaction.

**Figure C1. Conceptual Model**

![Diagram showing the conceptual model with boxes labeled: Integral Experience of Workplace, Emotional Engagement, Job Satisfaction, Cognitive Engagement, Worker Performance as Innovator, Satisfaction with Workspace Attributes, Satisfaction with Facility Attributes. Arrows indicate the relationships between these factors with hypothesis labels H1, H2, H3.]

**The Mediating Factors between Workspace Perception and Worker Performance**

Job satisfaction and engagement of workers has been a prominent topic for both practitioners and researchers in the organizational management and behavior domains dating back to the 1930s (Brief & Weiss, 2002; Elfenbein, 2007). Engagement, as a
psychological construct, has numerous definitions. It is presumed to encompass involvement, commitment, passion, enthusiasm, focused effort, and energy representing individual attitudes and behaviors (Macey & Schneider, 2008). The presumption is that the antecedents of these attitudes and behaviors are found in work environments and that the outcomes benefit organizational performance (Erickson, 2005). Kahn (1990) originally defined engagement as the commitment of an individual’s complete self to work-role performance through physical, emotional, and cognitive energies. The implication being that the individual’s perception of their work context, in combination with their individual dispositions, create attitudinal conditions that cause worker engagement in work performance. Given the fact that I am testing the effect of the worker experience with the integral workplace as an affect measuring antecedent to engagement, I posit that it will impact emotional and cognitive engagement differently. Thus, I hypothesize the following:

_Hypothesis 1a._ Perceived experience of workplace mediated by emotional engagement positively affects innovator performance of knowledge workers in the organizational work context.

_Hypothesis 1b._ Perceived experience of workplace mediated by cognitive engagement positively affects innovator performance of knowledge workers in the organization work context.

Similarly, positive emotions are associated with job satisfaction (Staw et al., 1994; Wright & Staw, 1999). In fact, job satisfaction has been argued to be a response to both affective and cognitive processing modes (Brief & Weiss, 2002). The ongoing debate revolves around the issue of categorizing job satisfaction as an evaluative judgment and a result of cognitive processing, or an attitude driven by affective processing. Moorman (1993) found that measures of job satisfaction using affective
versus cognitive scales resulted in the same predictive criteria. In other words, job satisfaction can be interpreted as an evaluative judgment or an emotional response to the affective experience in the work environment. Thus, I posit the following:

**Hypothesis 1c.** Perceived experience of workplace mediated by job satisfaction positively affects innovator performance of knowledge workers in the organizational work context.

**Method**

In this study, I wanted to focus on the experience of office workers in their physical work environment and its effect on their emotional and behavioral response to their jobs. In other words, does the experience of the integral physical work environment affect workers and should it matter to organizations? Using environmental design and psychology literature, I derived my exogenous variables as the measure of workers’ affective experience of themselves in the integral workplace. From organizational behavior and psychology literature, I defined my dependent variable as multiple dimensions of worker performance and the antecedents to performance as job satisfaction and job engagement. These antecedents became the mediating factors between perceived satisfaction with workspace and worker performance. The appropriate way to test these relationships is a quantitative analysis (Creswell, 2008). Thus, I developed a research model and stated my hypotheses to test the mediation effects between the independent and dependent variables.

I based this study on cross-sectional survey data for two reasons. First, I did not want to factor in the type or quality of workspace into this study as this subjective judgment would confound the results. Second, I felt that a diversity of workers across industries generations and workspace occupancies would make the findings more
generalizable. The most effective way to accomplish this was to use panel data. Thus, the unit of analysis is an unidentified knowledge worker participating in a self-administered and self-reported data collection effort.

Sample

The study sample was created from a Qualtrics, online panel data respondent pool of 860 randomly selected office workers from a variety of occupations and organizations who completed the survey over a two-week period in November 2014. A data set was then derived using the following filters: (1) full-time employed; (2) works in an office environment; (3) has a designated workspace; and (4) comes to the office on a regular, weekly basis. The resultant data set was then checked for different types of response bias. For acquiescence bias (Baumgartner & Steenkamp, 2001), I used attention checks at multiple points in the survey, where not answering with the expected attention response ended the survey. To measure social desirability bias, I asked a series of five questions that were unrelated to the study constructs. This would allow us to control for bias in the structural model analysis (Steenkamp et al., 2010). For common scale bias, I used different scale formats and response types in the online survey (Chang, 2010).

Of the 860 total responses, I utilized a final sample of n=408 fully completed surveys, of which half the participants were female; less than 1% worked in the facility less than one year and over 50% more than six years; 40% worked in a private office, 47% in a semi-private partition enclosed workstation and 13% at an open desk. The respondent pool covered five levels of job classification (administrative, clerical, professional, managerial, consulting/contracting) and ten industry sectors.
(finance/banking/insurance, utilities, manufacturing office, technology, research and development, transportation, institutional/public, design, construction, and service).

The randomness of the sample was deliberate as I did not want to affect the validity inferences with the knowledge of the actual layout or quality of the work space the respondents occupied. However, this approach prevented me from being able to assess non-response bias as I could not ascertain the sequence or source of the data collection process (Armstrong & Overton, 1977).

**Construct Operationalization**

In order to test the conceptual model, I adapted previously validated scales from the extant literature. With the exception of the experience of workspace scale, which is a semantic differential type, the selected scales were Likert-type measures on a five-point distribution defined as reflective (Jarvis et al., 2003). Table C1 lists the constructs and their relationships used in the study model.

**Scales Adaption and Refinement**

The survey instrument was developed from a review of relevant literature from both the organizational behavior and the workplace environment domains. I assessed reliability and construct validity using Q-sort (Thomas & Watson, 2002), and Bolton’s (1993) talk aloud method to identify respondents’ cognitive difficulty in the among office worker population. Both exercises resulted in minor scale revisions. First, I updated the terminology of the questions to fit the current definition of workspace types and technological advances in office environments. Second, I adjusted the phrasing of the questions pertaining to the perception of workspace to specifically elicit the individual’s emotional response, where appropriate. I solicited consensus from the test subjects that
each construct was uniquely defined and all the questions were specific to that construct.

The final survey instrument consisted of 41 items covering the constructs described below. The control variable was workspace type (e.g. private office, high panel workstation, low panel workstation, and open desk) given the ongoing discussion in the workplace arena relative to the benefits of open-plan versus enclosed office accommodation of employees (Brennan et al., 2002; Brookes & Kaplan, 1972; Zalesny et al., 1985).

Measures

**Performance (dependent variable).** In order to measure the performance outcomes construct, I used the Role-Based Performance Scale (RBPS) (Welbourne et al., 1998). While most scales measuring performance focus on employee behavior on the job, I wanted to assess performance that meets broader organizational objectives. The RBPS covers five dimensions of performance: job, career, innovator, team, and organization. To provide evidence to organizational leadership of the importance of the relationship between workplace context and performance outcomes, I focus on the innovator dimensions of performance as a metric in a knowledge work context. The respondents were asked to address each item using a 5-point Likert scale ranging from (1) ‘need much improvement’ to (5) ‘excellent’. The alpha reliability for all the dimensions of the scale ranged from 0.76 to 0.90.

**Job satisfaction (mediator).** The job satisfaction scale was adapted from a study conducted on aspects of psychological well-being (Warr et al., 1979). The study assimilated a robust instrument of eight constructs dealing with the quality of work life, job satisfaction being one of the scales. I utilized 14 of the 15 items in the job satisfaction
scale, excluding only the question pertaining to rate of pay as I did not consider the question relevant for the study of randomly selected participants. The remaining items asked about the satisfaction with intrinsic and extrinsic features of the job on a 5-point Likert scale ranging from (1) ‘very dissatisfied’ to (5) ‘very satisfied’. The alpha reliability for the original scale was 0.85.

**Job engagement (mediator).** I used two dimensions of the engagement scale compiled to reflect Kahn’s (1990, 1992) definition of engagement (Rich et al., 2010). The two dimensions were emotional (six items) and cognitive (four items). The original source for the measures of emotional engagement came from Russell and Barett’s (1999) core affect research. The measure is comprised of two dimensions—pleasantness (positive feelings) and activation (sense of energy)—that are associated with respondents’ work roles. The cognitive engagement measure came from Rothbard’s (2001) scale that included attention and absorption. I chose not to utilize the physical engagement scale given that the intent was to compare the positive affect of the emotional measures with the intellectual aspects of the cognitive construct, which focused on levels of attention and absorption on the job. The question pertained to the extent of agreement/disagreement with the items relative to the respondent’s job on a 5-point Likert scale. The alpha reliability of the overall scale was 0.95.

**Perception of satisfaction with workspace and facility - Independent variables also used in the Olson (2015) study.** In reviewing previous studies on the perception of physical office environments on worker reactions I found two distinct approaches: (a) emotion (perceptions of satisfaction) and (b) judgment (qualities, conditions). I selected the 18-item Satisfaction with Environmental Features (SEF) scale as modified by Veitch
et al. (2007), which focused participants on their satisfaction with specific attributes of workspace components. I modified the wording to a general description of ‘workspace’ from a more restrictive definition of ‘office’ or ‘workstation’. In addition, I created two dimensions of workspace definition, namely individual workspace and facility-related items in order to focus the respondent on the contextual aspects of space rather than the physical conditions. The individual items were intended to trigger a perceptual response to noise, distraction, and privacy; while the facility items addressed the ambient triggers related to temperature, ventilation, and lighting. Based on the pre-test, I also slightly modified the wording of questions that appeared to use jargon specific to the workplace design industry. Participants responded on a 5-point Likert scale ranging from (1) ‘extremely dissatisfied’ to (5) ‘extremely satisfied’. The original scale had three dimensions, namely privacy/acoustics, ventilation/temperature, and lighting with reliability scores ranging from 0.76 to 0.88.

**Experience of workplace - independent variable in current study.** The semantic differential originated as a measure of meaning of natural language composed of three dimensions, namely, evaluation, activity, and potency (Osgood et al., 1957; Osgood, 1952). It has been tested in assessing verbal rating of stimuli of concepts, art objects, music, and even human beings. The measure, described by Osgood (1969) as comprised of affective factors, has been extensively used in various domains of psychology. Mehrabian and Russell (1974) applied it to meaning attributed to molar physical environments by renaming the three dimensions:

Evaluation = Pleasure / Activity = Arousal / Potency = Dominance
In testing the dimensions in an empirical study of the molar physical environment (Mehrabian & Russell, 1974), they concluded that the potency/dominance factor was a perceptual/cognitive dimension as it calls for a judgment and, thus, removed it from the scale. In contrast, evaluation/pleasure and activity/arousal reflect the changes in the internal emotional state of the individual. Even though arousal is clearly an affective response, I agreed with Mehrabian and Russell (1974) that it had a potential confounding effect in that it could be a representation of the level of activity in the space rather than the reflection of the individual’s response to the space. Thus, I chose to only use the pleasure–displeasure factor of the scale in the survey instrument to measure the affect, or the emotional expression in language to place, as the emotion-inducing quality that an individual attributes to workplace (Russell & Pratt, 1980).

The pleasure–displeasure dimension also has the strongest reliability score of the three factors in the original scale of 0.91. Pleasure–displeasure consists of six bipolar items. I used a seven-point response range in the survey, asking respondents to state how they feel after spending time in their workspace. I replaced three of the 12 bipolar descriptives with synonyms of the word in order to better relate it to the context of office workers.

**Data Analysis**

The IBM Statistical Package for the Social Sciences (SPSS, v. 23) was used to perform data screening and ensure a clean data set prior to analysis. Several statistical techniques were used to ensure validity, reliability, and adequacy of the data and to create appropriate model specification prior to testing the hypotheses. First, the final, complete data set (n=408) was screened for statistical assumptions including outliers, normality,
linearity, and multicollinearity (Mertler & Vannatta, 2005). The EFA was run to check the extent to which the indicators meet the a priori expectations of factorability. The pattern matrix gave us an initial assessment of the convergent and discriminant validity of anticipated factors and their scale reliability. I used AMOS (Analysis of Moment Structures) software to conduct a confirmatory factor analysis (CFA) to evaluate the quality of the measurement model. Using the final pattern matrix developed during EFA, I tested the reflective measurement model for variance, reliability, convergent and discriminant validity, common method bias, and model fit. Finally, I created a structural equation model (SEM), reflective of the initial conceptual model, using the composite factors. I tested the hypotheses using multiple methods of mediation testing including the Baron and Kenny (1986) method, indirect mediation using bootstrapping method, and the Sobel test (Preacher & Hayes, 2004).

Due to the fact that the final data was extracted from a much larger set of panel data, I was able to screen out all surveys with incomplete responses. I eliminated any unengaged responses by checking for standard deviation scores of less than 0.5. A social desirability scale was included in the survey instrument to check for response bias. The dataset was screened using univariate assumptions. The test for kurtoses revealed no issues as all the items were well within the range (-1 to +1). With the exception of the experience of space variable, which used a 7-point semantic differential scale, all other factors were measured using a 5-point Likert scale. Thus, I did not see it necessary to test for skewness of data.
Exploratory Factor Analysis

An exploratory factor analysis (EFA) was conducted in order to determine how well the survey instrument measured the contracts in the conceptual model. I used Promax rotation and Maximum Likelihood to extract the seven factors plus social desirability. The Kaiser-Meyer-Olkin (KMP) measure of sampling adequacy (KMP=.95) and the Barlett’s test of sphericity (approximate $\chi^2=14145.495$, df=703, $p<0.001$) show suitability of the data for structure detection. The significant p-value was expected due to the large data sample, n=408. The communalities of the study constructs were 0.5 or higher indicating that all items adequately correlate with all other items and should load on a factor. The five social desirability items had low communalities, which was to be expected, but did all load together onto one factor. The eight-factor structure explained 70.62% of variance extracted with the first factor explaining the most variance at 41.85%. The number of factors was confirmed by examining the scree plot. Upon completion of the EFA, the seven-factor structure representing the conceptual model consisted of 41 total items plus 5 items measuring the social desirability factor. Due to both low-and cross-loading, several items associated with the satisfaction with workspace and facility constructs as well as job satisfaction construct were sequentially deleted from the analysis until an acceptable model emerged where each item reliably measured their intended construct. All items were adequately correlated with causality flowing from construct to measure; thus, I could conclude that the constructs are, in fact, reflective (MacKenzie, 2005).

The Social Desirability scale (Hays et al., 1989) was added to the survey instrument for potential bias due to the fact that the data collection effort was solely
based on a self-reported survey. The scale consisted of five items that were unrelated to the core constructs in the conceptual model. The items converged on a single factor during EFA and only explained 1.9% of the total variance.

Convergent validity of the items was achieved as the combined loadings on their respective factors were above 0.7 (Straub, Boudreau, & Gefen, 2004). All items were significant with a factor loading greater than 0.5 (Hair et al., 2010). Discriminant validity was evident as no cross-loadings were above 0.2. In addition, correlations between the factors were all below 0.7. Reliability was examined using Cronbach’s alpha for each factor (Cronbach, 1951; Fornell & Larcker, 1981). The results were greater than the recommended level of 0.70 (Nunnally, 1978). Correlations between the factors and Cronbach’s alpha are shown in Table 1.

Table C1. Means, Standard Deviations, Correlations and Reliability

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>MEAN</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Job Satisfaction</td>
<td>3.6369</td>
<td>.88828</td>
<td><strong>0.917</strong> *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Emotional Engagement</td>
<td>3.8468</td>
<td>.85818</td>
<td>.657</td>
<td><strong>.954</strong> *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Cognitive Engagement</td>
<td>4.0137</td>
<td>.80614</td>
<td>.661</td>
<td>.666</td>
<td><strong>0.939</strong> *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Performance - Innovator</td>
<td>3.5132</td>
<td>.74680</td>
<td>.512</td>
<td>.527</td>
<td>.580</td>
<td><strong>.930</strong> *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Experience of Workplace</td>
<td>4.8286</td>
<td>1.42813</td>
<td>.482</td>
<td>.519</td>
<td>.683</td>
<td>.535</td>
<td><strong>.971</strong> *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Satisfaction - Workspace</td>
<td>3.4190</td>
<td>.76234</td>
<td>.128</td>
<td>.088</td>
<td>.201</td>
<td>.180</td>
<td>.248</td>
<td>.126</td>
<td><strong>.830</strong> *</td>
<td></td>
</tr>
<tr>
<td>8. Social Desirability</td>
<td>2.4719</td>
<td>.66312</td>
<td>.435</td>
<td>.375</td>
<td>.322</td>
<td>.287</td>
<td>.292</td>
<td>.543</td>
<td>.075</td>
<td><strong>.760</strong> *</td>
</tr>
</tbody>
</table>

*Cronbach's Alpha on diagonal

Measurement Model (CFA)

A confirmatory factor analysis (CFA) was conducted in order to evaluate the correspondence between the theoretical model and the data (Hair et al., 2010: 671) in terms of model fit, validity, reliability, invariance, and common method bias. I created a measurement model by using each construct and its associated items identified in the final EFA. The model was further refined through appropriate covariance relationships using modification indices (Byrne & Ragin, 2009). The psychometric properties of the
seven latent constructs were evaluated simultaneously in one confirmatory factor analysis. The overall fit for the model was good (CMIN=966.432; df=595; CMIN/df = 1.62, RMSR = 0.054, TLI =0.970, CFI = 0.973, GFI = 0.887, RMSEA = 0.039, PCLOSE = 1.0).

Fornell and Larcker (1981) identify three procedures to assess convergent validity. These include item reliability of each measure, composite reliability of each construct, and the average variance extracted. Hair et al. (2006) suggest that an item is significant if its factor loading is greater than 0.50. As shown in Table C2, the factor loadings of all the items in the measures being studied range from 0.56 to 0.97, thus meeting the threshold set by Hair et al. and demonstrating convergent validity at the item level. At the construct level, Hair et al. (2010) recommends that the composite reliability (CR) should be used in conjunction with SEM to address the tendency of the Cronbach’s alpha to understate reliability. For CR to be adequate, a value of 0.70 and higher is recommended (Nunnally & Bernstein, 1994). The CR values for all of the study constructs exceed this recommendation. The final indicator of convergent validity is the average variance extracted (AVE), which measures the amount of variance captured by the construct in relation to the amount of variance attributable to measurement error (Fornell & Larcker, 1981). Convergent validity is judged to be adequate when AVE equals or is greater than 0.50. As shown in Table C3, the convergent validity for the proposed constructs of this study is adequate.
### Table C2. Results of the CFA

<table>
<thead>
<tr>
<th>Constructs and Items</th>
<th>Unstandardized Estimates</th>
<th>Standard Estimate</th>
<th>S.E.</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE-INNOVATOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERFINO1 1.12</td>
<td>Come up with new ideas</td>
<td>1.12</td>
<td>0.889</td>
<td>0.056</td>
<td>0.056</td>
</tr>
<tr>
<td>PERFINO2 1.082</td>
<td>Work to implement new ideas</td>
<td>1.082</td>
<td>0.938</td>
<td>0.038</td>
<td>0.038</td>
</tr>
<tr>
<td>PERFINO3 0.976</td>
<td>Find improved ways to do things</td>
<td>0.976</td>
<td>0.851</td>
<td>0.041</td>
<td>0.041</td>
</tr>
<tr>
<td>PERFINO4 0.893</td>
<td>Create better processes and routines</td>
<td>0.893</td>
<td>0.776</td>
<td>0.045</td>
<td>0.045</td>
</tr>
<tr>
<td>COGNITIVE ENGAGEMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COGENG1 1.054</td>
<td>My mind is focused on my job</td>
<td>1.054</td>
<td>0.896</td>
<td>0.036</td>
<td>0.036</td>
</tr>
<tr>
<td>COGENG2 0.948</td>
<td>I pay a lot of attention to my job</td>
<td>0.948</td>
<td>0.918</td>
<td>0.033</td>
<td>0.033</td>
</tr>
<tr>
<td>COGENG3 0.978</td>
<td>I am absorbed by my job</td>
<td>0.978</td>
<td>0.857</td>
<td>0.039</td>
<td>0.039</td>
</tr>
<tr>
<td>COGENG4 0.948</td>
<td>I concentrate on my job</td>
<td>0.948</td>
<td>0.902</td>
<td>0.034</td>
<td>0.034</td>
</tr>
<tr>
<td>EMOTIONAL ENGAGEMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMOENG1 0.948</td>
<td>I am enthusiastic in my job</td>
<td>0.948</td>
<td>0.906</td>
<td>0.032</td>
<td>0.032</td>
</tr>
<tr>
<td>EMOENG2 1.044</td>
<td>I feel energetic in my job</td>
<td>1.044</td>
<td>0.89</td>
<td>0.037</td>
<td>0.037</td>
</tr>
<tr>
<td>EMOENG3 0.865</td>
<td>I am interested in my job</td>
<td>0.865</td>
<td>0.856</td>
<td>0.034</td>
<td>0.034</td>
</tr>
<tr>
<td>EMOENG4 0.831</td>
<td>I am proud of my job</td>
<td>0.831</td>
<td>0.829</td>
<td>0.035</td>
<td>0.035</td>
</tr>
<tr>
<td>EMOENG5 0.933</td>
<td>I am positive a out my job</td>
<td>0.933</td>
<td>0.867</td>
<td>0.035</td>
<td>0.035</td>
</tr>
<tr>
<td>EMOENG6 1.055</td>
<td>I am excited bout my job</td>
<td>1.055</td>
<td>0.91</td>
<td>0.035</td>
<td>0.035</td>
</tr>
<tr>
<td>JOB SATISFACTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOBSAT4 0.996</td>
<td>Recognition from good work</td>
<td>0.996</td>
<td>0.855</td>
<td>0.044</td>
<td>0.044</td>
</tr>
<tr>
<td>JOBSAT5 0.824</td>
<td>Immediate boss</td>
<td>0.824</td>
<td>0.751</td>
<td>0.048</td>
<td>0.048</td>
</tr>
<tr>
<td>JOBSAT8 0.894</td>
<td>Relationship between mgmt. &amp; employees</td>
<td>0.894</td>
<td>0.789</td>
<td>0.046</td>
<td>0.046</td>
</tr>
<tr>
<td>JOBSAT9 0.901</td>
<td>Chance of promotion</td>
<td>0.901</td>
<td>0.749</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>JOBSAT10 0.956</td>
<td>Way your department is organized</td>
<td>0.956</td>
<td>0.843</td>
<td>0.044</td>
<td>0.044</td>
</tr>
<tr>
<td>JOBSAT11 1.004</td>
<td>Attentions to suggestions you make</td>
<td>1.004</td>
<td>0.869</td>
<td>0.044</td>
<td>0.044</td>
</tr>
<tr>
<td>INTEGRAL EXPERIENCE -WORKPLACE (Semantic Differential)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPWP1 1.113</td>
<td>Annoyed&lt;---&gt;Please</td>
<td>1.113</td>
<td>0.912</td>
<td>0.038</td>
<td>0.038</td>
</tr>
<tr>
<td>EXPWP2 1.056</td>
<td>Dissatisfied&lt;---&gt;Satisfied</td>
<td>1.056</td>
<td>0.924</td>
<td>0.024</td>
<td>0.024</td>
</tr>
<tr>
<td>EXPWP3 1.028</td>
<td>Unhappy&lt;---&gt;Happy</td>
<td>1.028</td>
<td>0.957</td>
<td>0.029</td>
<td>0.029</td>
</tr>
<tr>
<td>EXPWP4 0.97</td>
<td>Tense&lt;---&gt;Relaxed</td>
<td>0.97</td>
<td>0.892</td>
<td>0.033</td>
<td>0.033</td>
</tr>
<tr>
<td>EXPWP5 1.033</td>
<td>Frustrated&lt;---&gt;Contented</td>
<td>1.033</td>
<td>0.915</td>
<td>0.033</td>
<td>0.033</td>
</tr>
<tr>
<td>EXPWP6 0.899</td>
<td>Depressed&lt;---&gt;Hopeful</td>
<td>0.899</td>
<td>0.892</td>
<td>0.031</td>
<td>0.031</td>
</tr>
<tr>
<td>SATISFACTION -FACILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SATFAC8 1.118</td>
<td>Quality of light</td>
<td>1.118</td>
<td>0.802</td>
<td>0.077</td>
<td>0.077</td>
</tr>
<tr>
<td>SATWS7 1.006</td>
<td>Amount of light for computer work</td>
<td>1.006</td>
<td>0.827</td>
<td>0.064</td>
<td>0.064</td>
</tr>
<tr>
<td>SATWS8 0.895</td>
<td>Reflected light or glare</td>
<td>0.895</td>
<td>0.735</td>
<td>0.062</td>
<td>0.062</td>
</tr>
<tr>
<td>SATISFACTION -WORKSPACE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SATFAC2 0.97</td>
<td>Degree of enclosure</td>
<td>0.97</td>
<td>0.774</td>
<td>0.063</td>
<td>0.063</td>
</tr>
<tr>
<td>SATFAC3 1.035</td>
<td>Distance between workspaces</td>
<td>1.035</td>
<td>0.856</td>
<td>0.058</td>
<td>0.058</td>
</tr>
<tr>
<td>SATFAC4 1.034</td>
<td>Size of individual workspace</td>
<td>1.034</td>
<td>0.83</td>
<td>0.058</td>
<td>0.058</td>
</tr>
<tr>
<td>SATFAC5 1.031</td>
<td>Ability to alter physical condition</td>
<td>1.031</td>
<td>0.761</td>
<td>0.067</td>
<td>0.067</td>
</tr>
</tbody>
</table>

Model fit statistics: \( \chi^2=966.432 (df=959) \)

- CMIN/df = 1.62; CFI = 0.973; TLI = 0.970;
- GFI = 0.886; RMSEA = 0.039; PCLOSE = 1.00
The analysis assessed discriminant validity using AVE and inter-factor correlations in combination. Discriminant validity is established if the AVE is larger than the common variances (Chin, 1998; Götz, Liehr-Gobbers, & Krafft, 2010). Table C2 indicates the square root of AVE on the diagonal for each construct to be greater than the correlations among the constructs shown in the off-diagonal values of the matrix. The results demonstrated adequate discriminate and convergent validity, as shown in Table C3.

### Table C3. Discriminant and Convergent Validity during CFA

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>CR</th>
<th>AVE</th>
<th>MSV</th>
<th>ASV</th>
<th>SocDes</th>
<th>ExperWS</th>
<th>JobSat</th>
<th>EmoEng</th>
<th>PerfIno</th>
<th>CogEng</th>
<th>SarWS</th>
<th>SatFac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Desirability</td>
<td>0.593</td>
<td>0.440</td>
<td>0.123</td>
<td>0.068</td>
<td>0.663</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience of Workplace</td>
<td>0.882</td>
<td>0.555</td>
<td>0.404</td>
<td>0.218</td>
<td>0.745</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>0.844</td>
<td>0.476</td>
<td>0.386</td>
<td>0.187</td>
<td>0.200</td>
<td>0.551</td>
<td>0.690</td>
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<td>Emotional Engagement</td>
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<td>0.583</td>
<td>0.429</td>
<td>0.244</td>
<td>0.302</td>
<td>0.607</td>
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<td>0.764</td>
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<td>0.799</td>
<td>0.502</td>
<td>0.216</td>
<td>0.111</td>
<td>0.287</td>
<td>0.351</td>
<td>0.465</td>
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<td>Cognitive Engagement</td>
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<td>0.655</td>
<td>0.428</td>
<td>0.164</td>
<td>0.351</td>
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<td>0.419</td>
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<td>Satisfaction Workspace</td>
<td>0.813</td>
<td>0.524</td>
<td>0.404</td>
<td>0.166</td>
<td>0.136</td>
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<td>Satisfaction Facility</td>
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<td>0.589</td>
<td>0.294</td>
<td>0.112</td>
<td>0.099</td>
<td>0.414</td>
<td>0.343</td>
<td>0.295</td>
<td>0.207</td>
<td>0.248</td>
<td>0.542</td>
<td>0.768</td>
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The data collection method used for the study (i.e. mono-method, single source, survey-based, self-reporting) raised the possibility of common method bias (CMB) (Podsakoff et al., 2003). In order to evaluate this possibility, I first conducted the Harman’s single factor test to ensure that a single factor did not explain the majority of the variance. The results indicated less than 50% (41.85% on factor 1) of variance explained on a single factor indicating no evidence of CMB. I next took the multi-method approach to testing for CMB (Doty & Glick, 1998; Podsakoff et al., 2003) by adding an unmeasured Common Latent Factor (CLF). I compared the standardized regression weights before and after adding the CLF to the CFA model and calculated the difference. None of the deltas were above the limit (>.20). Thus, I concluded that no method bias
was present. Composite variables were created using regression imputation without the CMB adjusted latent factor.

Multivariate data screening assumptions were completed prior to creating the structural model. An analysis of multicollinearity between the three exogenous variables and the three mediating variables exhibited tolerance and VIF values within acceptable limits (tolerances greater than 0.5 and VIF less than 3.0). I concluded that the statistical standards were sufficiently met for structural equation modeling (Hair et al., 2010).

**Structural Equation Model**

Structural equation modeling (SEM) was used for hypotheses testing given that *a priori* hypotheses have been directly specified for estimation. The hypothesized relationships identified in the conceptual model were tested using the structural model with the results shown in Figure C2. Best fit was achieved prior to testing for mediation. In order to obtain model fit and test for mediation effects, three conditions had to exist in the relationships of the variables: (a) direct effects between the independent and dependent variables were non-significant. This was shown to be the true in the earlier study between the two satisfaction with components variables and the performance variable. In addition, the theoretical assumption of the study is that the effect of workspace on performance had to be mediated through an emotional state. Thus, the hypothesized relationships are assumed to be fully mediated; (b) the serial mediating effect of job satisfaction and both types of engagement still needed to exist in the overall model structure. In the prior study, this chained effect was necessary in order to establish a relationship between workspace and performance as the paths between satisfaction with workspace components and engagement were non-significant. In the current model, the
paths between affective perception of the integral workplace and engagement are significant; nevertheless, the paths from job satisfaction to engagement are still necessary to achieve model fit; and (c) the error terms of emotional and cognitive engagement had to be co-varied as the two constructs both measure the common trait of job engagement. The model fit statistics are as follows: CMIN=2.720; df=3; CMIN/df=0.907; RMSR=0.008; TLI=1.00; CFI=1.00; RMSEA=0.00; PCLOSE=0.766. All the direct paths of focus in this study reached statistical significance at p=<.05 level.

**Figure C2. Structural Model**

The mediation hypotheses were tested using the Baron and Kenny (1986) step-wise approach of assessing the direct effect with and without the mediator. The results were confirmed by obtaining the two-tailed significance values of the indirect effects using both bootstrapping at 2,000 samples and 95% bias-corrected confidence interval method as well as the Sobel test (Preacher & Hayes, 2004).
Results and Findings

This study contributes to the conversation between organizational management and the design community concerning the effects of an organization’s physical workspace on the emotional and behavioral outcomes of knowledge workers. Worker perception of workspace has been historically evaluated using the satisfaction with atomistic components of space on job satisfaction. The purpose of this study is to show that the worker’s perception of the integral or holistic workspace impacts their job engagement. Olson’s (2015) study showed a strong relationship between the perceived satisfaction of workspace and worker performance or worker as innovator ($r^2=47\%$) as suggested by the mediation effect through job satisfaction as well as a chained effect through job satisfaction and then engagement. As a result, the path from satisfaction with workspace components and worker engagement was non-significant. Given the challenges that managers experience in achieving worker engagement in knowledge work organizations, I wanted to empirically test the workers’ affective experience of their physical work environment had an impact on performance through engagement. Thus, I hypothesized that the experience of the integral workplace would be fully mediated by not only job satisfaction but also emotional and cognitive engagement in the relationship with worker performance outcomes. All three of the hypotheses were supported, as shown in Table C4.
Another important finding of this study shown in the structural model (Figure C2) is that the workers’ experience of the integral workplace minimizes the influence of the other predictors on the outcome. Once the experiential workplace construct was introduced into the structural model, the relationship between the satisfaction with components of workspace and the mediators became non-significant or very weak. In other words, all the explanatory power of the influence of physical context is shifted to the worker affective perception of the integral workplace (ExpWp $\rightarrow$ EmoEng $\beta=0.49$, $p=.001$; ExpWp $\rightarrow$ JobSat $\beta=0.66$, $p=.001$; ExpWp $\rightarrow$ CogEng $\beta=0.17$, $p=.017$). Although the influence on worker performance as innovator change minimally from the earlier model ($r^2=45\%$), the ability of workers’ affective experience of the integral workplace to influence worker performance through primarily emotional engagement is an important finding for both management and workplace design. It supports my proposition that the affective processing of the experience that workers have with the physical work context is highly influential in their emotional response to their job in the form of engagement and satisfaction, and it impacts their behavioral outcomes relative to performance; in this case, their ability and interest to innovate.
Discussion

The results show, through empirical data analysis, that knowledge workers’ affective experience of their workplace is a dominant influence on their emotional and cognitive job engagement, as well as, their job satisfaction. This is a significant finding in suggesting a causal relationship between the physical context of an organization and the performance of its workers, in this case, their willingness to think innovatively. These results present a convincing argument to organizational management, who seek to engage their workforce and optimize performance, that workplace matters. At the very least, it is another tool in the tool box of leadership in knowledge work organizations looking to engage workers and improve worker performance.

Intuitively and heuristically, architects and designers of physical work environments have long known the value and importance of workplace design in affecting worker behavior; however, there has been little evidence to prove it. While the design community insists that workplace is an active enabler (or deterrent) in doing office work, organizational management has focused primarily on utilization efficiency and cost control (Vischer, 2007c). Research in workplace design has been predominantly concerned with user satisfaction of workspace components. While this is important data for designers and planners, it has had serious limitations in advancing this area of study and practice for three reasons:

1. Target-specific research, such as case studies, which is prominent in this area of study, is not often generalizable to other locations, populations or building types (i.e. just because it works for Google does not mean it works for IBM).

2. Assessment of user responses to atomistic components of space (ambient or physical) does not readily aggregate into a holistic set of design principles.
3. Research has targeted various aspects of physical space—its features, delivery methods, and materials—but not the perception and experience of space users, who remain undifferentiated and largely excluded from the problem definition and design solution efforts.

This research has demonstrated that in order to engage the worker, it is necessary to understand the meaning they attach to the workplace they occupy. The prior study (Olson, 2015), showed that it is certainly possible to impact worker performance by isolating the cognitive assessment of workspace features and attributes mediated by job satisfaction. However, once the workers’ affective experience of the integral workplace is introduced, it not only shown to predict job engagement but the explanatory influence of satisfaction with workspace components is dramatically minimized. This supports my claim that the significance of workspace influence on worker job engagement, job satisfaction and performance outcomes resides with the workers’ personal experience of their integral workplace.

The challenge, of course, is how to associate the worker’s unique self-identity, defined here as “…conscious, personally held beliefs, interpretations and evaluation of oneself…relative to the social and physical settings” (Proshansky et al., 1983: 58), and their workplace experience. First, it is important to understand that the physical work environment is not about materials and systems, cubes, and offices; it is about a work environment that carefully balances space, technology, resources, and protocols to support the nature of work (Rice & Mitchell-Ketzes, 2003). Second, the worker needs to be considered as an individual with unique set of experiences and behaviors across situations and in a variety of settings, namely the self. A substructure of the self is the
concept of self-identity, which is a dynamic state responsive to the social and physical conditions of the surroundings (Marris, 1974; Proshansky et al., 1983).

Given that this research shines a light on the importance of the workers’ relationship to the organizations’ physical environment or the workplace, in order to explain the worker self-identity role, I need to take the self-identity concept one step further into place-identity. Consistent with symbolic interactionism theory, identities can be represented as meanings one attributes to oneself (Burke, 1980). Place-identity is meanings, conceptions, and experiences an individual attributes to the world in which he/she exists, both present and past. Identities are prioritized based on the value and importance the individual places on them (Stryker, 1980). If the place holds a high value and is critical to one’s self-identity, a place–person convergence may occur, where the place-identity becomes part of the concept of the individual self-identity definition. A worker spends at least one-third of their daily hours in a work environment. A positive experience with that physical environment can generate a positive emotional and behavioral outcome that transcends satisfaction with features of workspace.

The results of my study lead me to believe that the affective experience of the workplace on the part of the worker that predicts job engagement is at the convergence of the worker–workplace identity. Thus, in order to create this phenomenon, it is essential that one understands the identity of the workers and not only their affective response to the physical environment. How does this construction of worker–workplace relationship manifest itself and what are the relational and attitudinal antecedents found in the individual worker’s self-identity that connects them with the place? It is my hope that this is the beginning of a research stream that will influence the next paradigm in design
methodology of design thinking in all domains of social science that deals with the human factor.

**Implications for Research and Practice**

The research presented in this paper begins to examine a paradigm shift in the approach to workplace design from a design–requirements–optimization perspective to a worker–experience-centered perspective. In order to explain the effect of integral workplace on emotional and behavioral states of workers, it is necessary to transform the workers’ self- and place-identities into a nominal scale of work manifestations (work styles) and workspace preferences (space types) to which he/she responds or desires, in a predictive assessment. I believe that the key concepts that need to be defined can be found in the attitudinal (self-identity) and relational (place-identity) spectrums of the experience the workers have of themselves in their workplace. I propose that in a work environment, the attitudinal work styles spectrum would range from individual (alone work) to social (group work); while the relational space preferences would span between personal (dedicated space) and communal (shared space). The Experiential Model in Figure C3 illustrates these relationships and suggests spatial implications that can be translated into workspace design criteria. I propose, as the next step in this research stream, that it is necessary to develop a new set of scales that define and measure these dimensions into a second order construct that conceptualizes the experiential workplace.
There are several limitations to the research presented here that deserve mentioning. First, the data is cross-sectional; thus, it does not take into account the range of attitudinal and dispositional variations that an individual worker would undergo over the course of a work day, week or month. Second, the data was obtained from a third-party panel. This could present an external validity problem in that I cannot determine or verify the source and composition of the sample. In addition, the population was limited to only workers in office environments. This could raise questions of generalizability to knowledge workers who do not work in office work environments. However, it also adds to the internal validity of data as the population is completely randomized and not tied to a specific type or quality of workspace. Third, the performance construct is measured
only with self-reported data. This leaves doubt as to the strength of the results relative to performance outcome. However, this is a secondary focus of my research, with the primary focus resting with the antecedent effects on the relationship between emotional and behavioral outcomes. Fourth, the semi-exploratory approach to the studies leaves open the possibility that other factors may be contributing to the stated outcomes, which are not being considered here.

**Conclusion**

Physical context is not a recognized artifact in work environments until it becomes a point of contention (Proshansky et al., 1983). The recognition arises when the workspace in which we find ourselves does not meet our expectations based on our own interpretation of need. Once we become aware of the situation, we either adjust our expectations through rationalization or we reject the condition by finding an alternative workplace or become ineffective in the work we do. Understanding the mental model and affective state of the worker not only affords the workplace design team the ability to develop a more successful work environment, but it also aids the management in identifying the motivations that workers needs in their job performance.

The study of the physical work environment has been predominantly focused on artifacts and processes, or put in practitioner terms, materials, and methods. The space user is often considered a factor in this effort but seldom the central focus. I posit that it should become all about the worker.
REFERENCES


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