Theses and Dissertations

12-1-2017

Architecture of Social Learning and Knowing: Using Social Learning and Knowing Perspectives and Design Thinking to Frame and Create Change in a Workplace Redesign Project

Amin Mojtahedi
University of Wisconsin-Milwaukee

Follow this and additional works at: https://dc.uwm.edu/etd

 Part of the Architecture Commons, and the Social and Behavioral Sciences Commons

Recommended Citation

Mojtahedi, Amin, "Architecture of Social Learning and Knowing: Using Social Learning and Knowing Perspectives and Design Thinking to Frame and Create Change in a Workplace Redesign Project" (2017). *Theses and Dissertations*. 1672.
https://dc.uwm.edu/etd/1672

`

ARCHITECTURE OF SOCIAL LEARNING AND KNOWING: USING SOCIAL LEARNING AND KNOWING PERSPECTIVES AND DESIGN THINKING TO FRAME AND CREATE CHANGE IN A WORKPLACE REDESIGN PROJECT

by

Amin Mojtahedi

A Dissertation Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

in Architecture

at

The University of Wisconsin – Milwaukee

December 2017

ProQuest Number: 10686972

ProQuest 10686972

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

`

ABSTRACT

ARCHITECTURE OF SOCIAL LEARNING AND KNOWING: USING SOCIAL LEARNING AND KNOWING PERSPECTIVES AND DESIGN THINKING TO FRAME AND CREATE CHANGE IN A WORKPLACE REDESIGN PROJECT

by

Amin Mojtahedi

The University of Wisconsin-Milwaukee, 2017
Under the Supervision of Professor Brian Schermer

There is a consensus among many theorists and practitioners from the fields of architecture, learning, and organizations that the ability to orchestrate learning and knowledge practices in the workplace creates potential for new and valuable ideas to emerge. However, due to the changing nature of the learning and knowing landscape in the knowledge economy, the role of the physical space pertaining to learning and knowing practices needs to be reexamined. To do so, and to make theories of learning and knowledge relevant to the physical space, this research study (1) uses a strand of theories and perspectives emerged in the past 30 years that frames learning and knowing as social and situated processes as opposed to strictly cognitive functions; and (2) complements the aforementioned theories and perspectives with architects' and environmental design researchers' normative views and empirical findings about the physicality of places that are supportive of learning and knowing practices. This theoretical and practical plug-and-play between the two realms of knowledge resulted in the dissertation's research question: Can we impact boundary mechanisms, as practices or artifacts that can be the source of continuity across various social unites in an organization, through 'physical space' and the process of 'making the physical space'?

`

To address the research question, this dissertation proposes 'architecture of social learning and knowing' as a trinary solution comprised of (1) design thinking methodology as a form of action research, rooted in the neo-pragmatic philosophy, for cultivating sustainable change in an organization's learning and knowledge practices or producing new ones from scratch; (2) a toolset that combines people-space analytics, ethnographic research methods, and ethnographic thick description to not only map and record the change in users' work practices, but also encourage their engagement as a way of generating insights; and (3) a theoretical lens inspired by social theories of learning and knowing for framing and understanding the change in the organization.

This study was conducted in the Milwaukee office of a national architecture firm where the redesign of the workplace was framed as an opportunity to rethink the way work happens. A total of 63 people participated in different phases of a design thinking process to re-imagine their workplace of the future. During the earlier phases of the process, a series of empathy-building exercises and workshops were conducted to generate insights for participatory ideation. After studying the options generated during ideation, a full-scale prototype or mock-up of the new workplace was designed and built in an area as large as 8000 sqf inside the office. Using a combination of sensor-network technology and location tracking, participants' social networks and spatial behavior were mapped before and after installing the mock-up to study the potential change in the quantity and quality of the organization's boundary mechanisms. Results from the mapping study showed a significant increase in the employees' brokering behavior and space utilization as well as change in certain groups of users' spatial behavior after installing the mock-up. These results were then shared and discussed with a smaller group of participants to make sense of the changes captured during the mapping study. Eventually, the thick description

`

revealed the emergence of four types of peripheral participation as different forms of boundary mechanisms. The first set of findings showed that workplace redesign project had had an impact on participants' types of interactions and not the quantity of their interactions. In other words, after installing the mock-up, the quantity of interactions did not increase, yet more people manifested brokering behavior. The second set of findings indicated that in cultivating new learning and knowledge practices, the impact of making-process preceded the impact of product. The study showed that some new learning and knowing practices were often negotiated and created during the participatory and emancipatory process of 'making' the physical space. It was during this phase that users were empowered to challenge existing practices and were equipped to imagine different ways of conducing work. Consequently, on the methodological level, design thinking was discussed as a refined version of action research with a focus on the neo-pragmatic human inquiry and producing new systems from scratch.

Finally, in addition to the framing of the architecture of social learning and knowing, this research advances the social theories of learning and knowing by introducing new constructs, expands the action research method by incorporating the element of design into its framing, and contributes to the literature on the planning and design of work environments by introducing a shift from network view to community view in understanding workplace important outcomes.

`

`

To

My beloved Mom and Dad, Heshmat and Hamid

My life and intellectual partner, my best friend and wife, Tahereh

My siblings, Saba, Mohammad Reza, Faraz, Ann Mary, and Chris

`

TABLE OF CONTENTS

`

LIST OF FIGURES

`

CHAPTER 5

`

LIST OF TABLES

`

ACKNOWLEDGEMENTS

`

1. Introduction

There is a consensus among many organizational theorists that knowledge and learning are valuable assets through which organizations can gain a competitive advantage (Davenport & Prusak, 1998; Nonaka & Takeuchi, 1995; Pfeffer & Sutton, 1999, Wenger, 2016; Cardona, Lugo & Gonzalez, 2012). For many organizations, and from a knowledge-based view, the ability of orchestrating learning and knowing practices within and among various social units is considered an important goal because it creates potential for new ideas, and consequently new products and services to emerge[1]. Furthermore, making changes in the physicality of a workplace could be an opportunity for the organization to be proactive about learning and knowledge strategies that can help gain that advantage. Yet, the potential of learning and knowledge theories and strategies in understanding, framing, informing, or driving change during the planning and design of workplaces is often unrealized. This could be partially due to learning and knowledge theories taking the physicality of workplaces for granted[2].

The significance of this study is threefold pertaining to three realms of theory, method, and practice: (1) Contributing to literature on learning and knowledge through developing accounts of a learning and knowing perspective as they relate to the physical space; (2) offering a methodology for making change in learning and knowing practices of an organization through the process of making the workplace architecture; and (3) making a widely used learning and knowledge strategy relevant to the physical space by the virtue of social and spatial analysis and description of workplace dynamics. Therefore, what this dissertation hopes to accomplish is to

---

[1]) See the literature on the relationship between knowledge management and innovation in Du Plessis (2007), Adams and Lamont (2003), Cardinal et al. (2001) Darroch and McNaughton (2002), Pyke (2002), and Shani et al. (2003) among others.

[2]) "The physical environment within the organization is often taken for granted, but it is another important foundation upon which knowledge management rests" (Becerra-Fernandez & Sabherwal, 2010).

`

provide a useful account for a way of understanding, framing, and driving change in the workplace architecture while offering a roadmap for creating settings that foster learning and knowing.

It is important to note that in this dissertation, and following a half-century tradition of using social science theories and methods in architecture, *the way things happen inside buildings* is part of the definition of architecture. From this perspective, and for a research study that investigates the architecture of workplaces, *the social domain of work* as well as *ways of manipulating it* become important. Knowing the social domain of work and its relationship to workplace requires a review of organizational theories which is provided in chapter two. Yet this project in its essence is concerned with shaping the social domain of work pertaining to the core demands of knowledge economy – an economy built around knowledge practices that generate value. Therefore, chapter two will also cover a wide range of relevant theories and perspectives regarding learning and knowing.

The goal of this chapter is to provide an overview of the what, why, and how of this research. I will start by explaining the core research concern of this dissertation as well as its significance and will conclude by reviewing the approach towards addressing research questions.

1.1. Problem statement

The shifting landscape of learning and knowing[3] calls for revisiting the knowledge economy's "new sites of production" (Madanipour, 2013) among which are workplaces. There are many signs indicating the complex knowledge challenges that organizations are facing: the

---

[3]) Knowledge lives in the human act of knowing (Wenger et al., 2002, p. 8).

`

emphasis on knowledge, creativity, and innovation as the essential elements of thriving societies (Birgeneau, 2005), the collapsing business model of many traditional colleges and universities in light of disruptive innovation (Christensen et al., 2011), the nature of work becoming increasingly knowledge-based, more dependent on social skills[4] and technological competence, and more time pressured (Chan, Beckman, and Lawrence, 2007), emergence of new knowledge and learning ecologies forecasting a new culture of learning (Thomas & Brown, 2011), characteristics and traits of the "millennial" generation[5] (Rickes, 2009) and its need to acquire new knowledge and skills on an almost continuous basis (Brown & Adler, 2008) as a result of organizations' greater reliance on intellectual capabilities of skilled labor force of managers and professionals (Wenger et al., 2002; Powell & Snellman, 2004; Madanipour, 2013), are among the many other factors contributing to the knowledge dilemma of our time.

Such a list raises many questions for researchers and practitioners from various fields from education to business. For the field of architecture, these might be some potential candidates: (1) what should we expect from the physicality of 'new sites of production' in the knowledge economy? (2) What does account for the value and the role of space and place within an economy based on intellectual capital? And more fundamentally, (3) what do these new places look like? Frank Duffy (2008) addresses the first two questions by arguing that "in the knowledge economy we will measure places by amount of knowledge that is accumulated and quantity of ideas that are generated within their fabric". Consequently, he provides a hint for the third one: look for physical and spatial features of workplaces which are part of the larger ecology of people, information, and practices driving processes of learning that result in the

---

[4]) Chan, Beckman and Lawrence (2007) write that knowledge work tends to be more team-based and collaborative, which has led to changes in the organizational structures that govern work.
[5]) According to multiple Gallup surveys in 2016, 50% of the millennials will be leaving their workplaces in 2017, and only 29% of them are actively engaged in the workplace.

`

generation, accumulation, and dissemination of knowledge. After all, "if knowledge is not found everywhere, then where it is located becomes a particularly significant issue" (Malecki, 2000, p. 110).

1.2. Scope and research goal

Workplace is a complex ecology comprised of various relationships between people, spaces, objects and artifacts, practices, technology, and information. These relationships are important because they are often directly tied to important workplace outcomes such as recruitment and retention, business performance and productivity, efficient allocation of resources and spaces, brand and culture, return on real estate investment, work-life balance, and strategizing for knowledge practices among others. That said, decoding this ecology in its entirety is neither easy nor necessary. A useful investigation could reveal meaningful constellations within this ecology (Figure 1).
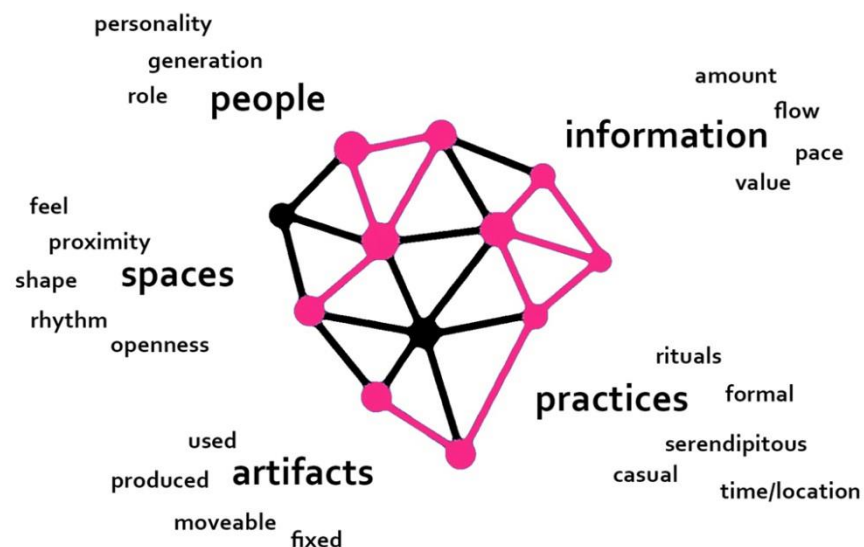
Figure (1) The goal is to reveal meaningful constellations that describe a narrative about people, space, knowledge, and learning in the complex ecology of the workplace.

`

A typical workplace constellation might include a certain team's work-dynamics and its generational make-up, configuration of spaces they use, and the variety of moveable furniture within those spaces. But similar to the tales of zodiac in the sky, a meaningful constellation in the workplace should tell us a compelling story. Characters of the story, challenges that they face and opportunities that they create as a result of their engagement with one another, as well as with their surroundings shape the scope. And within this new scope, a set of more specific questions emerge: What are those constellations which account for learning and knowledge within organizations? How do they function? What is the quality of the bonds among their components?

According to many thinkers and theorists in the field, these constellations are essentially social phenomena. Therefore, and in the next chapter, I will use a series of theories and perspectives that have emerged in the past 30 years which frame learning and knowing as social and situated processes as opposed to strictly cognitive functions. For the convenience of discussion in this dissertation, I will refer to this collection of theories as "social theories of learning and knowing". However, to conceptualize these constellations as entities that could include spatial and physical components, one needs to take into account architects' and environmental design researchers' normative views and empirical findings about the physicality and spatiality of environments which are supportive of learning and knowing processes.

The theoretical and practical plug-and-play between these two realms of knowledge benefits from the use of two components on two levels of theory and methodology. On the theoretical level, the dissertation's narrative mostly benefits from the community of practice perspective which is rooted in attempts to develop accounts of the social nature of human

`

learning inspired by anthropology and social theory and largely conceptualized by the social learning theorist Étienne Wenger (Lave & Wenger, 1991; Wenger et al., 2002; Wenger, 1998, 2000a, 2000b, 2007, 2009, 2010, 2013) – this first component will be covered in the second chapter. On the methodological level, design thinking as a form of "action research that comes from fail-friendly, iterative prototyping in context of immersive social research" (Tonkinwise, 2010, p. 381) is used to emancipate and empower a group of workplace employees to engage them in the process of shaping the workplace architecture – and eventually create new learning and knowing practices. The second component is explained in the third chapter.

1.3.   Research approach

The [neo]pragmatist worldview gives us the license to replace the quest for certainty with the demand for imagination (Dewey, 1929), and as it gives primacy to "building a better future" over "correspondence to reality" it shifts the purpose of the inquiry from finding the truth, to achieving "agreement among humans about what to do", to bringing "consensus on the end to be achieved and the means to be used to achieve those ends" (Rorty, 1999). The individual and collective emancipation from correspondence to reality and empowerment for creating consensus and constructing a local version of reality is at the heart of action research[6]. As a form of action research, design thinking is also concerned with developing practical knowing, using participatory processes, uncovering real human problems, and employing various ways of knowing, yet, it adds empathy, ideation, and prototyping methods and techniques into the

---

[6]) "Philosophical pragmatism, especially the works of the philosopher of education Dewey and his close friend the philosopher and social psychologist Mead, was the first grand theory to provide a firm foundation for action research" (Boog, 2003, p. 429).

`

equation while clarifying their integration, sequencing, and overall goal based on the project's local features.

Therefore, drawing from core principles of the pragmatist philosophy, this dissertation uses design thinking as a methodology emerged from the action research tradition. During the first phases of the design thinking process, 63 users of the workplace were engaged to address the complex challenge of redesigning the physical and social domain of workplace. In doing so, they tackled the specific problem of increasing cross-pollination among people and social units through reimagining the workplace interiors. The result was the development of a series of insights which eventually led to the design of a full scale mockup to later be tested and iterated.

Later, and in the final phase of the process, 19 employees across different organizational levels and generations volunteered to participate in a social and spatial mapping study which used people-space analytics to understand and evaluate social and spatial patterns before and after installing the full scale prototype as large as 5000 sqf. The data was interpreted from the perspective of social theories of learning and knowing and was later shared with a number of participants. Finally, thick description (Geertz, 1973) was used as a way of going beyond factual accounts and giving meaning to participants' actions by placing them in their cultural context.

2. Literature review, conceptual framework, and research questions

In this section, I will first provide a broader view of social theories of learning and knowing which shape the basis for this dissertation's theoretical focus. Next, I will review the literature on workplace research and design with a special consideration regarding social dynamisms including the organizational side of work. Eventually, in the third and final section of this chapter, I will explain the main focus of this dissertation followed by two hypotheses.

2.1. Social theories of learning and knowing: A broader context

Framing the discussion about a multi-faceted topic like learning which involves a wide web of various terms and concepts can begin by sorting main theorists or theories. For example, Merriam and Caffarella (1991) identified 19 learning theorists categorized under four major orientations to learning: behaviorist, cognitivist, humanist, and social and situational. In an alternative grouping, the HoTEL group (Holistic approach to Technology Enhanced Learning) identified 26 learning paradigms and key concepts pertaining to 20 theorists from seven scientific disciplines: social anthropology, psychology, linguistics, cybernetics, philosophy, education, and organization. Wenger (1998) explains his take on learning theories from a similar viewpoint. He recognizes eight groups of theories representing at least three different approaches: neurophysiological theories of learning inspired by studies on human's neurological functions; behaviorist, cognitive, constructivist, and social learning theories developed within the province of psychological theories; and finally, activity, socialization, and organizational theories which are not exclusively psychological. Exploring the differences between all these theories, one thing becomes evident:

`

To some extent these differences in emphasis reflect a deliberate focus on a slice of the multidimensional problem of learning, and to some extent they reflect more fundamental differences in assumptions about the nature of knowledge, knowing, and knowers, and consequently about what matters in learning. (Wenger, 1998, p. 3-4).

But how would one navigate within this larger landscape? Which terms, concepts, theories, or perspectives to pick and choose, to combine by plug-and-play? I will attempt to answer some of these questions as I present a series of arguments and perspectives in the next few sections. That said, to provide the reader with an initial response, I should say that my main criteria for selecting certain perspectives are guided by an approach within pragmatic philosophy which gives primacy to a perspective's usefulness – pertaining to the topic of this dissertation – as well as its potential to evoke imagination in favor of providing more interesting alternatives to present beliefs[7] – about work environments.

Accordingly, and also to avoid lexical confusions and maintain the integrity of arguments, I will commit the language and vocabulary of the discussion to a certain intellectual realm which is most useful and evocative for and relevant to the topic of this dissertation. I will do so by focusing on a series of theories or perspectives for explaining learning and knowing as situated, distributed, and social processes. To draw a clearer map of the many words, phrases, and concepts, first I will explore, in more detail, a group of neighboring theories and perspectives within a larger landscape comprised of all the theories, paradigms, and perspectives which address learning and knowing.

---

[7]) "[One] should stop worrying about whether what one believes is well grounded and start worrying about whether one has been imaginative enough to think up interesting alternatives to one's present beliefs (Rorty, 1994, p. 34)."

nature of human learning

LEARNING THEORIES

cognition and knowing as complex social phenomena observed in everyday practice

SOCIAL ANTHROPOLOGY OF COGNITION

situated learning

situated cognition

landscapes of practice

SOCIAL THEORY

organizational learning and knowledge management

create new knowledge by producing perspectives that make sense of the world

cognitive apprenticeship

ORGANIZATIONAL THEORY

community of practice

study organizations to identify patterns and structures they use to function best

Figure (2) Relationships between neighboring theories and perspectives contributing to this research's theoretical lens: All the social theories and perspectives of learning and knowing discussed in this dissertation happen at the intersection of four overarching areas of study – studies on learning, studies on organizations, social theory, and social anthropology of cognition. Community of practice and landscapes of practice perspectives start their conceptualizations of learning and knowing with an understanding of the literature on situated learning, cognitive apprenticeship, organizational learning, and knowledge management.

`

Although these perspectives and theories are coherent packages with their own language and set of concepts and assumptions, they need to be cross-examined to the extent which they contribute to the topic of this dissertation. Therefore, what controls the jellylike boundaries of this discussion and their tendency to permeate other topic areas such as power relations or actor-network theory[8] is the dissertation's commitment to explore the social nature of human learning and knowing in favor of creating better work and environments. Figure (2) shows relationships between several of the neighboring theories and perspectives which will be discussed in this dissertation.

2.1.1.   Situated cognition:

Knowing is constructed capability in social practice

The shift to situated cognition for understanding human cognition, knowledge, and knowing was widely recognized during the 1980s. That said, "scholars knew the concepts and methods of situated cognition from a much broader and deeper background" (Clancey, 2008, p.11) which can be traced back the early 1950s[9]. To make the diverse body of work on the topic more navigable, Wilson and Meyers (2000) suggest two camps of researchers that are typically associated with situated cognition. They write that anthropologists like Jean Lave (1988, 1991) and Lucy Suchman (1993) are interested in the cultural construction of meaning which melds

---

[8]) Learning does not seem to be a central topic in actor-network theory although there has been research, such as Fenwick and Edwards (2010), investigating this subject matter. In another study, Fox (2000) explored how the community of practice perspective and actor-network theory can enrich each other and together make a greater contribution to our understanding of organizational learning.

[9]) According to Clancey (2008, p.11) indications of this shift could be seen in "Dewey's (1896) early objections to stimulus-response theory, Wittgenstein's (1953/1958) notion of family resemblances and the language game, Gibson's (1966) affordances, Bateson's (1972) ecology of mind, Polanyi's (1966) tacit knowledge, von Bertalanffy's (1968) general systems theory, and so on, in the work of dozens of well-known figures in philosophy, psychology, linguistics, ethology, biology, and anthropology"

anthropology and critical theory with the sociocultrualism of Vygotsky (Forman, Minick, & Stone, 1993; Newman, Griffin, & Cole, 1989; Rogoff, 1990). In the other camp, however, cognitive scientists like Allan Collins, John Seeley Brown, Don Norman, and Bill Clancey are interested in cognition at individual and social levels.

Phrases like cognition plus or person plus are used by proponents of situated cognition to indicate the shift in the unit of analysis for understanding human cognition from individual knowing to "individual knowing and social action intertwined" (Wilson & Meyers, 2000). It is a way of talking about knowing within which "the physical context is being reunited with the social, within the thought process" (Light & Butterworth, 1992, p.1). Jean Lave's (1988) *Cognition in Practice* is one of the first camp's best examples for depicting this shift. In her book, inspired by theories of social practice, she advocates for 'social anthropology of cognition' as a more comprehensive project for understanding human cognition – a complex social phenomenon that can be observed in everyday practice; that is situated in and "stretched across mind, body, activity, and setting" (p.18).

In concert with Lave who argues for "knowledge-in-practice constituted in the settings of practice" (p.14), Bill Clancey, computer scientist specialized in cognitive science and AI, puts emphasis on the shift in perspective from "knowledge as stored artifact to knowledge as constructed capability-in-action" (1997, p. 4). 11 years after his 1997 publication, his conceptualization of knowledge is more sensitive to certain social contexts. He argues that Situated cognition views human knowledge not as final objective facts but as (1) arising conceptually (e.g., dynamically constructed, remembered, reinterpreted) and articulated within a social context (i.e., a context conceived with respect to social roles and norms); (2) varying

`

within a population in specialized niches (areas of expertise); (3) socially reproduced (e.g., learning in communities of practice; Lave & Wenger, 1991); and (4) transformed by individuals and groups in processes of assimilation that are inevitably adapted and interpreted from unique perspectives (improvised in action, not simply transferred and applied) (Clancey, 2008).

2.1.2.   **Situated learning:**

Learning is participation in social practice

As the natural companion of situated cognition, situated learning was developed at the intersection of this view of knowledge and the attempt to understand the nature of human learning. Perhaps, what distinguishes the situated view of learning from other theories of learning including behaviorist (Skinner, 1974), cognitive (Hutchins, 1995), constructivist (Piaget, 1954), social (Bandura, 1997), and experiential (Dewey, 1938; Kolb, 1984) is in its use of the terms participation and practice. Situated learning explains learning as social participation in a sociocultural practice. In other words, "participation in social practice is the fundamental form of learning (Lave & Wenger, 1991, p. 54)". This conception of situated learning "is more encompassing in intent than conventional notions of 'learning in situ' or 'learning by doing' (Lave & Wenger, 1991, p. 31). Lave and Wenger (1991), in their seminal publication *Situated Learning: Legitimate Peripheral Participation* expand on this notion:

> We emphasize the significance of shifting the analytic focus from the individual as learner to learning as participant in the social world, and from the concept of cognitive process to the more-encompassing view of social practice. (p. 43).

`

The theory suggests that learning, as Hanks (1991) puts it, is "a way of being in the social world, not a way of coming to know about it" (p. 24)[10]. To describe this social and situated nature of learning and knowing, Lave and Wenger (1991) use examples of apprenticeship from different cultural and historical traditions. In reviewing their work, Lemke (1997) writes that Lave and Wegner observed people in the routine activities of their lives, engaged in what for us is problem solving, but which for them is simply a way of participating in immediate, concrete, specific, meaning-rich situations. In his view, the authors framed their subjects as functioning in microecologies, material environments endowed with cultural meanings; acting and being acted on directly or with the mediation of physical-cultural tools and cultural-material systems of words, signs, and other symbolic values:

> In these activities, 'things' contribute to solutions every bit as much as 'minds' do; information and meaning is coded into configurations of objects, material constraints, and possible environmental options, as well as in verbal routines and formulas or 'mental' operations. (Lemke, 1997, p. 38).

In addition to its usefulness for explaining the social and situated nature of learning, Lave and Wenger's interest in apprenticeship is also due to its historical significance "as a form for producing knowledgeably skilled persons" (Lave & Wenger, 1991, p. 62). They use 'legitimate peripheral participation' to explain relations between newcomers and old-timers as well as possibilities for developing identities of mastery. They argue that newcomers' legitimate peripherality provides them with more than an 'observational' lookout post, but it crucially involves participation as a way of learning – of both absorbing and being absorbed in – the

---

[10]) Developmental psychologist and a proponent of constructivist theory of learning Jerome Bruner reminds us that there is a tremendous difference between learning about physics and learning to be a physicist.

`

'culture of practice'. Newcomers' mastery identity evolves over time because "[a]n extended period of legitimate peripherality provides learners with opportunities to make the culture of practice theirs" (Lave & Wegner, 1991, p. 95).

2.1.3. **Distributed cognition:**

Programmable artifacts distribute knowing across time as well as social and material space

The distributed cognition approach was largely developed by Edwin Hutchins and colleagues at UCSD in the mid to late 1980s. This branch of cognitive science studies the representation of knowledge both inside the heads of individuals and in the world, thus, it considers the unit of analysis as a cognitive system, or a socio-technical system, comprised of individuals and the artifacts they use to accomplish a task (Flor and Hutchins, 1991; Hutchins, 1991, Hutchins, 1994). Hutchins makes this argument in his studies of shipboard navigation (1994) and cockpit of a commercial airliner (1995). In his article, 'How a cockpit remembers its speed', he takes the cockpit system as the unit of analysis and refers to the cognitive properties of a system comprised of many representations that are inside the cockpit system and outside the heads of the pilots:

> [R]ather than trying to map the findings of cognitive psychological studies of individuals directly onto the individual pilots in the cockpit, we should map the conceptualization of the cognitive system onto a new unit of analysis: the cockpit as a whole. (p. 267).

`

In this study, however, "thinking of organizations as cognitive systems" is not Hutchins main contribution; "what is new is the examination of the role of the material media in which representations are embodied, and in the physical processes that propagate across media" (p. 266). Accordingly, Hutchins offers two descriptions of memory for speed to explain representations inside the system and the processes that operate on them outside and inside the pilot. "Outside the pilot, using the technological devices introduced into the cockpit environment, a representation is produced "that will serve as a resource that organizes performances that are to come later" (p. 279). Hutchins uses the term cockpit system's memory to refer to the process of programming interrelated artifacts and saving that state to be "used to organize subsequent activities". Inside the pilot, what we call memory is "a combination of recognition, recall, pattern matching, cross modality consistency checking … that is conducted in interaction with a rich set of representational structures" (p. 284).

The cognitive system, like any other system[11], has a tendency to achieve its goal. In the case of the cockpit, the goal is "the successful completion of a flight [which] is produced by a system that typically includes two or more pilots interacting with each other and with a suite of technological devices (Hutchins, 1995, p. 265)". Yet, the artifacts involved in the system, not only distribute cognitive labor across social space, but also permit a shift in the distribution of cognitive effort across time (Hutchins, 1991, 1994, 1995) which means they are programmable.

2.1.4. Cognitive apprenticeship:

Focus on schooling

---

[11]) Nardi (1996, p. 39) writes that "distributed cognition moves the unit of analysis to the system and finds its center of gravity in the functioning of the system, much as classic systems theory did (Weiner, 1948; Ashby, 1956; Bertalanffy, 1968)".

`

Cognitive apprenticeship (Brown, Collins, Duguid, 1989; Collins, Brown, Newman, 1987; Collins, 1989; Collins, 2006) evolved alongside situated cognition, distributed cognition, and situated learning as an alternative model of learning and teaching to conventional schooling practices. This model advocates for embedding learning in activity and making deliberate use of the social and physical context. In other words, novices develop cognitive skills as they interact with experts through participating in authentic learning experiences.

Cognitive apprenticeship methods attempt to enculturate students into authentic practices through activity, using resources of the community, and social interaction in a way similar to craft apprenticeship (Brown, Collins, Duguid, 1989; Collins, Brown, Newman, 1987). Brown, Collins, and Duguid (1989) argue for the nexus of activity, tool, and culture within which learning is promoted through cognitive apprenticeship. To them, material and conceptual tools and the way they are used reflect the particular accumulated insights of communities and reflect the cumulative wisdom of the culture in which they are used and the insights and experience of individuals. They also suggest that the activities of members are framed by the culture of the domain which essentially means their meaning and purposes are socially constructed through negotiations among present and past members:

> [A]uthentic activities then are most simply defined as the ordinary practices of the culture. (p. 33-34).

In explaining differences between cognitive and traditional apprenticeship, Collins (2006) writes that traditional apprenticeship is limited in what it can teach, for the problems and tasks that are given to learners arise not from pedagogical concerns, but from the demand of the workplace. Moreover, whereas traditional apprenticeship emphasizes teaching skills in the

17

`

context of their use, cognitive apprenticeship emphasizes generalizing knowledge and skills so that they can be used in many different settings.

2.1.5.   **Learning and knowing in organizational theory**

Organizational learning, learning organization, organizational knowledge, and knowledge management are four terms that dominate almost all conversations about learning and knowing in organizations.

In a comprehensive study about learning in organizations provided by the Society of Organizational Learning (SOL) (2015), John Dewey's concept of experiential learning in 1938 is the first relevant concept of organizational learning. It took 40 years for the concept of organizational learning to appear in the literature. Argyris and Schön not only coined the term in 1978, but also argued for the first principle of organizational learning on which the majority of scholars have consensus on: learning on organizations begins at the individual level and translates to the organizational level when shared among individuals who act on behalf of the organization (Aksu & Özdemir, 2005; Hurley, 2002; Senge, 1990; Nonaka, 1991; Teare, 1997).

The second principle argues for different processes of organizational change that are associated with different types of organizational learning. Beck (1997) categorizes these types of learning under adaptive – changes that have been made in reaction to changed environmental conditions – and proactive – organizational change that have been made on a more willful basis and goes beyond reacting to environmental change. Haque's (2008) summary of types of learning within different organizational theories follow a similar pattern of categorization: lower-level and higher level learning (Fiol & Lyles, 1985), adaptive and generative learning (Senge,

1990; Slater & Narver, 1995), single-loop and double loop learning (Argyris, 1993; Argyris & Schön, 1978), first-order and second-order learning (Lant & Mezias, 1992), operational and conceptual learning (Kim, 1993), behavioral-level and strategy level learning (Duncan & Weiss, 1979), exploitation and exploration (March, 1991), and primary-level and meta-level learning (Hedbeg, 1981).

Many have also used the term "knowledge" to provide a more practical framework for talking about organizational learning. Lyles (1992, 1998) defines organizational learning as the changes in the state of knowledge. Huber (1991) argues that an organization learns if any of its units and components acquires knowledge that it recognizes as potentially useful for the organization. On a similar note, Fiol (1994) writes that organizational learning is the ability to acquire diverse information and to share common understanding so that this knowledge can be exploited. It is the sharing of knowledge that facilitates the individual learning to be translated to the organizational learning and to be used on the organizational level (McDougal & Beattie, 1998; An & Reigeluth, 2005). Accordingly, converting the knowledge in the organization into the organizational knowledge is one of the main goals of knowledge management. Pawlowsky's (2001) overview of various concepts (Table 1) used by authors to explain organizational knowledge provides a useful understanding of what the term captures in its essence.

Author	Organizational knowledge concept
Boulding (1956)	Image
Wilensky (1967)	Organizational intelligence
Argyris and Schön (1978)	Organizational theories-in-action
Tushman and Nadler (1978)	Information-processing system
Duncan and Weiss (1979)	Knowledge of relationship btwn specific actions and outcomes
Starbuck (1982)	Logically integrated clusters of belief
Daft and Weick (1984)	Organizational interpretation systems
Hall (1984)	Organization's cause map
Shrivastava and Schneider (1984)	Organizational frames of reference

`

Salancik and Porac (1986)	Distilled ideologies
Sims and Gioia (1986)	Organizational schemata
Sanderlands and Stablein (1987)	Organizational mind
Lundberg (1989)	Collective 'cause maps'
Pautzke (1989)	Organizational knowledge base
Senge (1990)	Shared mental models
Klimecki, Probst, and Eberl (1991)	Joint construction of reality
Lyles and Schwenk (1992)	Organizational knowledge structures and shared belief structures
Baitsch (1993)	Local theory
Nonaka and Takeuchi (1995)	Organizational knowledge-base layer

Table (1) Concepts used by various authors to explain organizational knowledge (Pawlowsky, 2001)

Knowledge management includes processes of handling and wielding organizational knowledge to favor the organization's goal(s). Organizations seek to manage the collective knowledge for a variety of reasons: increasing workplace productivity, executing core processes more efficiently, reducing activities that reinvent the wheel, adding value to the processes and operations, developing and transferring best practices, shaping strategy around knowledge, accelerating growth and innovation, fostering and commercializing innovation, creating knowledge repositories, creating a good learning environment, and most importantly, providing a competitive yet sustainable advantage (Fontain & Lesser, 2002; Davenport el al., 1998; Herling & Provo, 2000; Saint-onge & Wallace, 2003; Rampersad, 2004, Day & Wendler, 1998).

Knowledge management strategies or best practices have also been explained by many. In their comprehensive review of knowledge management strategies, 'choosing your knowledge management strategy', Haggie and Kingston (2003) write that some of the most influential and helpful classifications of knowledge management for practitioners are based on a combination of knowledge accessibility (i.e. where is the knowledge stored or located and in what form?) and knowledge transformation (i.e. the flow of knowledge from one place to another and one from to another). One example of a widely known knowledge management strategy that explains the

`

dynamics between tacit and explicit knowledge, individual, group, and organization is Nonaka and Takeuchi's (1995). Haggie and Kingston (2003) provide a concise summary of their matrix (Figure 3): The matrix classifies knowledge as either explicit and tacit and either individual or collective. There are also processes that transform knowledge from one form to another. In socialization, knowledge transforms from tacit to tacit because an individual acquires tacit knowledge directly from others through shared experience, observation, imitation and so on. In externalization, tacit knowledge is articulated into explicit concepts. During combination, knowledge transformation flows from one form of explicit to another form of explicit through a systematization of concepts drawing on different bodies of explicit knowledge. Finally, in internalization, explicit becomes tacit through a process of learning by doing and through a verbalization and documentation of experiences. Pertaining to individual and collective classification, Nonaka and Takeuchi "model the process of 'organizational knowledge creation' as a spiral in which knowledge is 'amplified' through these four modes of knowledge conversion. It is also considered that the knowledge becomes 'crystallized' within the organization at higher levels moving from the individual through the group to organizational and even inter-organizational levels" (Haggie & Kingston, 2003, p. 2).
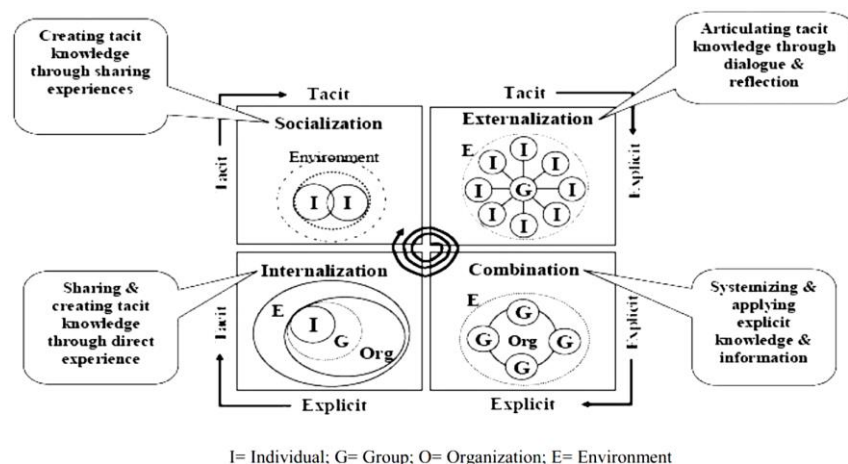
Figure (3) Nonaka and Takeuchi's (1995) knowledge matrix

`

2.1.6. **Wenger's social theory of learning and knowing: Two core concepts**

As I earlier discussed, learning has been explained by a diverse range of theories. Within the larger landscape comprised of all these theories, paradigms, and perspectives, Wenger's social theory of learning is perhaps the most comprehensive and articulated, thus, it has been the most impactful in forging the lens through which this dissertation studies work environments. I will first start with his overall description of the theory and will then expand on two core concepts of this perspective: community of practice and landscape of practice.

In his 1998 publication, communities of practice: learning, meaning, and identity, Wenger explains that although the kind of social theory of learning he proposes has its own set of assumptions and focus, it is not a replacement for other theories of learning that address different aspects of the problem. "[T]he primary focus of this theory is on learning as social participation" (p. 4). According to him, participation here refers not just to events of engagement with certain people in certain activities, but to a process of being participants in the practices of social communities and constructing identities in relation to these communities: "Such participation shapes not only what we do, but also who we are and how we interpret what we do" (p. 4). He continues by arguing for meaning, practice, community, and identity as four components for characterizing social participation as a process of learning and knowing. The following table frames two sets of descriptions of the four components.

Component	Wenger (1998) definition	Expansion on Wenger's definition
Meaning	A way of talking about our (changing) ability – individually and collectively – to experience our life and the world as meaningful.	What is our experience? Learning and knowing as experience is a result of negotiating meaning.
Practice	A way of talking about the shared historical and social	What are we doing? Learning and

	resources, frameworks, and perspectives that can sustain mutual engagement in action.	knowing as doing is a result of engagement in practice.
Community	A way of talking about the social configurations in which our enterprises are defined as worth pursuing and our participation is recognizable as competence.	Where do we belong? Learning and knowing as belonging encourages creating community.
Identity	A way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities	Who are we becoming? Learning and knowing as becoming contributes to constructing identity.

Table (2) Wenger's (1998) four components of a social theory of learning and knowing

Wenger's theory of learning and knowing can be explored through each of these four lenses. Yet, in his 1998 publication, he chooses *practice* as one of the four components and frames the theory using its various aspects. In other words, he explains the theory through the lens of practice. A summary of these aspects is provided in Table (2):

Basic aspects of practice	Defining concepts	Description
Practice as meaning	Participation	The social experience of living in the world in terms of membership in social communities and active involvement in social enterprises. It suggests both action and process by combining doing, talking, thinking, feeling, and belonging. It involves our whole person including our bodies, minds, emotions, and social relations. Participation is also a source of identity (Wenger, 1998).
	Reification	The process of giving form to our experience by producing objects that congeal this experience into thingness. It covers a wide range of processes that include making, designing, representing, using, reusing, decorating, and recasting (Wenger, 1998).
Practice as community	Mutual engagement	Members' engagement in regular interaction through which they shape the community's culture and its practices (Wenger, 1998; Holmes & Meyerhoff, 1999).
	Joint enterprise	In a community of practice, people do not only engage in random interaction, but through negotiation, they work towards some shared goals or enterprises and create a shared understanding that bind people together and provide cohesion to actions. The joint enterprise is

		sometimes referred to as the domain of the community (Wenger, 1998; Wenger et al., 2002; Meyerhoff, 2006).
	Shared repertoire	Communal resources, including language, routines, sensibilities, artifacts, tools, stories, styles, etc., that the community produces and to which provides access for members (Wenger, 1998, 2000b).
Practice as learning	Shared history of learning	Produced by the interplay of participation and reification with time and sustained mutual engagement in a joint enterprise and is manifested through shared language, stories, physical objects, and memories. Reification yields a memory of forms that allows our engagement in practice to leave enduring imprints in the world. Participation affords opportunities for collecting individual memories (Wenger, 1998; Julian, 2010).
Practice as boundary	Boundary objects	Artifacts, documents, terms, concepts, and other forms of reification around which communities of practice can organize their interconnections. Boundary objects support connections between different practices (Wenger, 1998, 2000b)
	Brokering	Connections provided by people who can introduce elements of one practice to another (Wenger, 1998, 2000b).
	Boundary Interactions	Include boundary encounters, boundary practices, and peripheries. Boundary encounters provide direct exposure to a practice. Boundary practices shape when a boundary requires so much sustained work that it becomes the topic of a practice of its own. Peripheries are provided by communities to serve people who need some service, are curious, or intend to become members. They accommodate for some boundary activities for outsiders and/or newcomers without subjecting them to the demands of full membership or overwhelming the community. Periphery surrounds the practice with a degree of permeability and allows legitimate access, observation, and some level of engagement (Wenger, 1998, 2000b).
Practice as locality	Constellations of practices	A configuration formed by related communities of practice due to: sharing historical roots, having related enterprises, serving a cause or belonging to an institution, facing similar conditions, having members in common, sharing artifacts, having geographical relations of proximity or interaction, having overlapping styles or discourses, and competing for the same resources (Wenger, 1998).

Table (3) Wenger's (1998) basic aspects of practice and their defining concepts

Additionally, he explains the intellectual context to which his conceptualizations of learning, meaning, practice, community, and identity belong:

The main tradition to which I think this work belongs … is social theory, a somewhat ill-defined field of conceptual inquiry at the intersection of philosophy, the social sciences, and the humanities. In this context, I see a social theory of learning as being located at the intersection of intellectual traditions along two main axes, as illustrated in figure (Figure 4). (p. 12).
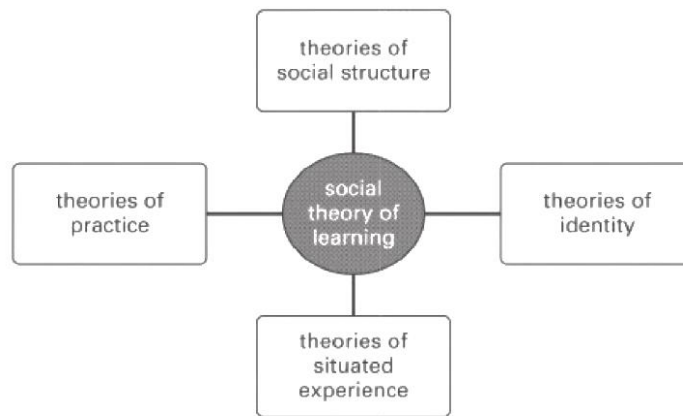
Figure (4) Social theory of learning at the intersection of four intellectual traditions (Wenger, 1998)

The vertical axes refer to the duality of structure and agency, or action, as a core topic in the social theory tradition. To explain agency and action as opposed to social structure, Wenger relies heavily on theories of situated experience in philosophy (e.g. Heidegger, 1927), psychology (e.g. Gibson, 1979), education (e.g. Dewey, 1922), and sociology (e.g. Garfinkel, 1967). It can be argued, however, what we see on the horizontal axes is not only the main concern of the book and many other Wenger's publications, but also lays the very foundation for two of the most important concepts within the theory: community or practice and landscapes of practice. The reason is that in our discussion about learning and knowing in the context of organizations the main concern is practice – e.g. best practices, communal memory, etc. – while in our exploration of learning and knowing in the context of education, one's identity becomes the most important topic. Accordingly, the former mostly focuses on how communities of

`

practice deal with learning and knowledge within the organization while the latter is concerned with helping a person to develop an identity or trajectory across multiple communities of practice within a landscape of practices.

2.1.6.1. **Community of practice (CoP)**

The community of practice perspective is largely conceptualized and explained by the social learning theorist Étienne Wenger (Lave & Wenger, 1991; Wenger et al., 2002; Wenger, 1998, 2000a, 2000b, 2007, 2009, 2010, 2013). This perspective has its roots in attempts to develop accounts of the social nature of human learning inspired by anthropology and social theory reflected in Lave's cognition in practice (1988), Bourdieu's habitus/field theory (1977), Giddens' structuration theory (1984), Foucaultian concept of power (1980), Vygostsky's zone of proximal development (1978), and Engeström's version of activity theory (1987). Yet, CoP has also been widely referred to as a key component of a knowledge strategy in organizations (Brown & Duguid, 1991; Lesser et al., 2000; Allee, 2000; Wenger et al., 2002; Saint-Onge & Wallace, 2003).

Since the early 1990s, the concept of CoP has been extensively used as a theoretical construct, a practical learning and knowledge strategy, and an effective managerial tool to address issues of individual learning and organizational development across multiple social science disciplines and professional fields (Koliba & Gajda, 2009; Amin & Roberts, 2008; Hughes et al., 2007). Therefore, there have been various interpretations of the concept. In their brief introduction to CoPs, Wenger and Trayner (2015) explain that "communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavor … [they] are groups of people who share a concern or a passion for something they do

and learn how to do it better as they interact regularly" (p. 2). They put forward various examples of communities of practice such as a band of artists seeking new forms of expression, a group of engineers working on similar problems, a clique of pupils defining their identity in the school, a network of surgeons exploring novel techniques, and so on. They also explain that CoPs can be either formal or informal, and although there are self-organized, very effective CoPs out there, most communities need some cultivation. In any case "the role of CoPs is [not only] to share knowledge … [but also] to innovate and solve problems … [To] measure the impact of CoPs … you can build a good case using quantitative and qualitative data to measure different types of value created by the community and trace how members are changing their practice and improving performance as a result" (p. 5).

At the level of individual, CoP grants different levels of participation to learners and legitimizes persons' positions on the periphery of practice. In other words, it enculturates learners (Brown, Collins, & Duguid, 1989) and encourages them to become insiders by learning to function in the community (Brown & Duguid, 1991). Respectively, it fosters belonging as the source of sharing (Wenger, 2000), and allows members to negotiate their individual and collective identities as the wellspring of creativity (Wenger, 1998, 2000).

At the level of organization, the concept has been mostly used in two contexts of business and education. However, despite the context or form, all CoPs have the three elements of a domain, a community, and a practice in common: they are groups of people who share a common concern or passion for something they do (domain); in pursuing their interest in the domain, they engage in joint activities, help each other, share information, and build relationships that enable them to learn from each other (community); members, as practitioners,

`

develop a shared repertoire of resources: experiences, stories, tools, and ways of addressing recurring problems – in short, a shared practice (practice) (Wenger, 2005; Wenger et al., 2002; Wenger, 2013).

CoP "has been adopted most rapidly by people in business because of the recognition that knowledge is a critical asset that needs to be managed strategically (Wenger & Trayner, 2015)". As living repositories for organizational knowledge, CoPs tend to have different names in different organizations: tech club (DaimlerChrysler), thematic group (World Bank), learning community or network (Hewlett Packard), best practice team (Chevron), family group or process improvement community (Xerox), and center of competence (Denning, 2009; Wenger et al., 2002; Corso & Giacobbe, 2005). Perhaps one of the most important advantages of CoPs is their impact on performance: "Communities among practitioners create a direct link between learning and performance, because the same people participate in CoPs and in teams and business units (practitioner-oriented) … practitioners can address the tacit and dynamic aspects of knowledge creation and sharing, as well as the more explicit aspects (informality)" (Wenger & Trayner, 2015, p. 4). CoPs are also strategic resources for cross-pollination due to their constellation-like anatomy – "they create connections among people across organizational and geographic boundaries (crossing boundaries). From this perspective, the knowledge of an organization lives in a constellation of CoPs each taking care of a specific aspect of the competence that the organization needs" (Wenger & Trayner, 2015, p. 4).

Figure (5) is an attempt to map the CoP perspective within Fiol's (1994) matrix of organizational learning, learning organization, organizational knowledge and knowledge managment processes. The model suggests that learning and knowing in a CoP is a matter of

`

connecting, or blurring the boundary between, process and content as well as practice and theory. The model also proposes that the CoP is part of a larger constellation that shapes the participants' learning organization, facilitates their organizational learning, and embodies and manages their organizational knowledge. Based on this model, learning is concerned with an organization's process whereas knowledge is with its content. Furthermore, concepts of organizational learning and organizational knowledge are theoretical constructs while knowledge management and learning organization deal with the practical knowledge and learning topics in an organization.

- Organizational learning builds on the knowledge in a constellation of CoPs

- Organizational knowledge lives in a constellation of CoPs

- Learning organization is comprised of and benefits from a constellation of CoPs

- Knowledge management is cultivating and leveraging a constellation of CoPs

	Process	
	Organizational Learning builds on the knowledge in	
Theory	**Learning Organization** is comprised of and benefits from	Practice
	A constellation of CoPs	
	Organizational Knowledge Lives in	**Knowledge Management** is cultivating and leveraging
	Content	
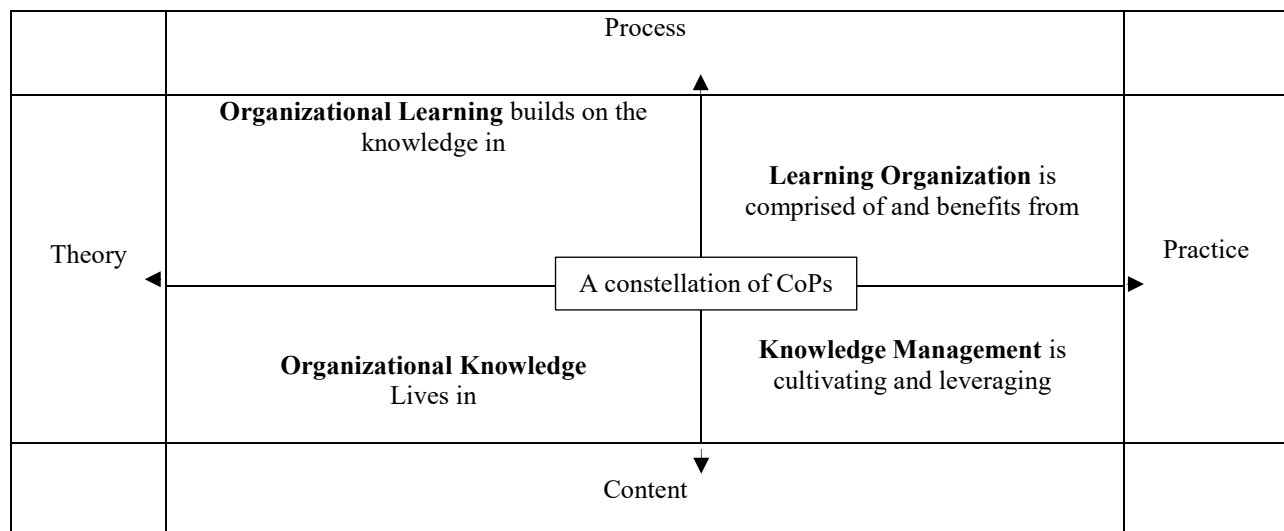
Figure (5) Landscape of practices in relation to OL, LO, OK, and KM. In this model, landscape of practices and CoPs can be used interchangeably.

The ability of CoPs to steward knowledge as a living process depends on some measure of informality and autonomy (Wenger, 2002). They must be acknowledged, supported and fully

integrated into the operation of organizations; and all this without disrupting the collegiality, self-organization, and internal leadership. However, trying to control CoPs, or leaving them alone are two sides of the same attitude. That is why cultivation seems to be an apt analogy – an organization's support should be more like the nurturing art of gardening because successful communities are driven by the passion, identification, and leadership of their members, and the environment can either favor or hinder their growth (Wenger, 2000; Wenger et al., 2002; Wenger & Snyder, 2004). Following this, Wenger et al. (2002) argue for seven principles for cultivating CoPs. These principles are summarized in Table (3):

Seven Principles for Cultivating CoPs	
Design for Evolution	As the community grows, new members bring new interests and may pull the focus of the community in different directions. Changes in the core science or technology of a community constantly reshape it. The key to designing for evolution is to combine design elements in a way that catalyzes community development.
Open a dialogue between inside and outside perspectives	Good community design requires an insider's perspective to lead the discovery of what the community is about, but it often takes an outside perspective to help members see the possibilities. Good community design brings information from outside the community into the dialogue about what the community could achieve.
Invite different levels of participation	Core group is the heart of the community and takes on much of the community's leadership. Active group participate occasionally but without the regularity of the core group. Peripheral participants, the largest portion of members, rarely participate but observe and gain their own insights from the discussions and put them to good use. Outside these three are people surrounding the community who are not members but have an interest in the community. The key to good community participation and healthy degree of movement between levels is to design community activities that allow participants at all levels to feel like full members. Successful communities build benches for those on the sidelines.
Develop both public and private community spaces	Informal back channel discussions (phone call, email exchange, problem solving conversation, etc.) help orchestrate the public space and are key to successful meetings. When the individual relationships among community members are strong, the events are much richer. The key to designing community spaces is to orchestrate activities in both public and private spaces that use the strength of individual relationships to enrich events and use events to strengthen individual relationships.
Focus on value	Communities thrive because they deliver value to the organization, to the teams on which community members serve, and to the community members themselves. Value is key to community life because participation in most communities is voluntary. Rather than attempting to determine their expected value in advance, communities need to create events, activities, and relationships that help their potential value emerge and enable them to discover new ways to harvest it.
Combine	As communities mature, they often settle into a pattern of regular meetings, teleconferences,

familiarity and excitement	projects, website use, and other ongoing activities. The familiarity of these events creates a comfort level that invites candid discussions. Like a neighborhood bar or café, a community becomes a place where people have the freedom to ask for candid advice, share their opinions, and try half-baked ideas without repercussion. They are places people can drop by to hear about the latest tool, exchange technical gossip, or just chat about technical issues without fear of committing to action plans.
Create a rhythm for the community	At the heart of a community is a web of enduring relationships among members, but the tempo of their interactions is greatly influenced by the rhythm of community events … When the beat is strong and rhythmic, the community has a sense of movement and liveliness … the rhythm of the community is the strongest indicator of its aliveness.

Table (4) Principles for cultivating CoPs (Wenger et al., 2002)

2.1.6.2. **Landscape of practice**

As CoPs undertake ownership and stewardship of practice and knowledge, and as they contribute to the continued vitality, application, and evolution of them, these bodies of knowledge become the locus for the definition of competence in practice (Wenger, 2000, 2014; Wenger, et al., 2015). For example, the community of architectural studio instructors in an architecture school has a collective understanding and definition of a competent studio instructor which often makes new instructors, as newcomers, to show accountability to it – to be recognized as a competent member of the community. However, as the new instructor becomes more experienced, s/he might engage in negotiating the definition of competence in the community. Wenger et al. (2015) explain that competence is not merely an individual characteristic but it is something that is recognizable as competence by members of a CoP. That said, they emphasize that a regime of competence is not static and although it shapes personal experience, it can also be shaped by it. From their view, this means that learning in a CoP is "a claim to competence":

`

When newcomers are entering a community, it is mostly the regime of
competence that is pulling and transforming their experience – until their experience
reflects the competence of the community. This is what happens in apprenticeship, for
instance. Conversely, experience can also pull, challenge, and transform the community's
regime of competence. (Wenger et al., 2015, p. 14).

From an individual learner's standpoint, however, a single CoP is not the only body of
knowledge. In this case, the body of knowledge is composed of multiple CoPs that become
related to the extent that their practices form a meaningful and useful connection with one
another. These larger systems become landscapes of practice across which one engages to find
her individual way of gaining knowledgeability or shaping her knowledgeable identity. In other
words, one's identity is not limited to one community, but is defined across communities
(Wenger, 2000, 2014; Wenger, et al., 2015). This is where Wenger and Trayner (2015) introduce
landscape of practice consisting of a complex system of CoPs and boundaries between them
which embodies the body of knowledge of a profession. Within this framework, the concept of
knowledgeability manifests in a person's relations to a multiplicity of practices across the
landscape, so it is used to account for the complex relations that people build across the
landscape whereas competence is used to describe the dimension of knowing negotiated and
defined within a single CoP (Wenger & Trayner, 2015).

2.2.   Social learning and knowing in the workplace literature

As it was mentioned in the first chapter of this dissertation, the broader goal of this
research is to contribute to the discourse of architectural research and practice as it relates to the
social theories of learning and knowing. In doing so, I attempt to develop accounts of the

architecture of social learning and knowing by framing and explaining certain workplace dynamics through the lens of the theory. Two prerequisite for developing these accounts are: (1) understanding learning and knowing as social and situated processes, as opposed to strictly cognitive functions, reflected in social theories of learning and knowing; and (2) understanding architects' and environmental design researchers' normative views and empirical findings about the physicality and spatiality of environments which are supportive of learning and knowing processes. The former was addressed in the first section of this chapter while the following section is concerned about the latter. Section two of this chapter is also comprised of two parts. I will first explain how workplace design has been influenced by changes in the organizational philosophies during the past century. Later, I will review architectural practitioners' and environmental design researches' expert opinions about the physicality of workplaces as it relates to the social domain.

2.2.1. **A social and organizational approach towards the evolution of workplaces**

Correlations between workplace, as a physical and spatial entity, and different organizational philosophies can be traced back to scientific management. The development of Taylorism, beginning in the 1880s and within the manufacturing industries, was associated with the rise of large companies seeking industrial efficiency on the one hand and immigration, population increase, and influx in low-paid workers on the other hand. Scientific management's main objective was improving economic efficiency mainly through controlling workers to favor labor productivity. Frank Lloyd Wright's Larkin Company Administration Building in Buffalo,

`

New York, built between 1904 and 1906, has been held up by many as a model for scientific management:

> The Larkin Building elevates the commercial purpose of the company to something that brings the need for clerical efficiency into focus with corporate symbolism. What was needed in this environment was a place in which individuals could work with maximum efficiency and uniformity in the performance of isolated and repetitive tasks. (Grabow & Spreckelmeyer, 2015, p. 43).

Beyond the building's spatial organization which made disciplined work and orderly management possible, even the formal and physical characteristics of the building have been described as expressive of Tayloristic work ethics. In describing the building's physicality, Weston (2004) writes that to contemporary observers, the austere, strictly orthogonal forms unrelieved by arises or moldings at their corners might seem excessively brutal and utilitarian, yet to Wright, they were "genuine and constructive affirmation of the new Order of this Machine Age … a genuine expression of power directly applied to purpose" (Weston, 2004, p. 26).

Almost two decades later, human relations approach, popularized by the Hawthorne experiment, colonized important territories of the workplace landscape. The new approach's motto was to promote the concerns of the individual worker in an atmosphere that was too focused on production. The shift in emphasis from task to worker was human relations' distinguishing factor as opposed to scientific management. An early 1950s open plan office space planning movement known as bürolandschaft grew in a work culture shaped mainly by the human relations approach. Ninoflax office in Nordhorn, Germany, is described as a typical early example of a bürolandschaft building. Duffy and Hutton (2005) write that Ninoflax offices "are

`

entirely open-plan: the building form and constructional grids are non-orthogonal" (p.77). Yet, perhaps similar to Larking building, "the building is a product of organizational ideas in a particularly obvious way, and is almost a diagram of a large clerical organization run with a certain management style" (Duffy & Hutton, 2005, p.77). This means although human relations employed a different approach towards work and management compared to scientific management, its relationship to architecture stayed the same: open layout as well as open management were imposed from above because senior management were able to adopt 'advanced' policies without question; therefore, architect's ideas were subordinate to the ideas behind bürolandschaft (Duffy & Hutton, 2005). This lack of symbiotic relationship between architect's view of workplace and that of learning-knowing theorists and practitioners once again highlights one of the core missions of this dissertation: understanding each side's world in the form of a literature review and eventually making a group of learning and knowing theories relevant to architecture.

Organizational thinking encountered another major contribution after the biologist Ludwig von Bertanlanffy developed open systems theory in 1956 which was soon applied across disciplines. Characterizing organizations as an assemblage or combination of interdependent parts drew attention to the role of the environment as essential ingredient:

> Every organization exists in a specific physical, technological, cultural, and social environment to which it must adapt … The environment can be seen as a store of resources as well as a source of opportunities and constraints, demands and threats. (Scott and Davis, 2007, p. 19-20).

`

In designing Centraal Beheer in 1976, Herman Hertzberger framed the work environment as reflective of the larger societal forces by recreating urban fabric in the architectural scale to create a balance of privacy and open communication. Centraal Beheer goes way beyond traditional human relations in Ninoflax for it not only maximizes visual connection and social interaction but also allows for a high level of personalization by employees. In an interview with Tom Dychhoff in 2011, Hertzberger said: " At that time, the end of the 60s, there was a need and urge for people to show their identity and they were sort of competing each other with things … they brought in birds and animals". Tendency to achieve equilibrium, as a characteristic of open systems, seems to be a central principal in designing Centraal Beheer.

Open systems approach seems to have remained as the last widely-received organizational philosophy in mainstream architectural practice. Most recently and in describing his six determinants of designing the new workplace, Clive Wilkinson (2015) used a rather metaphoric definition of open system to explain his notion of the 'culture model'. He discusses how the US culture of maturity and sophistication in which power resides in the old, resembling a closed system, broke apart around the First World War and as a consequence a culture of immaturity, youth, and naivety with a bias towards experimentation and play, symbolizing an open system, was evolved. He illustrates his point as he compares the interior of the Palace of Versailles with that of the Disney Store in Los Angeles where they designed a modular honeycomb structure which served as furniture, architectural wall dividing spaces, and storage space for products that were made at the headquarters building.

2.2.2. How the workplace literature describes the social domain – a domain most receptive to social learning and knowing practices

`

Only by reviewing the great number of metaphors and analogies inspired by the social domain – from urban landscape to network science – and used in the field of workplace research and design one can conclude designers' and researchers' high level of interest in and curiosity about the social domain of work environment. At the 2016 AIA convention in Philadelphia, Rem Koolhaas said that architecture and the language of architecture, such as platform, blueprint, structure, and so on, became almost the preferred language for describing different phenomenon exported from Silicon Valley:

> They took over our metaphors and it made me think that regardless of our speed, which is too slow for Silicon Valley, we can perhaps think of the modern world maybe not always in the form of buildings, but in the form of knowledge or organization and structure and society that we can offer and provide.

Another example is Clive Wilkinson's analogous use of city's social life and anatomy to explain workplace. In his view, the city not only organizes complexity and provides a stage for cultural diversity, but also is an embedded lexicon of familiar forms (Wilkinson, 2016). He argues that terms such as neighborhood, town hall, main street, production, brand, distribution, client face, network, social space, etc. are used to both inform the design and communicate the design ideas with the client:

> [The] fundamental … reference point for us, in our work, is the city … because it's a place that everyone is familiar with, that everyone has a concatenation of images in their heads, and therefore, contains in a way the archetypes of what we believe to be, the life we want to live.

`

Beyond the formal parallels between urban landscape and workplace, the interstitial nature of congenial city spaces and their great potential in engendering serendipity[12] has also been the source of inspiration for many architects and researchers who have attempted to create alternative spatial and programmatic paradigms for designing workplaces. Duffy (2005) writes what constitutes for the success, productivity and congeniality of the city social life is the density of overlap among various social networks either physical or virtual – this is what makes cities interesting and useful places to inhabit:

> Places are excellent at opening up unanticipated opportunities – they engender serendipity … Chance is embedded in streets, in non-linear events, in surprise, in open-endedness, in the coincidences that belong to a non-programmed world. (p. 63).

Despite Duffy's (2005) interest in chance encounters, the literature on social learning and knowing reminds us that learning and knowledge practices are more 'purposeful' than serendipitous. This means for chance encounters to fall under the category of purposeful and useful, they need to be strategic and encouraged among certain individuals or social units. That is why increasing the probability of such encounters through design has become a topic of interest for many. For example, Duffy (2005) argues to stimulate the probability of collision between social networks, they need to be able to penetrate into interstitial places. Accordingly, he refers to 'interstitiality' and 'permeability'[13] as two socio-spatial qualities that determine the extent of leakage between networks leading to serendipity. To foster cultural and intellectual discourse, Duffy believes, cities and buildings should offer many degrees of permeability whilst being

---

[12]) The street as a center of activity, much more than of motion, a center of commerce and sociability, of nonstop human drama, of endless surprises and stimulation. One might call it, as many did at the time, a theater for living (Ehrenhalt, 2012).

[13]) There can be no better image of controlled permeability than a thousand highly varied and infinitely welcoming restaurant and café doors (Duffy, 2005).

`

mindful of the fact that it is not a quality of 'brittle' (Richard Sennett) places, but a characteristic of 'buildings that can learn' (Stewart Brand) and have the capacity to be adaptable and accommodate growth and change.

While Duffy elaborates on the socio-spatial qualities of places that engender serendipity, William H. White (1980) addresses physical and programmatic features. In his seminal work, the social life of small urban spaces, White describes a phenomenon he calls 'triangulation' in which some external stimulus provides a social bond between people and prompts strangers to talk to each other as though they were not. The importance of this phenomenon is not limited to stimulating the probability for serendipity, but it also contextualizes the social encounter. In other words, the subject of triangulation, whether physical or programmatic[14], becomes a topic for social interaction. To make an early link to the social theory of learning literature, if permeability offers different levels of participation in a CoP, then triangulation is a stimulus for learning and the trajectory for serendipitous encounters.

Many workplaces have attempted to emulate city-like social dynamisms in breakout zones and playspaces[15] such as informal catering areas, kitchens and bistros, library corners, lounges, recreation zones, cafés or restaurants, and other adaptable spaces[16] that support a wide range of informal interactions (Remmers, 2011; Sullivan & Horwitz-Bennett, 2010; Toker, 2006;

---

[14]) Sculptures, posters, models, artworks, etc. are examples of physical, and vendors, musicians, galleries, entertainers, etc. are examples of programmatic triangulation.

[15]) Meyer (2010) argues for workplace as playspace for new ideas, perspectives, and possibilities. Ehmann et al. (2012) also indicates that the worlds of work and play are merging. Brown and Thomas (2011) in A New Culture of Learning have a different take on play, yet they introduce it as one of the three dimensions of learning: knowing, making, and playing.

[16]) Flexibility and adaptability are also among the popular terms among those who are interested in workplace research and design. There seems to be a consensus on that workplaces should provide choice and diversity, experimentation and discovery, and play and disruption to the point that one can argue in the context of workplace design, form follows hack: "Creating architecture is like planting seeds of the future – seeds of possibilities and inspirations which are the countless fragments of the future" (Fujimoto, 2012).

`

Toker & Gray, 2010; Ehmann et al., 2012; Worpole, 2013). Yet, researchers like Becker and Sims' (2001) alternative way of approaching office design makes incorporating 'breakout zones' seem like a cautious response to, what Remmers (2011) calls "designing office buildings like cities". They suggest that "rather than thinking of the office as a place primarily for solitary activity, from which one occasionally breaks out in time and space to settings intended for social activity, the office is designed primarily as a social setting, from which one occasionally seeks out more private places for contemplation, concentration and confidentiality." Herman Hertzberger, also in his design of the Centraal Beheer, took the notion of breakout zone further and expanded it to the extent that made the building "feel like a Mediterranean city (Hertzberger, 2012)"[17]. Wisconsin Institute for Discovery and Federal Center South Building 1202 are other examples in which the semi-public spaces, including "everything that lies between individual workstations and meeting rooms (Remmers, 2011)", resembles a convivial cityscape with gardens, alleys, plazas, shops, and a variety of programmatically neutral sittable spaces.

Many architects and researchers have indicated the significance of 'triangulation', 'permeability', and 'interstitial or in-between spaces' in cultivating chance encounters. An additional set of terms and concepts such as 'community', 'collaboration', 'patterns of communication', and 'physical-virtual coupling or hybridity' are used by others to frame the purpose of serendipitous interactions.

Many workplace researchers (Worthington, 2005; Remmers, 2011; CABE, 2005; Becker, 2004; Becker and Sims, 2001) indicate that the growth of the knowledge economy is placing more emphasis on the importance of communicating knowledge and collaboration. The

---

[17]) according to Herman Hertzberger's (2010) Material, streets, light, alleys, trees, plazas, etc.

`

physicality of place in relation to communication and collaboration in the increasingly virtual world advanced by the disruptive nature of information technology[18] has been a controversial subject. Considering the inevitability of physical-virtual coupling[19], organizations often attempt to strategically use the technology in favor of creating productive hybrid places – Xerox PARC's "wired coffee pots"[20] is perhaps one of the famous examples of such hybridity.

To Remmers (2011), translating concepts such as "invisible computing" and "ubiquitous computing" into physical space can range from internet and server access in canteen and recreational areas to utilizing walls and other elements of the room itself as a communal interface. Despite the significance of this subject, however, less attention has been paid to hybrid solutions for communication[21], and studies have been mostly concerned about either physicality or virtuality.

Some studies on higher education settings and research buildings can also provide useful insights about the social side of workplaces. For example, Gromling (2011), in his study on the typology of research buildings refers to the "overall atmosphere that facilitates and promotes

---

[18]) The theory of disruptive innovation, first coined by Christensen (1997), describes a process by which a product or service transforms an existing market by introducing simplicity, convenience, accessibility, and affordability.

[19]) Success in the new economy will go to those who can execute clicks-and-mortar strategies that bridge the physical and the virtual worlds … the benefits of integration are almost always too great to abandon entirely (Ranjay Gulati and Jason Garino, Harvard Business Review, 2000)

[20]) "We wired the coffee pots to the internet. Which meant that any time that anyone created a fresh pot of coffee that signal went up on the net. Anyone on that floor would know that a fresh pot of coffee was being brewed. They would come streaming out of their office doors from various parts of the building so that they could come and get a fresh pot of coffee, and would of course collide in front of the coffee pot. And so this signaling mechanism actually brought people of different disciplines together… around the coffee pot, as a next step as a new kind of space, we installed ceiling to ceiling white boards, huge white boards, so that you actually start a conversation around the coffee pot … we constructed cameras in the ceiling that would take sixteen snapshots of this whole wall, digitally stitch that together, with an ultra-high-resolution image, and put that up on the web. Then you could browse that, you could zero in on any kind of tiny, tiny content, and you could add to that white board, if you wanted, and so on; it fostered the continuation of the conversation. (JSB, 2001)"

[21]) how the virtual realm of communication will be expressed architecturally remains to be seen in future (Gromling, 2011).

`

scheduled and ad hoc communication" as one of the four approaches to the design of interdisciplinary research institutes. Research into innovation processes also amplifies the importance of unprogrammed learning and creative encounters as well as the role of place in supporting them[22]. Toker (2006) and Toker and Gray's (2008) exploratory analyses showed that university research center scientists make extensive use of face-to-face consultations for information exchange[23] and that such consultations mainly take place in the form of unprogrammed encounters[24]. Finally, they argue that configurational accessibility and high visibility of offices and amenities are main consultation facilitators among researchers[25]. In another study, Mojtahedi and Schermer (2013) conceptualized a relationship between place attachment processes and bridging social capital by mapping the geography of certain social relationships in the physical setting of the campus. Consequently, they argued that creative encounters[26], either serendipitous or programmed, can be realized within the context of other predictors of place attachment such as anchors and magnets[27] (Beckley, 2003), functional distance and proximity (Sugihara & Evans, 2000), scale and enclosure (Kaplan, 1984), smallness (Devlin, 2010), distinctiveness and continuity (Twigeer-Ross & Uzell, 1996), prospect and Refuge (Appleton, 1984), and connection to nature (Clayton, 2003).[28]

---

[22]) Important insights are often the result of a chance encounter in the staff canteen, in the car park or while waiting for the lift (Remmers, 2011).

[23]) Toker's (2006) findings signify an overwhelming predominance of face-to-face consultations (89%) over consultations through electronic media.

[24]) Unprogrammed encounters formed 80% of all reported consultations (Toker, 2006).

[25]) No technological innovation, however sophisticated, can really match the quality of real, face-to-face contact in laying the foundations for effective collaboration: trust, empathy, team spirit as well as creativity, commitment and dependability. And above all, as instinctively territorial beings, we rely on physical space as a frame of reference for our social interactions (Remmers, 2011).

[26]) Salovey in Halsband, 2005

[27]) Magnets are attributes that draw people to a place, and anchors are factors that keep people in place.

[28]) Another determinant factor in engendering creative encounters on campus recognized by Mojtahedi and Schermer (2013) was the "institutional character" of the place-type. For instance, library turned out to be a more

`

Other research on higher education settings has also recognized the role that different types of encounters play in the general campus ecology. Cranz et al. (1997) study showed how the informal seating arrangements along with the furniture's size and flexibility facilitate "casual encounters". Halsband (2005) indicated on "creative encounters" fostered by places of informality and interaction such as shared spaces for dining and living as well as diverse places where people feel welcome. Illustrating a picture of the "learning campus", Kenney et al. (2005) wrote about "planned and chance encounters" and their correlation with exciting places where faculty and students alike enjoy hanging out. Authors complete this image by suggesting the followings: appropriate closeness of buildings (density), juxtaposition of activities that complement one another (mixed use), scattered indoor and outdoor spaces, informal settings such as cafés, coffee shops, bistros in favor of evoking the Starbucks phenomenon, integration to wider community, and including opportunities for virtual socialization.

Following the same trend, studies on campus settings have also paid attention to Oldenburg's conceptualization of third place (1997, 1998, 2001) – a place where people relax in good company, community is brought together, newcomers are welcome, individuals similar to oneself can be found, individuals become familiar, and fun, entertainment as well as intellectual discussions are fostered[29]. Waxman et al. (2011) used this conceptualization and came up with guidelines for designing library coffee shops. Among the guidelines suggested by them are using anchors in the layout that allow people to establish temporary territories, providing a variety of

---

successful place for supporting creative encounters due to its "intellectual atmosphere" compared to the student union. Similar studies help campus policy makers to capitalize on place-types that already have the potential to support students' desire for learning and knowledge creation – places such as research institutes, library commons, etc.

[29]) The concept has also found its way to the knowledge management literature. Wenger et al. (2002) writes: "Communities of practice are what Ray Oldenberg calls 'neutral places,' separate from the everyday work pressures of people's jobs."

`

seating types, creating visual appeal, incorporating art into space, and providing access to reading material. In another study, Banning et al. (2011) explored special places for students on the campus focusing on third places and restorative environments (Kaplan et al., 1998).

2.3. Boundary mechanisms in the workplace

As stated in the first chapter, the goal of this dissertation is using social learning to provide a useful account for a way of understanding, framing, and driving change in the workplace architecture. So far, I have introduced the two realms of the social learning and knowing theories and workplace architecture. My contribution emerges as I use the social learning and knowing theoretical lens and lexicon to provide structure for, and later theorize, the wide range of terms and phrases used in the workplace literature, such as creative encounter, cross-pollination, serendipity, collision between social networks, scheduled and ad hoc communication, chance encounters, etc. to convey certain learning and knowledge practices.

According to the literature, it seems that these learning and knowledge practices are conceptualized by Wenger as 'boundary mechanisms' whose definition is useful in providing a more specific framing for this dissertation's hypotheses. Yet, before expanding on boundary mechanisms, I need to remind the readers that Wenger tends to use geographical metaphors in explaining his theory, possibly more than any other theorist of social learning and knowing. However, one should be mindful of the fact that his application of these terms is not literal and the direct extension and generalization of them to the material realm will most probably lead to misunderstanding. Consequently, examining Wenger's theory in the context of an architectural academic effort requires additional sensitivity towards the theory's terminology. Keeping this in mind, and to clearly state this dissertations hypothesis, I start by explaining differences and

`

similarities between several important terms in the context of CoP perspective. These terms include periphery, peripheral participation, boundary, boundary object, brokering, boundary encounter, boundary practice, and overlaps.

According to the CoP theory, as novices initially join communities of practice, they start learning at the periphery. This mode of learning happens as newcomers participate in low intensity and low-risk yet productive and necessary activities. For their learning experience to be authentic, peripheral participants are also granted legitimate access to resources of the community including its members and shared repertoire in use. Therefore, as the newcomer becomes acculturated to the norms and practices of the community, she becomes more knowledgeable, develops mastery identity, and eventually turns into an old-timer. Of course, peripheral members take responsibility of certain tasks that are necessary for the functioning of the community. However, as they move from peripheral to more active and core participation in the community, become more central, and construct new identities, they also naturally engage in a process of negotiating the identity of the community of practice. The constant negotiation of meaning contributes to the community's longevity, evolution, or paradigm shift as long as it keeps recruiting new members, and, of course, its core practices are not disrupted by other communities in the landscape. Differentiating between peripheries and boundaries, Wenger (1998) writes that although they both refer to the edges of the communities of practice, they emphasize different aspects:

> Boundaries – no matter how negotiable or unspoken – refer to discontinuities, to
> lines of distinction between inside and outside, membership and nonmembership,
> inclusion and exclusion. Peripheries – no matter how narrow – refer to continuities, to

`

areas of overlap and connections, to windows and meeting places, and to organized and causal possibilities for participation offered to outsiders or newcomers. (p. 44).

While peripheral participation has an inward tendency and is concerned about its host community of practice, boundary turns the focus outward and encourages the community to consider the broader landscape of practice. Wenger (2010, p.182-183) explains that learning, as the production of practice, creates boundaries, "not because participants are trying to exclude others (though this can be the case) but because sharing a history of learning ends up distinguishing those who were involved from those who were not". In other words, boundaries "are an unavoidable outcome of any depth of knowledge requiring a shared history of learning". In this way, the anatomy of a practice is like a culture where "even common words and objects are not guaranteed to have continuity of meaning across a boundary". Yet, Wenger emphasizes that a system requires the coexistence of "depth within practice" for creating learning potential and "active boundaries across practices" for creating innovative potential:

The meetings of perspectives can be rich in new insights and radical innovations … This means that the innovation potential is greater, but so is the risk of wasting time or getting lost. (p. 183).

Therefore, boundaries are important in that they not only connect communities but also "offer learning opportunities in their own right (Wenger, 2003, p.84). Tsui, Edwards and Lopez-Real (2009) complement Wenger's perspective by arguing that learning opportunities at the core of a community are different from those at the boundaries.

`

The former arise because competence and experience need to converge in order for a community to exist. The latter, in contrast, are brought about by the divergence of experience and competence. (p. 39).

Various boundary mechanisms can be the source of continuities and discontinuities across different communities of practice. Two types of boundary mechanisms that encourage connection between communities are boundary objects and brokering. According to Wenger (1998) boundary objects are artifacts, documents, terms, concepts, and often forms of reification around which communities of practice can organize their interconnections whereas brokering includes connections provided by people who can introduce elements of one practice into another. Similar to brokers, Wenger and Snyder (2000) and Wenger et al. (2002) refer to boundary spanners – individuals who span different worlds. This role creates connections between people from different organizations, cultures, sectors or localities, brokering and translating varying perspectives, and facilitating the application of ways seeing and doing across different domains (Hart, Davies, Aumann, Wenger, Aranda, Heaver, Wolff, 2015). Wenger (1998) writes that most of us in occasions exhibit brokering behavior. Yet, there seem to be individuals who thrive on being brokers: "They love to create connections and engage in "import-export," and so would rather stay at the boundaries of many practices than move to the core of any one practice". (p. 38).

Boundary encounters are another way of sharing a particular domain's local knowledge with another CoP in a relevant and useful way. Boundary encounters immerse members of a CoP in the activities of another CoP for a period of time and allows them to bring new knowledge from the interaction to the original community. Examples of boundary encounters include visits,

`

discussions, sabbaticals, etc. Wenger (1998, 2000b, 2010 in Chris Blackmore) writes that practice can also offer connections that go even beyond boundary encounters: boundary practices, overlaps, and peripheries. Boundary practices emerge as a result of a boundary's need for sustained work which can lead to the emergence of a CoP in its own right. Examples include new yet established academic disciplines such as environmental psychology that have their origins in boundary practice. Overlap does not require a specific boundary enterprise, but is provided by a direct and sustained overlap between two practices. An example is two departments with different disciplinary backgrounds working on a mutual project. Finally, peripheries provide experiences – of the kind Wenger argues newcomers need – to people who are not on a trajectory to become full members. Frequently asked questions pages, open houses and fairs, and even help desks are examples of peripheries:

> The idea is to offer them various forms of causal but legitimate access to a practice without subjecting them to the demands of full membership [and thus overwhelming them]. This kind of peripherality can include observation, but it can also go beyond mere observation and involve actual forms of engagement. The periphery of a practice is thus a region that is neither fully inside nor fully outside, and surrounds the practice with a degree of permeability. (p. 43).

During the next chapters, it will be shown how words and phrases such as observation (as a form of peripherality), casual access, permeability, boundary mechanisms, brokering, etc. become part of the attempt for creating a meaningful connections between social theories of learning and knowing and architect's framing of learning and knowing practices in workplaces.

2.4. Research questions

`

      The goal of this chapter so far has been to address two main curiosities: (a) what is the architectural expression of organizations' learning and knowing practices? And (b) can we impact these practices through physical space? To answer the first question, I reviewed the literature from two vantage points (social learning and knowing theories as well as those of architects and environmental design research) to learn about relationships and intersections between the physical space and learning and knowing processes. This effort included the understanding of learning and knowing in general and in the context of organizations, exploring social theories of learning and knowing, and reviewing empirical and normative views about learning and knowledge practices in the realm of architecture and environmental design research.

      Framing the nature of learning and knowing processes as constructed in social practice (Berger & Luckmann, 1966; Lave, 1988; Lave & Wenger, 1991), often tacit (Polanyi, 1967), enacted (Weick, 1979), distributed across time as well as social and material space (Hutchins, 1994), situated in authentic social and physical contexts (Brown, Collins, Duguid, 1989), starting at the individual level and translates to the organizational level (Senge, 1990; Nonaka, 1991), cultivated in organizations (Wenger, 2002), connecting practices from different communities in a landscape of practices (Wenger, 2015), material as well as mental and social (Lotour, 1987), resilient, but provisional and developing (Unger, 1987), and developed through participation within communities of practice (Lave & Wenger, 1991) changed the way this dissertation approaches the second question. Considering that all these qualities emphasize the social, procedural, and emergent nature of learning and knowing, a more accurate research question to ask is: can we impact learning and knowing practices through 'the process of making' the physical space?

49

`

Answering the new and improved research question requires bringing additional components into the equation. First and foremost, a methodology that could help the organization to navigate through change in its physical space as well as learning and knowing practices. Moreover, there is a need for a method of capturing and recording the aforementioned change for the purpose of engaging participants in the process of making sense of the change. The next chapter will expand on both.

`

3.   Method

The main driver in framing the method section of this dissertation is what Weisman (1983) refers to as "research application problem". He shows that there is substantial literature dealing with the problems of research and application in different areas of social and behavioral sciences and argues that environmental design research is not an exception either. Weisman (1983) identifies three root causes for the application problem: (a) Framing research as "an accumulation of social facts that can be drawn on by practitioners when they are ready to apply them (Susman & Evered, 1978)"; (b) institutionalized separation of research and application activities within the behavioral sciences due to the general tendency toward specialization in modern science and scholarship[30]; and, (c) adoption of traditional positivist and empiricist approaches to science which is simply not capable of dealing with many of the issues central to the study and understanding of organizations. This problem, as Susman and Evered (1978) argued, reflects not a "crisis of relevancy or usefulness … [but] really a crisis of epistemology".

I will start by addressing the deepest or most fundamental of these three problems by framing this study's strategy of inquiry pertaining to its philosophical worldview and then will explain the research design. In doing so, and in the first section, I will make a case for pragmatism, or neo-pragmatism, as a paradigm that employs a methodology which uses the method of science and is open to exploring the different kinds of methods that are employed in different sciences (Stanford Encyclopedia of philosophy, 2013). In the second and third sections, I will draw from core principles of this philosophy to explain how and why design thinking as a methodology emerged from the action research tradition is pragmatic in nature and suitable for

---

[30]) Sanford (1970) characterizes this as a "science-engineering" model "in which discoveries are first made (in the lab as it were) and then 'applied'".

`

this study. In the fourth and fifth sections, I will explore several methods used throughout the design thinking process for examining this dissertation's research questions. Finally, the sixth and last section of this chapter is concerned with the research setting and participants. Figure (1) shows how I will build my argument by addressing Weisman's (1983) tiers of research application problem.
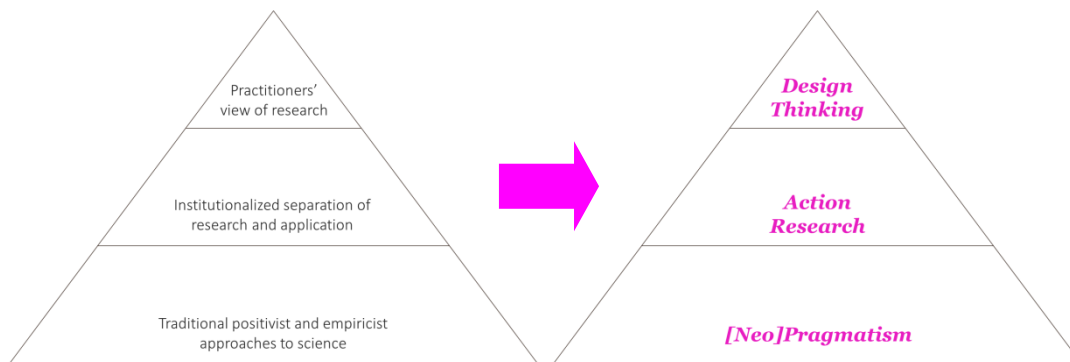
Figure (1) Addressing three tiers of research application problem.

3.1.   Pragmatism: The philosophical worldview

When it comes to researchers' strategy of inquiry pertaining to philosophy, there seems to be a consensus among authors on four commonly agreed worldviews: postpositivism, constructivism, advocacy/participatory/transformative, and pragmatism. "Positivism and its successor postpositivism are closely identified with quantitative research and constructivism with qualitative research (Hall, 2013)." Advocacy/participatory/transformative and pragmatism are associated with mixed methods approach. A summary of each worldview is shown in Table (1).

`

Postpositivism	Constructivism
• Determination • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation
Transformative	**Pragmatism**
• Political • Power and justice oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-centered • Pluralistic • Real-world practice oriented

Table (1) Hall's (2013) Summary of four philosophical worldviews pertaining to the strategy of inquiry

Pragmatism, the philosophical worldview used in this dissertation, can be traced back to the work of Peirce, James, Mead, Dewey, and later Rorty, Murphy, Patton, and Cherryholmes. Cresswell (2014) writes that there are many forms of this philosophy, but for many, pragmatism as a worldview arises out of actions, situations, and consequences rather than antecedent conditions (as in postpositivism). In other words, in pragmatism, there is a concern with applications – what works – and solutions to problems (Patton, 1990).

Fishman (1999) writes that "the pragmatic study combines the focus and structure of the positivist model with an emphasis on the hermeneutic thick description of case context". Such approach towards research is highly compatible with the current study which can benefit from a range of strategies and tactics offered by different methods each uncovering a certain aspect of an architecture of social learning and knowing. Some other characteristics of pragmatic approach towards research design are presented in the following (Robson, 2011; Fishman, 1999; Johnson & Onwuegbuzie, 2004; Creswell, 2014):

- Recognizes the existence and importance of the natural or physical world as well as the emergent social and psychological world. Therefore, knowledge is viewed as being both constructed and based on the reality of the world we experience and live in.

- Because pragmatism is not committed to any one system of philosophy and reality it endorses eclecticism and pluralism (e.g. different, even conflicting, theories and perspectives can be useful; observation, experience and experiments are all useful ways to gain an understanding of people and the world). This applies to mixed methods research in that inquirers draw liberally from both quantitative and qualitative assumptions when they engage in their research.

- Human inquiry (i.e. what we do in our day to day lives as we interact with our environments) is viewed as being analogous to experimental and scientific inquiry. We all try out things to see what works, what solves problems, and what helps us to survive.

- Endorses a strong and practical empiricism as the path to determine what works. And because truth is what works at the time, pragmatism is not based in a duality between reality independent of the mind or within the mind. Thus, in mixed methods research, investigators use both quantitative and qualitative data because they work to provide the best understanding of a research problem.

- Takes an explicitly value-oriented approach to research that is derived from cultural values; specifically endorses shared values such as democracy, freedom, equality, and progress.

- The guiding conception is typically (a) both molecular and holistic in focus; (b) systems-oriented and organic in concept; and (c) inclusive of a large number of variables.

- Discusses the study results in terms of (a) their applications to other similar case situations; and (b) their relevance for confirming the general usefulness of

the original guiding conception and/or for suggesting revisions of the guiding conception to make it more useful.

- Finally, pragmatists have believed in an external world independent of the mind as well as that lodged in the mind. But they believe that we need to stop asking questions about reality and the laws of nature (Cherryholmes, 1992) – "they would simply like to change the subject … [because such debates] does not get us anywhere" (Rorty, 1983, p. xiv)[31].

A useful and relevant explanation pertaining to the intent of this study's philosophical view is put forward by Richard Rorty, the American neo-pragmatist philosopher. Inspired by John Dewey, Rorty (1999) argues that the quest for certainty should be replaced with the demand for imagination, that one should replace knowledge by hope. He continues by saying that one should stop worrying about whether what one believes is well grounded and start worrying about whether one has been imaginative enough to think up interesting alternatives to one's present beliefs. So, in his view, concern about "building a better future" precedes the obsession about "correspondence to reality". This is a rather radical view of knowledge. Of course, researchers need to acknowledge and use 'evidence'. Yet the dilemma is that evidence often tells us about 'what is' whereas application, or what is referred to as 'design' in the architectural community, is often curious about 'what if' and 'what will be'. In the next section I will explain how Action Research resolves this dilemma.

---

[31]) "When they (pragmatists) suggest that we do not ask questions about the nature of Truth and Goodness, they do not invoke a theory about the nature of reality or knowledge or man which says that 'there is no such thing' as Truth or Goodness. Nor they have a 'relativistic' or 'subjectivist' theory of Truth or Goodness. They would simply like to change the subject. They are in a position analogous to that of secularists who urge that research concerning the Nature, or the Will, of God does not get us anywhere. Such secularists are not saying that God does not exist, exactly; they feel unclear about what it would mean to affirm His existence, and thus about the point of denying it." (Rorty, 1983, p. xiv)

3.2. From pragmatism to action research

In his comprehensive study of the emancipatory character of action research, Boog (2003, p. 429) writes that "Philosophical pragmatism, especially the works of the philosopher of education Dewey and his close friend the philosopher and social psychologist Mead, was the first grand theory to provide a firm foundation for action research". In the *Handbook of Action Research*, Peter Reason and Hilary Bradbury articulate five characteristics of action research: it is an approach to human inquiry concerned with developing *practical knowing* through *participatory, democratic processes* in the pursuit of *worthwhile human purposes*, drawing on *many ways of knowing* in an *emergent, developmental fashion*. Connections with the pragmatic philosophy are evident in all five characteristics of action research:

- Producing "practical knowledge" that is useful to people in the everyday conduct of their lives as a primary purpose of action research (Reason, 2002) is also at the heart of the pragmatic approach.

- Action research advocates for building "democratic, participative, pluralist communities of inquiry". In other words, action research is only possible with, for and by persons and communities (Reason & Bradbury, 2001). Rorty (1986) also argues that the desire for objectivity is not the desire to escape the limitations of one's community [to find a "higher, transcendent" truth (Fishman, 1999)], but simply the desire for as much intersubjective argument as possible, the desire to extend the reference of "us" as far as we can.

- "Worthwhile human purposes" in action research also corresponds with "usefulness[32]" of inquiry in pragmatism.

- Pragmatism, as the natural philosophical duo for mixed methods designs (Robson, 2011; Maxcy, 2003; Johnson and Onwuegbuzie, 2004; Johnson, Onwuegbuzie, and Turner, 2007; Onwuegbuzie and Leech, 2005; Bryman, 2006; Teddlie and Tashakkori, 2009; Denscombe, 2008; Creswell, 2014) is in alignment with action research's "drawing from many ways of knowing". Mixed methods, emerging as a third paradigm since the 1990s alongside qualitative and quantitative methodological worlds, involves combining or integration of qualitative and quantitative research and data in a research study (Creswell, 2014; Denscombe, 2008; Robson, 2011). In mixed methods design, research strategies and methods can be integrated in different ways.

- Finally, and regarding the "emergent" nature of inquiry, Reason (2002) explains that Rorty takes an evolutionary perspective which conforms to his anti-essentialist perspective: if there is no real reality to be described, if there are no absolute moral choices, human inquiry must be seen as a pragmatic process of continual problem-solving. Action research is similarly concerned with the emergent deepening of our understanding of the issues we wish to address, and the development over time of communities of inquiry.

---

[32]) When the question 'useful for what?' is pressed, [pragmatists] have nothing to say except 'useful to create a better future'. When they are asked 'Better by what criterion?' they have no detailed answer… [they] can only say something as vague as: Better in the sense of containing more of what we consider good and less of what we consider bad. When asked 'And what exactly do you consider good?', pragmatists can only say, with Whitman, 'variety and freedom' or, with Dewey, 'growth'. They are limited to such fuzzy and unhelpful answers because what they hope is not that the future will conform to a plan, will fulfil an immanent teleology… but rather than the future will astonish and exhilarate. (Rorty, 1999:27-8).

`

The emergent nature of action research is closely related to its participatory quality. Reason (2003) argues that many action researchers would agree with Rorty's position on the goal of the inquiry in the preface to *Philosophy and Social Hope*:

> We cannot regard truth as a goal of inquiry. The purpose of inquiry is to achieve agreement among human beings about what to do, to bring consensus on the end to be achieved and the means to be used to achieve those ends. Inquiry that does not achieve co-ordination of behavior is not inquiry but simply wordplay. (Rorty, 1999:xxv).

This is also reflected in Weisman's (1983) piece on Action Research where he argues that a central aspect of virtually all model of action research is the necessity of client/user-participation. The intent of participation in action research goes beyond capturing diverse voices; it is to make the element of action even bolder by empowering and equipping the user to participate in building and shaping a new reality – be it a new culture, a new design, or both. In most cases, such participation results in "gaining ownership of design from the users (Wener, 1982)" and consequently higher satisfaction (Reizenstein, 1976). But perhaps one of the most important outcomes of this participation is creating an organizational climate supportive of ongoing, small-scale modifications of the environment carried out by organization members even after the completion of the building (Schneekloth & Shibley, 1981).

It is important to touch on two additional attributes of action research approach. First, as Susman and Evered (1978) suggested, success "occurs because of the researcher's involvement, not from trying to avoid it". In other words and in Weisman's (1983) terms, "the action researcher has a commitment to the resolution of real problems". Second, when it comes to decision-making, "ordinary knowledge" (cf. Lindblom & Cohen, 1979) is as important as

`

scientific knowledge. Suggesting to involve more than "scientific data", Weisman (1983) refers to Lewin's earliest writings on action research where he emphasized the difficulties inherent in the application of "general" principles to "local" conditions. Figure (2) summarizes different aspects of action research.

Figure (2) Action research is a change-oriented approach to human inquiry which brings together, participation, empowerment, and action.
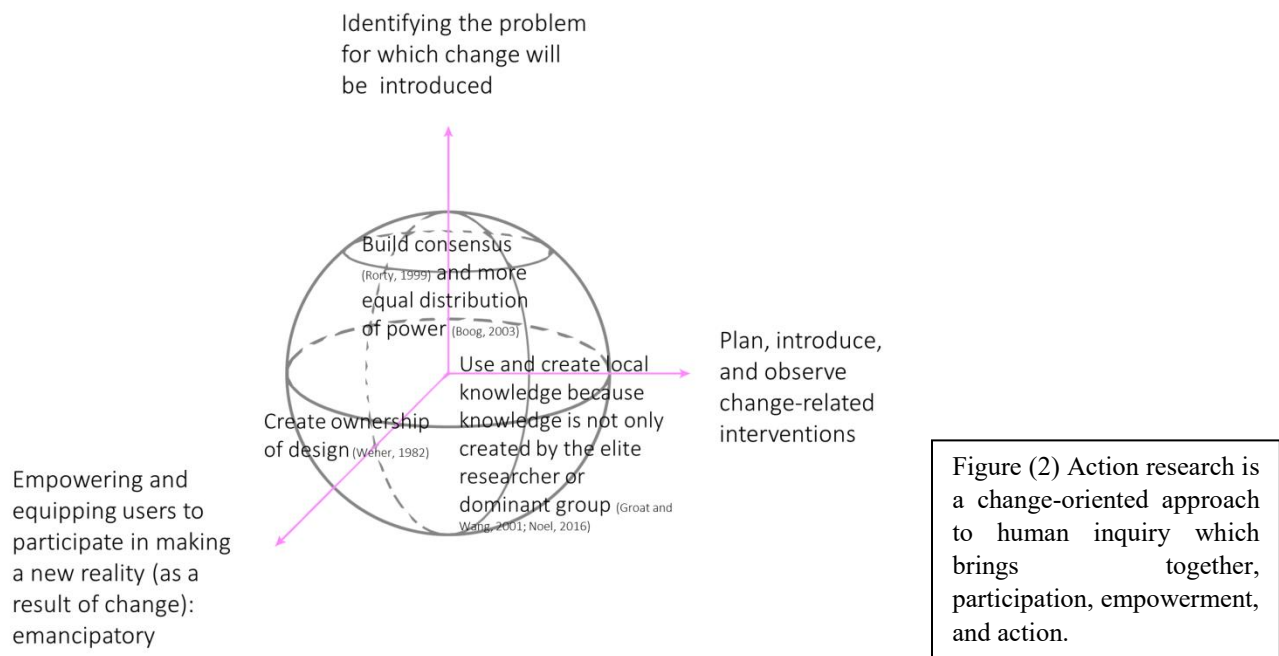
3.3. From action research to design thinking

Rooted in the participatory design tradition evolved since the early 1970s (Bjögvinsson et al., 2012; Gobble, 2014) and the ongoing design discourse about the nature of design since the 1960s (Rhinow & Meinel, 2014; Johansson-Sköldberg et al., 2013), Design thinking has been largely framed and popularized by IDEO in partnership with several other progressive design companies in the 1990s and Stanford University d.school during the mid-2000s as a way of enabling innovation and dealing with complex problems by making designers' way of thinking

`

accessible to non-designers (Camacho, 2016; Luchs, 2016; Katoppo & Sudradjat, 2014; Johansson-Sköldberg et al., 2013; Bjögvinsson et al., 2012; Melles et al., 2012). What has maintained the popularity of design thinking during the past two decades and across different disciplines is the fact that the subject of design, and consequently innovation, within the design thinking framework goes beyond artifacts and products and encompasses processes, systems, and even organizations. This has created an interested especially in the fields of management (Rhinow & Meinel, 2014; Liedtka & Ogilvie, 2011) including organizational change and development (Sato et al., 2010).

Design thinking is mainly characterized by the same attributes used to describe action research: it is concerned with developing practical knowing, uses participatory processes, is focused on real human problems, employs various ways of knowing, and heavily relies on iteration to collapse the user's understanding on something that she finds of value. In other words, it uses the same principles, methods, and techniques while clarifying their integration, sequencing, and overall goal based on the project's local features. Additionally, it incorporates the element of design[33], as a methodology and mindset for changing existing practices or situations or creating new ones from scratch, into the action research equation. Figure (3) summarizes different aspects of design thinking as it complements action research.

---

[33]) Romme (2003, 2004) explains that there are three archetypal modes of research. The goal of the science mode is to understand social phenomena on the basis of consensual objectivity by uncovering patterns. The goal of humanities mode is to understand experience of people inside social practice since knowledge arises from what people say about the world. Finally the goal of the design mode is to produce systems that do not yet exist either by changing existing practices and situations or by creating new ones from scratch. He further explains that the science mode continues to dominate the social science with the humanities mode as its emerging antithesis and critical opponent. This is while the design mode largely remains absent in social sciences.

Identifying the problem for which change will be introduced

Reinforcing optimism for change and emancipating new perspectives (borg et al., 2012) through rules of brainstorming

Start with people not the problem (empathy): Problem identified by participants to guarantee emancipation from oppressive cultural practices (Aasgaard & Karlsson, 2012)

Build consensus (Borty, 1999) and more equal distribution of power (Boog, 2003)

Use and create local knowledge

Plan, introduce, and observe change-related interventions

Create ownership of design (Wener, 1982)

Empowering and equipping users to participate in making a new reality (as a result of change): emancipatory

Fail-friendly, iterative prototyping (Tonkinwise (2010) to counter 'masking subtle exploitation' (Hart & Bond, 1995) by reducing risk

Figure (3) Design thinking as a methodology and mindset for changing existing practices or situations or creating new ones from scratch.

Several studies have recognized the many parallels between the two approaches. For example, Katoppo and Sudradjat (2015) adopted design thinking as a tool to complement participatory action research in architectural research method and argued "undoubtedly, the combination of PAR and DT will eventually enrich architectural research with new social and participatory dimensions". Trullen and Bartunek (2007) also recognized the similarities and wrote that design approaches "follow steps established in action research interventions – data collection, diagnosis, planning, taking action, and evaluating needs which may lead to another cycle of action" (p. 33). Tonkinwise (2010) went one step further by framing design thinking as a form of action research:

[D]esign thinking is foremost defined as the sort of action research that comes from fail-friendly, iterative prototyping in context of immersive social research. (p. 381).

`

Design thinking in essence argues for a social and situated view about the nature of design; that is, it uses certain tools and techniques to situate and embed the design work in the social setting which lives with the design challenge or opportunity. This view is the guiding principle underlying all the steps in the process: "Inspiration, ideation, and implementation (Brown, 2008)". The inspiration phase includes the process of creating insights through gaining deep ethnographic knowledge about the social setting within which the challenge or opportunity is situated – in the design thinking lexicon, this process is referred to as empathy. In his editorial note on Design Studies special issue, Articulating Design Thinking, Rodgers (2013) writes that "[t]here is no universally agreed upon definition of 'design thinking', but the strongest common denominator embraces the centrality of the user and empathy to the human condition". While the inspiration phase is concerned with the 'what is?', ideation, also a collective endeavor, focuses on the 'what if?' (Liedtka & Ogilvie, 2011) to transition the process from synthesized data and patterns to insights and needs in favor of creating opportunity areas for "generating, developing, and testing ideas that may lead to solutions (Brown, 2008)":

> At this stage … [w]e begin to wonder (borrowing the words of historians Neustadt and May) where the future might divert from the familiar flows of the past, how our insights could translate to new possibilities. Designers call this stage ideation. (Liedtka & Ogilvie, 2011, p.28).

Ideation is associated with divergent thinking during which many choices are created, whereas implementation's convergent mode encourages for choices to be made (Brown, 2009; Dym et al., 2005). It is during the implementation phase where ideas with higher level of

`

responsiveness to the setting's resources and constraints are identified and then piloted for the purpose of receiving feedback and iteration.

3.4.　Research methods and process

The third major element in Creswell's (2014) framework is the specific research methods that involve the forms of data collection, analysis, and interpretation that researchers propose for their studies. The following shows the overall flow of the research study and research methods used throughout the process.

Step 1: Inspiration

Goals: To collect data about behaviors, thoughts, feelings, personalities, and daily routines of participants to describe archetypal users in the workplace. Archetypes represent certain imaginary yet evidence-based demographics in the workplace with whom participants can empathize in an educated way. Archetypes not only define problems that certain demographics deal with in the office, but also offer opportunities for ideation.

Methods: The results from the company's office-wide survey were combined with those of the three questionnaires. Insights extracted from the surveys and questionnaires were used to create archetypal users.

- Work behavior questionnaire: This semantic differential questionnaire, designed by the author, asked participants to choose between various modes of work and behavior in the workplace. Participants also indicated the generation they belonged to (Z:

20s, Y: 30s, X: 40s, and Baby boomers: 50s and over), their discipline, department or practice group, and their level in the organization.

- Work persona questionnaire: This multiple choice questionnaire, designed by the author, asked participants to choose three personas that they most identify with out of 10 personas described in 'the ten faces of innovation' by IDEO's Tom Kelley and Jonathan Littman (2005).

- Work forecast questionnaire: This questionnaire, designed by the author, asked participants to describe their workplace 10 years in the past and then delineate their workplace 10 years in the future.

Step 2: Ideation

Goals: To engage users in a process of brainstorming about different ways of working in the workplace as well as the physicality of it. The process encourages for everyone's voice to be heard, for users to collectively negotiate allocation of spatial and physical resources in the future workplace, and for people to become change agents for the cultural shift. Afterwards, participants' artifacts are analyzed and themes and patterns that would help the design team to develop design scenarios are identified.

Method: 63 individuals volunteered to use the archetypes developed in step 1 to engage in a process of resource allocation in the future workplace. Each group became responsible of creating a prototype of their ideal workplace by choosing and distributing cards that represented furniture and space types which addressed problems and opportunities provided by archetypes.

`

During the analysis, the area and location dedicated to different furniture and space types were studied in all individual artifacts and in comparison with one another. Moreover, the popularity of certain furniture and space types were explored. Artifacts were also overlaid on top of each other to reveal recurring patterns of use and location. The design team used all the findings to develop design scenarios.

Step 3: Implementation

Goals: To create a mockup of the future workplace and test the hypothesis.

Methods: A combination of people-space analytics and thick description was used to map the behaviors of 19 participants before and after installing the mockup while going beyond factual accounts and giving meaning to participants' actions by placing them in their cultural context.

People-space analytics is a term that I use in this dissertation to describe an approach towards capturing, analyzing, and contextualizing social dynamics in the physical space for providing accounts about how organizations use the physical space. Launched in the summer of 2014 by Amin Mojtahedi and Tahereh A. Hosseini, people-space analytics toolbox employs different technologies, techniques, and theories – from tracking social interaction and location using social sensing technology to incorporating Social Network Analysis and ethnographic thick description.

Discussion about people-space analytics partly requires an understanding of 'datafication' and its applications in organizations. According to Kenneth Cukier (2013) datafication refers to the fact that daily interactions of living things can be rendered into a data

`

format and put to social use. Datafication starts with the assumption, or the fact, that there is a large body of information floating around, the Big Data, about different aspects of the world that have never been quantified before, that can be captured, analyzed, visualized, shared, and finally, put in new uses. Datafication is perhaps the partial actualization of Gordon Bell and Jim Gray's (1999) prophecy almost 15 years ago: "By 2047 almost all information will be in cyberspace … including all knowledge and creative works. All information about physical objects including humans, buildings, processes, and organizations will be online. This trend is both desirable and inevitable."

According to several researchers including Wenger himself, there is validity in using SNA methods and techniques in understanding CoPs. In 'communities of practice and social learning systems' Wenger (2010) writes that the concept of community emphasizes identity while network focuses on connectivity. Yet he also argues that the two usually coexist and CoPs are certainly networks in the sense that they involve connections among members. There are examples of studies such as Marsico et al. (2014) and Cross et al. (2006) which use SNA methods and metrics to map CoPs. That said, CoPs and networks are distinct structures since "community emphasizes identity and network emphasizes connectivity (Wenger, 2010)". Considering this, people-space analytics uses various knowledge and learning theories to make sense of the collected information, yet on the methodological level it draws inspirations from two fields. The first are is characterized by the work of Human Dynamics Lab at MIT Media Laboratories. This methodology is captured in Pentland's (2014) definition of social physics:

"Social physics is a quantitative social science that describes reliable, mathematical connections between information and idea flow on the one hand and people's behavior on

`

the other. Social physics helps us understand how ideas flow from person to person through the mechanism of social learning and how this flow of ideas ends up shaping the norms, productivity, and creative output of our companies, cities, and societies."

Ben Waber, a visiting scientist at the MIT Media Lab and the author of 'people analytics: how social sensing technology will transform business and what it tells us about the future of work', is also a proponent of data-driven strategies for building better organizations. Waber's sociometric badge combines infra-red (IR), accelerometer, microphone, and Bluetooth into a single device to record people's social activity and working behavior – when, how, and with whom they interact. Although Waber's work is mostly focused on the social side of organizations, he has acknowledged the significance of physical and spatial qualities of workplaces in several occasions (2013, 2014):

"Companies should always look to physical space as a key part of their toolbox for changing patterns of collaboration and behavior. The actual layout of the office, the type of furniture, and the decision to let employees work remotely all have a profound impact on both companies' and individuals' success. Distance is not dead. If anything, it's more central to our lives than ever."

While the first area puts emphasis on the network aspect, the second field draws from the principles of ethnography to expand on the community aspect. Here, the goal is to observe, record, and analyze the culture of the workplace by interpreting, gaining, and explaining the meaning of signs based on "thick description (Geertz, 1973)". The cultural anthropologist Geertz (1973) describes thick description as a way of going beyond factual accounts and giving meaning to certain actions, words, and things by placing them in their cultural context. Thin description

`

by contrast, is merely factual account of practices or the phenomenon without interpretation through the lens of the local culture.

3.5. Research setting and participants

This dissertation's research setting is in the Milwaukee (WI) office of a national architecture and engineering firm. The office is comprised of four larger practice groups including *Healthcare* for healthcare processes and buildings, *P|C* for government and corporate work settings, ACE for arts, community, and educational buildings, and EI for energy, building infrastructure, and engineering. Moreover, two sub-groups that support all practice groups are interior design and administration. One of the main reasons for choosing this site was that the organization is growing at a relatively fast pace and the existing layout of the office is no longer responsive to the emerging needs including those of recent recruits. Therefore, the most immediate demands are (1) need for additional space, and (2) need for space that is supportive of evolving organizational dynamics. Due to senior management's decision about staying in one location, the organization's response has been a combination of acquiring additional space as well as redesigning the interiors through revisiting general physical and spatial characteristics and arrangements of various space and furniture types in the workplace.

Participation in different steps of the process varied between 19 to 63 individuals based on the type of activity throughout the research process. Participation in step 1 and step 2 was voluntary and open to all employees in the office. Over 60 people participated in each of these steps. Participation for step 5 was also voluntary for the group of employees whose workstations were in the area where the mock-up was later installed. The reason behind this decision was to compare the results rendered by people-space analytics before and after installing the mock-up.

`

Prior to executing different steps of this process, it was explained to participants that their personal information will remain confidential. During focus groups, there was a mutual understanding between senior management and employees about creating a safe space for honest evaluation and impactful ideation. For the last step of the process, I needed to ensure that the results would not have a negative impact on the 19 participants' employment or would not give them special privilege. Therefore, I met with senior management in advance and explained that the purpose of the study is to look for insights, not gathering information about behaviors of individuals. Moreover, it was explained to participants that the final results will by aggregated and anonymized to the extent that cannot be traced back to individuals.

`

4.   Findings

As discussed in the previous chapter, design thinking, as a participatory method of identifying and addressing wicked[34] problems, was used to address the complex challenge of increasing cross-pollination among people and social units through reimagining the workplace interiors. During the inspiration and ideation phases of the process, 63 co-designers were engaged. In the implementation phase of the design thinking process, 19 employees across different organizational levels and generations volunteered to participate in a behavioral mapping study which used people-space analytics to track social interactions and locations in a full-scale prototype as large as 5000 sqf. In this chapter, I will report the findings at each phase, yet it is only the findings from the implementation phase that will be explained from the CoP perspective. While inspiration and ideation phases include the process of how the final prototype came to be, it is the implementation phase which becomes a test bed for understanding work dynamics in the physical space through the lens of CoP concepts.

4.1.   Findings from the inspiration phase

The goal of the inspiration phase is to first uncover users' behaviors, emotions, and needs pertaining to their workplace, and then, frame those findings in the form of insights that explain challenges and opportunities regarding their existing work and workplace conditions. Insights from the three surveys were captured in the form of six personas representative of various user-types in the workplace.

---

[34]) "Professor Horst Rittel of the University of California Architecture Department has suggested in a recent seminar that the term "wicked problem" refer to that class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Churchman, 1967, p.141).

`

Surveys

The analysis of results from the work behavior questionnaire across six departments at the workplace indicated that people's perception of their work behavior is mostly consistent inside their department but is different across departments. This was more evident in the *Public | Corporate*, *Arts, Community, and Education (ACE)*, *Interiors*, and *Admin departments*. For example, as it is shown in Figure (1), the majority of administrators share the same work behavior characteristics which are almost opposite to responses from Public| Corporate participants.
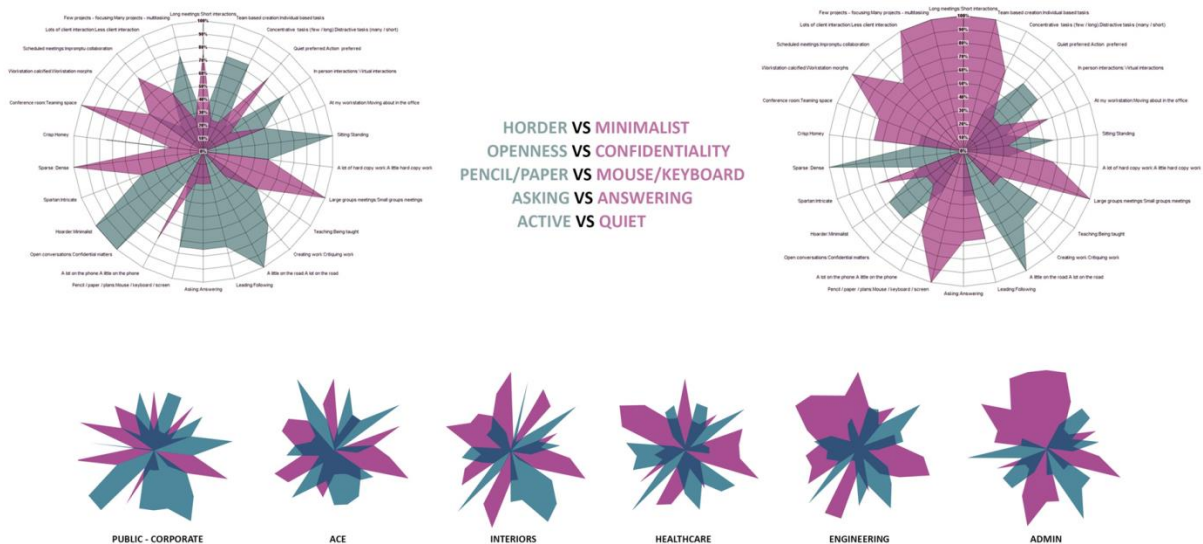
Figure (1) Work behavior questionnaire results include the analysis across six departments in the workplace. The top two graphs show the comparison between Public|Corporate and administrators behaviors as an example. Administrators and engineers reported similar work behaviors. Yet, their work behaviors were almost the complete opposite of those of Public|Corporate and ACE practice groups. Healthcare practice group had the most diverse population.

Work behavior data analysis across four generations also revealed an interesting insight. According to the results rendered in Figure (2), the respondents' consensus on their work behavior characteristics increases by age. The spikes in the Baby Boomers' diagram are

`

indicative of more maximums and minimums in participants' responses whereas the shape of the Generation Z's diagram is indicative of more diversity of behavior among respondents.

The most important finding in response to the work persona questionnaire was that not even a single Generation X and Baby Boomer perceived him/herself as a cross-pollinator. On the contrary, majority of Generation Y and Z participants associated themselves with that persona. As a result, cross-pollination as a function of age group became a topic for further investigation in the implementation phase.
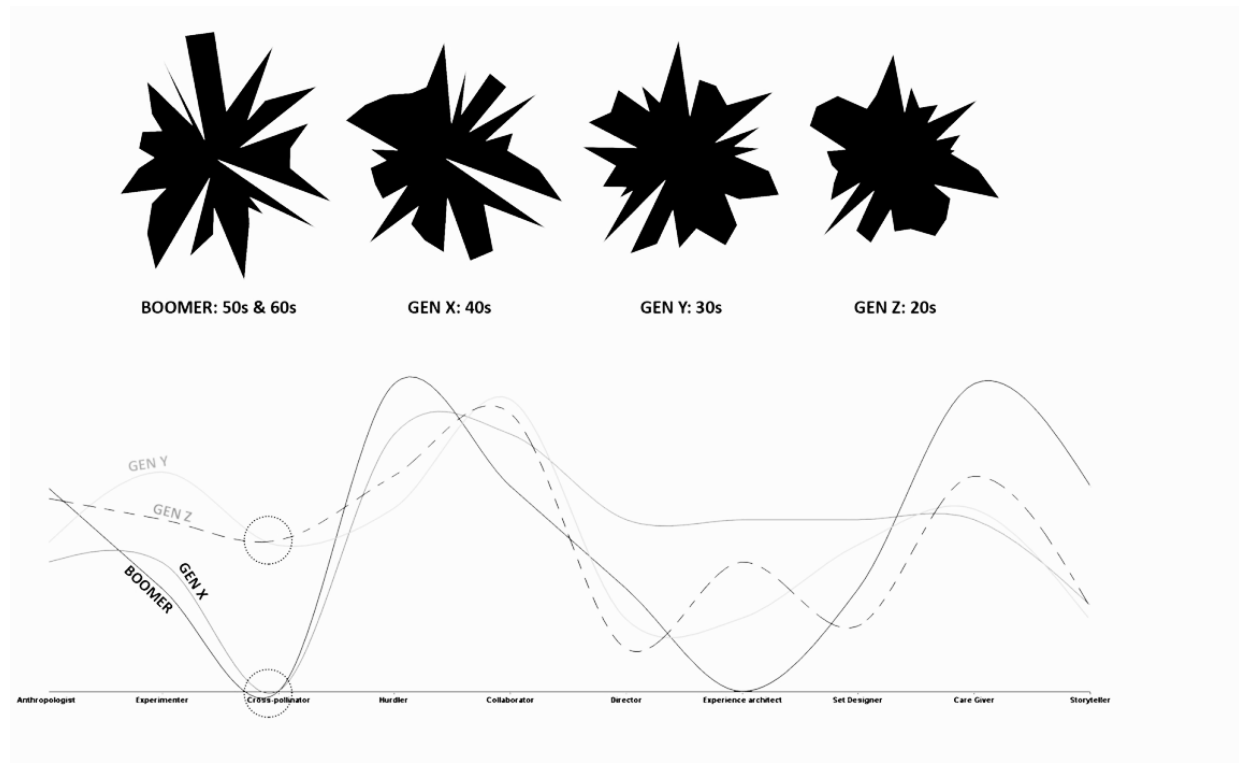
Figure (2) Top: results of the work behavior survey across four generations; bottom: results of the work persona survey across four generations. When it comes to work habits, baby boomers and Gen Z are the opposite ends of the spectrum. Gen Zers include the most diverse population while the majority of Baby Boomers have consensus on their work behaviors. This means Gen Z require a variety of different working conditions. Along with the Millenials, they also consider themselves the workplace's cross-pollinators. However, social network mapping study using social sensing technology later showed that there is not a significant difference between different generations' cross-pollinating behavior.

`

4.1.2. **Archetypes**

To frame challenges and opportunities for the ideation phase, patterns and insights generated from three surveys were captured in the description of archetypal characters which represented certain demographics in the office. Each archetype included a description which depicts a certain group of employee's traits, behaviors, and emotions about the work as well as the workplace. The archetype's description also renders needs and challenges as well as opportunities for redesigning the work and the workplace. The results from the work satisfaction questionnaire gathered from 112 employees, which was launched prior to this study, was combined with work behavior questionnaire and work persona questionnaire gathered from 63 participants to create coherent archetype descriptions. As a result, the following six characters were developed:

Jackie

Jackie is in one of the private semi-enclosed offices. Being with HGA for more than 10 years, she is a tireless problem-solver who gets a charge out of tackling something that's never been done before. When confronted with a challenge, she gracefully sidesteps the obstacle while maintaining a quiet, positive determination. This optimism and perseverance can help big ideas upend the status quo as well as turn setbacks into an organization's greatest successes - despite doomsday forecasting by shortsighted experts.

In a typical week, Jackie spends less than 30 hours at her workstation mainly because she travels a lot. The majority of her interactions with the client either happen at an offsite location or via email and phone. She doesn't think that her individual workstation necessarily has an impact on her performance, and because she spends a considerable amount of time on the road, she has developed the ability to work from different places. In fact, Jackie's main reason for going to the office is to collaborate, yet she doesn't find the office very supportive of unscheduled and impromptu meetings. So for her, collaborations mostly happen at workstations (either hers or others) as well as teaming spaces. For this very reason, she wishes the office had more teaming spaces with better privacy (both visual and auditory), surfaces on which she could write, soft seating, and standing tables - opinions that are being shared by the ma-jority of people in the office.

To Jackie, proximity to the project team members as well as copier and printer matters most. In addition to those, closeness to practice group colleagues and teaming spaces is also high priority. While at the office, Jackie likes to be in the middle of the action, and that's what she likes about her workstation - although it's not really supportive of her speech privacy. She is a multitasker who constantly moves in the office from workstations to conference rooms and teaming spaces, but prefers to keep her meetings short and in small groups.

`

Matt

Matt is in his late 20s and has been with HGA for less than 5 years. He is an experimenter who believes in learning through a process of enlightened trial and error. He spends most of his workday sitting at his workstation due to his mode of work which is often lean-forward computer-based, specific, and requires a high level of individual focus and concentration. Therefore, although he is in one of the corner cubes with a decent amount of personal space, sometimes he needs a more private space which he could occupy for a few hours to get away from disruptions and get his individual task done.

Proximity to practice group colleagues as well as project team members matter most to Matt because majority of his communications with others are impromptu face-to-face and happen at his workstation. He seldom interacts with the client, and since the majority of his collaborative activities are unscheduled, he prefers the concept of teaming spaces over conference rooms. However, he thinks teaming spaces have four major problems: they aren't flexible enough (e.g. no moveable tables), they aren't as quiet as they should be, they aren't very resourceful (lack of video conferencing, writeable surfaces, tackable surfaces, etc.), and finally they aren't really ideal for collaborative work in larger groups (more than 3 people). So when it comes to meeting people, he often has to choose between his workstation or a conference room.

Matt's work is often very specific and requires a high level of attention, so he can't afford getting distracted by a messy workstation. Although there are many things at his desk, he tends to keep his workstation tidy and organized. So the existing good amount of work surface and storage space at his workstation definitely helps

Rob

Rob has been with HGA for more than six years now. He is in one of the corner cubes which, of course, has its perks - for instance, it provides him with a very useful amount of work surface and more autonomy-, but at the same time, he thinks its non-adjustable features and lack of mobility are hindering his performance. Moreover, being close to conference rooms can sometimes be very distracting - especially before and after meetings where people hang out outside the room.

Rob doesn't think of himself as a cross-pollinator, rather a tireless problem solver who values the team over the individual in the interest of getting the job done. Therefore, to him, proximity to other practice group colleagues in the office is more important than being close to project-team members.

He thinks the office is designed mostly around individual work and scheduled meetings, so it doesn't effectively support impromptu and unscheduled work-related activities. This could partly be solved if the teaming spaces were more resourceful. For instance, if they had video-conferencing capabilities, necessary software programs, better visual and auditory privacy, writeable surfaces and were also more spacious.

Sometimes when Rob is engaged in group-based problem-salving activities, he needs proto-typing materials to make things visual and tactile as well as really large surfaces on which he can lay full size sheets. But there doesn't seem to be a readily available space in the office to afford such activities - again, teaming spaces are too small and not convenient for active brainstorming.

`

Megan

When it comes to solving problems, Megan values the team over the individual. In the interest of getting things done, she coaxes people out of their work silos to form multidisciplinary teams. Therefore, there are many times that proximity to project team members are more important to her than proximity to practice group colleagues or department. Although she considers her individual workstation as home-base, Megan is relatively mobile in the office. She seldom goes to work-related trips but has a fair share of client meetings at the office.

She is a multitasker and works on several projects all at once, so she prefers an active and energetic environment. Consequently, she finds the concept of teaming and breakout spaces very useful because they are supportive of her short meetings in small groups - which happen more often. That said, Megan doesn't find existing teaming spaces supportive of large group collaborative work (more than 3 people) or for meetings more than 30 minutes - simply because the furniture is not designed for them.

Megan likes personalizing her desk and keeping certain things where she can see them. Especially when it comes to drawings, she needs to have a good amount of surface area next to her monitor to be able to go back and forth between physical and digital. Additionally, although workstations provide a decent level of privacy and are supportive of her concentra-tive work, they don't respond well to her storage needs. In other words, Megan values her work surface area but because she deals with so many physical artifacts (e.g. samples, bind-ers, folders, etc.), she feels a need for a better storing mechanism rather than increasing desk surface area. The existing storage at her workstation is not really facilitating her work and the interiors library is just not enough.

Ashley

Ashley is deeply empathetic and an observer of human behaviors. Ashley's workstation is where 90% of her work happens, but because she constantly interacts with other employees, she has her finger on the pulse of the office. Ashley's one-on-one interactions with others are often short, involve answering questions, and mostly happen at her desk. She doesn't use the phone very often - most of her communications are either face-to-face or via email.

She is a multitasker and works on several projects all at once, so there are times that she requires a serene environment where she can focus far from distractions without being com-pletely cut off from her team members. Majority of her tasks are individual, so it happens very often that she needs visual and auditory privacy. However, she thinks that the office is not supportive of her concentrative work and doesn't provide her with speech privacy - in fact, she sometimes feels that she is being overheard. On the bright side, she thinks that her workstation is responsive to visual privacy, plus it has a good amount of storage space.

Ashley likes the casual yet efficient character of the coffee bar and thinks it's a good hub for socializing. She thinks teaming spaces could convey the same vibe if they had soft seating or standing tables with stools. Additionally, she thinks the lack of auditory and visual privacy as well as absence of tackable and/or writeable surfaces in teaming spaces has made them less effective.

When it comes to proximity to certain resources and spaces in the office, closeness to the reception and lobby area, lunch room, conference rooms, or even teaming spaces doesn't really matter to her; however, proximity to copier and printer is extremely important since she has to process lots of paperwork on a daily basis. That said, she keeps her workstation clean and clutter-free, so things on her desk constantly change.

`

Aaron knows that the path to innovation is strewn with obstacles and has developed a knack for overcoming or outsmarting those roadblocks. One of his strategies is to bring eclectic groups together, and often leads from the middle of the pack to create new combinations and multidisciplinary solutions.

Therefore, Aaron's work activities are very diverse and include a fair share of heads-down focused, small-group brainstorming around computer, short impromptu encounters, and one-on-one conversations among many others. This all means that he needs a variety of options and spaces depending on the type of work that he does, which in some occasions translates into him being more mobile. However, even if these spaces were available, his desktop, and more specifically Revit, would hinder his mobility. So Aaron thinks that his workstation, or the fact that he is bounded to his workstation, has an impact on his performance. Even when it comes to storage, Aaron prefers using horizontal surface, flat files, and drawers - properties that are not provided by his workstation.

A great number of his short and impromptu conversations with others happen either at his workstation or at a colleague's work space. Therefore his proximity to project team members is as important as his proximity to practice group colleagues. Also, he would rather to be close to printer/copier and teaming spaces. He likes the fact that the workstation provides him with a level of visual privacy and personal space, but at the same time, it's not responding to his various modes of work especially when he needs to make phone calls without interruptions, focus (e.g., reading and writing), do creative work, or have unscheduled meetings. In addition to these needs, there are also experiences that he wishes the workplace could afford – in conversation with a colleague, Aaron once said: "I'd love to be able to sit on a couch with a coffee and work in Revit!" He also thinks the architectural library is a missed opportunity.

These six archetypes were then used in ideating about the characteristics of the future workplace.

4.2. Findings from the ideation phase

During the ideation phase, groups of six or more participants received all six archetypes, a stack of cards which represented scaled furniture and space types, and a scaled game board representing the portion of the office in which the mockup was to be installed. Each individual in the group was asked to choose an archetype, to read it, and finally to represent it during the ideation. In other words, participants were encouraged to set aside their biases about the future workplace, gain empathy with data-driven archetypes developed based on multiple surveys, and make educated decisions regarding real challenges and opportunities in the workplace (Figure 3).

Figure (3) Individuals in groups of five to six channeled their archetype before creating the future layout.

Each individual representing an archetype then chose his or her corresponding furniture and space cards according to his or her demographic in the office to later engage in a negotiation with the other five individuals in the group about the distribution and configuration of cards on the game board. Maintaining their characters, each group was asked to create two artifacts: one representing a practical scheme and the other an extreme depiction of the future workplace. As a result, 14 artifacts were created by seven participating groups which were later translated into color-coded schemes (Figure 4).

Figure (4) 14 different configurations of space and furniture types created by seven groups of participants. The top two rows show the artifacts created during the ideation phase including the practical and extreme schemes whereas the bottom two rows are color-coded artifacts for the purpose of facilitating the study of adjacencies and measuring areas devoted to each space or furniture type.

`

The analysis of the artifacts was conducted on three levels:

(a) Calculating the area devoted to each furniture or space type across schemes

In addition to revealing the area required for each furniture or space type, this analysis also showed that participants assigned a significant area to enclosed spaces. In the practical scheme, the proportion of open working area to enclosed working area was 1.55 which was increased to 1.75 in the extreme scheme. Open working area included large table, medium table, large worksurface, small worksurface, and comfy chairs whereas the enclosed working area included large enclosed room, medium enclosed room, and small enclosed room. A summary of this analysis is represented in Figure (5).
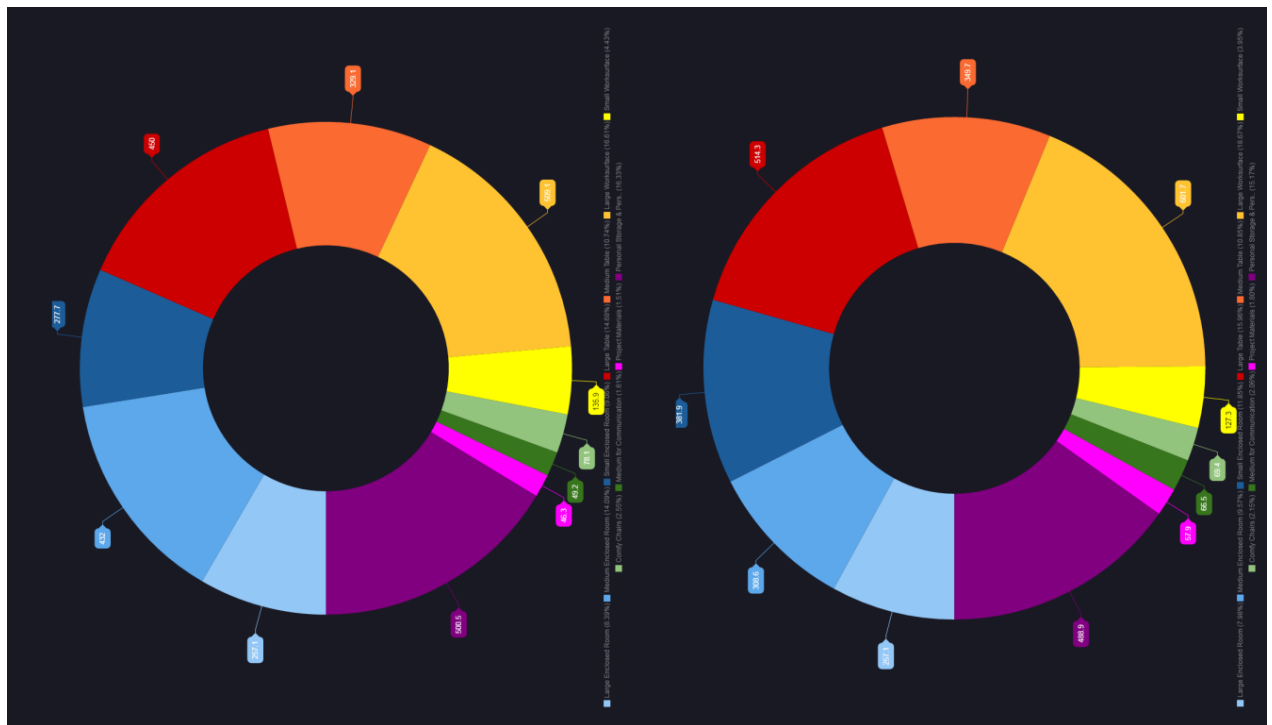
Figure (5) Percentage of the area dedicated to different space and furniture types in participants' practical (left) and extreme (right) schemes. There was not a significant difference between the two schemes pertaining to the area dedicated to each space or furniture type. Each color represents a certain space and/or furniture type. Light yellow: small work surface; dark yellow: large work surface; orange: medium collaborative table; red: large collaborative table; dark blue: small enclosed space; medium blue: medium enclosed space; light blue: large enclosed space; dark purple: personal storage; light purple: project materials space; dark green: medium for communication; light green: comfy chairs.

`

Figure (6) ranks different schemes based on the similarity of the area dedicated to space and furniture types compared to Figure (5) representing the average area. A higher score indicates higher similarity. This analysis shows groups with higher number have more consistency in their interpretation of the space and furniture type areas attributed to archetypes.

Figure (6) Each scheme's similarity to the average ranked from farthest (1) to closest (7). The left column represents all the practical schemes and their dedicated areas while the right column includes all the extreme schemes with their dedicated areas. The purpose of this analysis was to identify configurations whose area allocations were closest to the average. Therefore, the schemes which scored '7', '5', and '4' guided designers' decisions in creating the mock-up.

`

(b) Investigating trading patterns by counting the number of space and furniture types across schemes

This analysis, captured in Figure (7), shows different groups' behavior pertaining to their preference about choosing certain space or furniture types over others. The logic behind this analysis was that if a group has a card which is ranked minimum across all groups, then they have likely replaced it with another card ranked maximum across all groups. Therefore, each scheme was studied individually to identify maximum and minimum number of different cards across groups.

	Large Enclosed Room	Medium Enclosed Room	Small Enclosed Room	Large Table	Medium Table	Large Worksurface	Small Worksurface	Comfy Chairs	Medium for Communication	Project Materials
A1	1	3	6	3	2	4	6	2	3	2
B1	2	3	4	3	4	6	2	4	1	0
C1	2	3	0	1	1	8	24	7	0	0
D1	0	4	5	2	2	5	8	6	4	4
E1	1	4	3	3	3	5	2	4	2	3
F1	2	3	4	1	3	8	5	2	2	2
G1	0	1	2	1	1	8	0	2	5	5

	Large Enclosed Room	Medium Enclosed Room	Small Enclosed Room	Large Table	Medium Table	Large Worksurface	Small Worksurface	Comfy Chairs	Medium for Communication	Project Materials
A2	1	2	4	3	1	3	6	2	3	2
B2	2	3	4	3	4	9	2	4	2	0
C2	1	3	2	2	5	9	4	2	2	0
D2	1	2	8	1	1	4	6	2	4	0
E2	1	3	5	3	0	6	0	2	0	0
F2	2	0	6	2	4	11	15	6	8	10
G2	0	2	4	2	2	10	11	6	4	8

Figure (7) Studying each group's preference in using certain space or furniture types over others: The top table represents the number of cards in the practical scheme whereas the bottom table belongs to the extreme scheme. Each highlighted cell includes a number that is closest to the average number of a particular card used across different schemes. This means that in investigating maximums and minimums in each column, we need to study the two tails of each column. In other words, the numbers farthest from the highlighted cell in each column are the best candidates for unveiling participants' preferences.

Results of these exchanges between maximums and minimums are captured in the 11 diagrams of Figure (8). Each diagram is comprised of 3 main parts: (a) furniture or space type(s) at the top; (b) furniture or space type(s) at the bottom; and (c) connecting arrow. The furniture or space type(s) at the top represents the space or furniture type which is ranked minimum, or close to minimum, across all groups whereas the furniture or space type(s) at the bottom represents the one(s) which is ranked maximum, or close to maximum, across all groups. Grey arrow shows that the exchange has happened two times and the black arrow is representative of an exchange equal or more than three times.
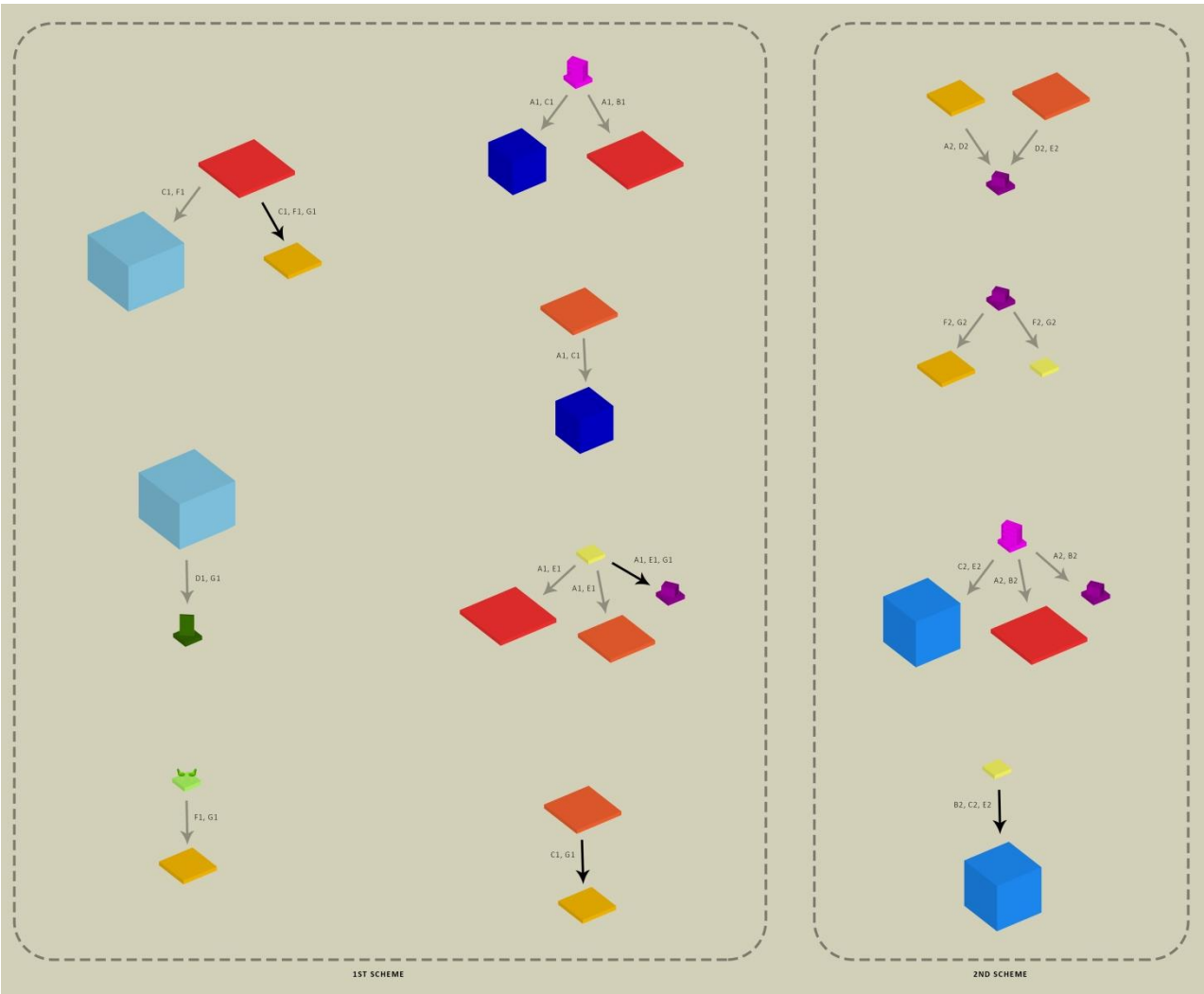
Figure (8) Space or furniture types which groups traded for others

Figure (9) summarizes the results of the trading analysis. Large enclosed room was the most unpopular items whereas small and medium enclosed rooms as well as large table and worksurfaces were among the most popular.

`
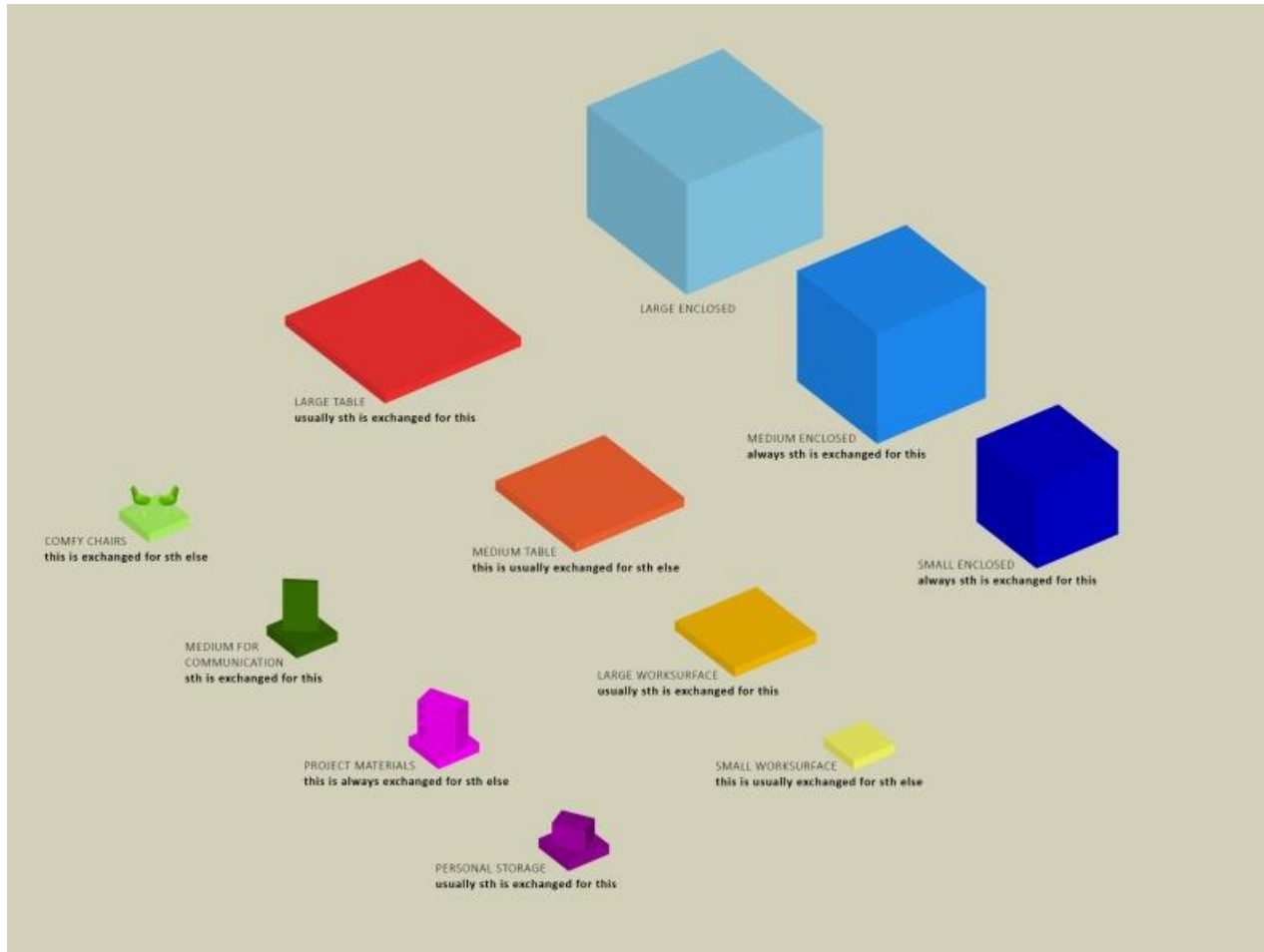
Figure (9) Summary of preferences: Large enclosed spaces, medium-size tables, and small workspaces are among the least popular items whereas medium and small enclosed spaces, large worksurfaces, and personal storage were among the most popular.

(c) The configuration of different furniture and space types

During the ideation phase, groups were asked to also record their five big ideas about the schemes they had developed and attach it to their artifact. These big ideas were later analyzed for recurring patterns. The following two diagrams show the overlay of the schemes whose big ideas were related to the hypotheses of this dissertation – location and distribution of open and enclosed furniture types. The analysis, rendered in Figure (10), shows that the majority of open

`

and collaborative spaces are clustered along the windows with a view to the Milwaukee River while the enclosed spaces are distributed along the perimeter of the space.
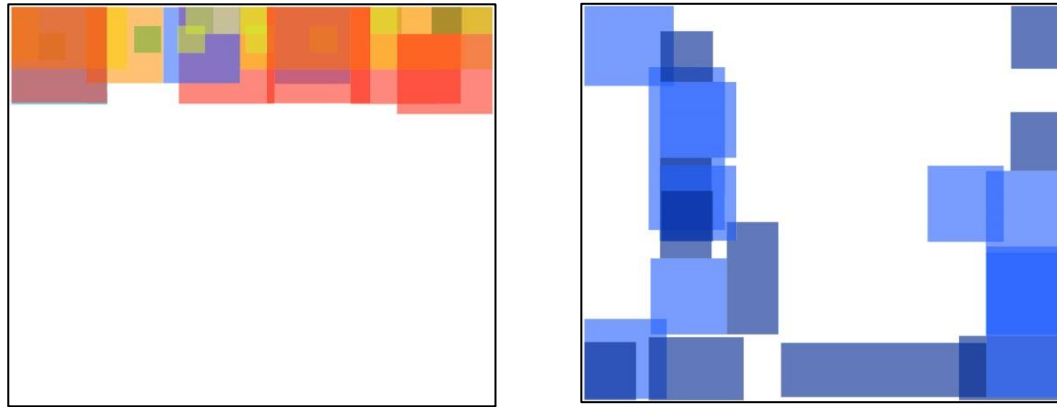
Figure (10) Location and distribution of furniture and space types in different schemes: Open collaborative spaces are placed along the windows overlooking the Milwaukee River whereas enclosed collaborative spaces, mainly small and medium, organized around the remaining the perimeter of the space.

4.3.   Findings from the implementation phase: From thin to thick description

During the implementation phase, a one-to-one scale mockup of the future workplace was installed in a portion of the office which was previously the subject of ideation. As mentioned in chapter 3, 19 individuals volunteered to provide feedback by participating in the mapping study which enabled me to record their behaviors before and after installing the mockup. To provide structure for a more detailed explanation, I frame the findings from the implementation phase around three questions pertaining to boundary mechanisms in the physical space: (1) how can we describe boundary mechanisms in space? (2) How can we map them relative to space? (3) How can we evaluate them relative to space?

`

Certain measures and metrics in Social Network Analysis in combination with face to face interviews helped answering the first question. For example, betweenness centrality, as a measure for quantifying the control of a human on the communication between two other humans in a social network (Freeman, 1979), is indicative of brokering or peripheral behavior. As a matter of fact, Pentland (2012) also uses this measure to explain how often people go exploring outside their team and bring new ideas and information back. So a boundary activity is a function of betweenness centrality, but is it not also a function of amount and number of interactions? Waber et al. (2008, 2010) and Wu et al. (2008) explain that there is a strong correlation between interaction and performance, but their definition of performance does not take betweenness centrality into account. That said, a significant number of workplace designers, especially proponents of drawing inspirations from urban life to create better work spaces – Frank Duffy, Clive Wilkinson, Herman Hertzberger, among many others – , seem to indicate that strategies which help increase interactions will eventually result in more creative or useful encounters. For example, Duffy (2008) believes what constitutes for the success, productivity, and congeniality of the city social life is the density of overlap among various social networks.

Similarly, several of our study participants thought that there is a logical connection between the two. For example, one study participant said: "More interaction is definitely good. You'll eventually talk to people with higher probability of relevance." Another participant believed: "You want for more people to talk to each other. That's how new ideas are born." In other words, more exposure through interaction will increase the chance for activating boundary mechanisms. Considering all this, the definition of boundary activity in our study takes betweenness centrality, the amount of interactions, and the number of people with whom interaction has happened into account: Boundary activity = f (betweenness, weight, degree). This

`

provides a basis for answering the second and third questions regarding mapping and evaluating boundary mechanisms in the physical space.

The pre-mockup data from sociometric badges is captured in Figure (11). The horizontal axis shows the increase in total interactions from left to right and the vertical axis represents betweenness – the number of times an individual acts as a bridge along the shortest path between two other individuals. Degree, signified by the size of each bubble, represents the number of individuals in the participant's social network. In Figure (11), selective team-players in the bottom left quadrant are those with the lowest amount of interaction and exploration. They mainly remain inside their social network and tend to be more strategic about their inward interactions. Similar to selective team-players, proactive team players in the bottom right quadrant also conduct most of their interactions with regulars in their immediate social network, yet, compared to selective team players, they seek more interactions with their fellow network members. Both selective brokers and proactive brokers in the top two quadrants tend to bridge between other individuals. As opposed to selective brokers, however, proactive brokers are dedicated to connecting different individuals, and perhaps disciplines and networks, to one another. That said, none of the participants in the pre-mockup study fell into the proactive broker category. Interestingly, and according to the distribution of bubbles in the matrix, proactive team-players and selective brokers who are closer to the proactive broker quadrant also have a higher degree. In other words, brokers, or those who show brokering potential, often have more people in their social network.

`
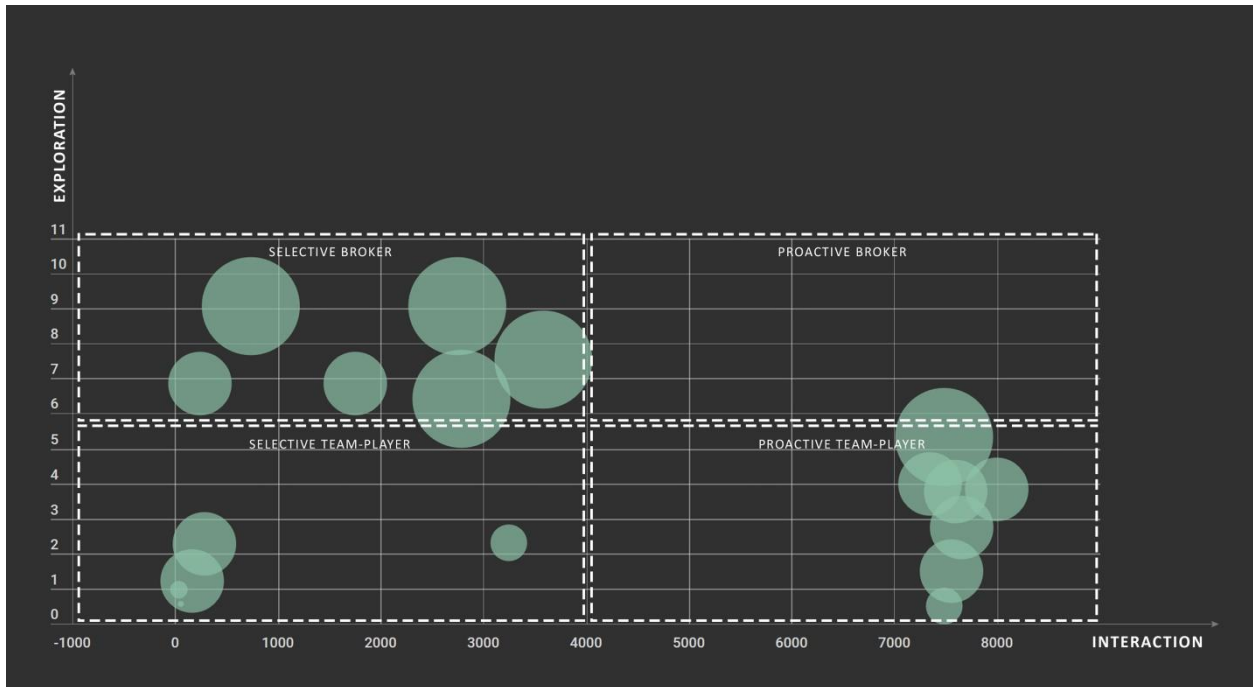
Figure (11) Various patterns among participants can be captured in four categories: Selective team-players, selective brokers, proactive team-players, and proactive brokers.

Overlaying the results from the post-mockup with the pre-mockup reveals a series of radical changes in the brokering behavior of participants. According to Figure (12), introducing the red post-mockup bubbles to the matrix explained in Figure (11) changes the scale of the diagram. This is due to the influx of brokering bubbles indicative of a growing tendency in the new layout for bridging between other individuals. With more than a 100% increase in the value of betweenness, from average 4.1 to average 8.3, it seems that the new configuration affords more opportunities for exploration. The emergence of a proactive broker with a relatively high degree and the overall increase in the degree are two other notable changes. Increase in degree is indicative of growth in the size of participants' social networks from pre- to post-mockup. Perhaps the most important finding here is that improving learning and knowing practices does not directly translate into increased social interactions. As shown in Figure (12), the post-mockup shows an increase in exploration or brokering behavior as opposed to overall interaction.

86

`
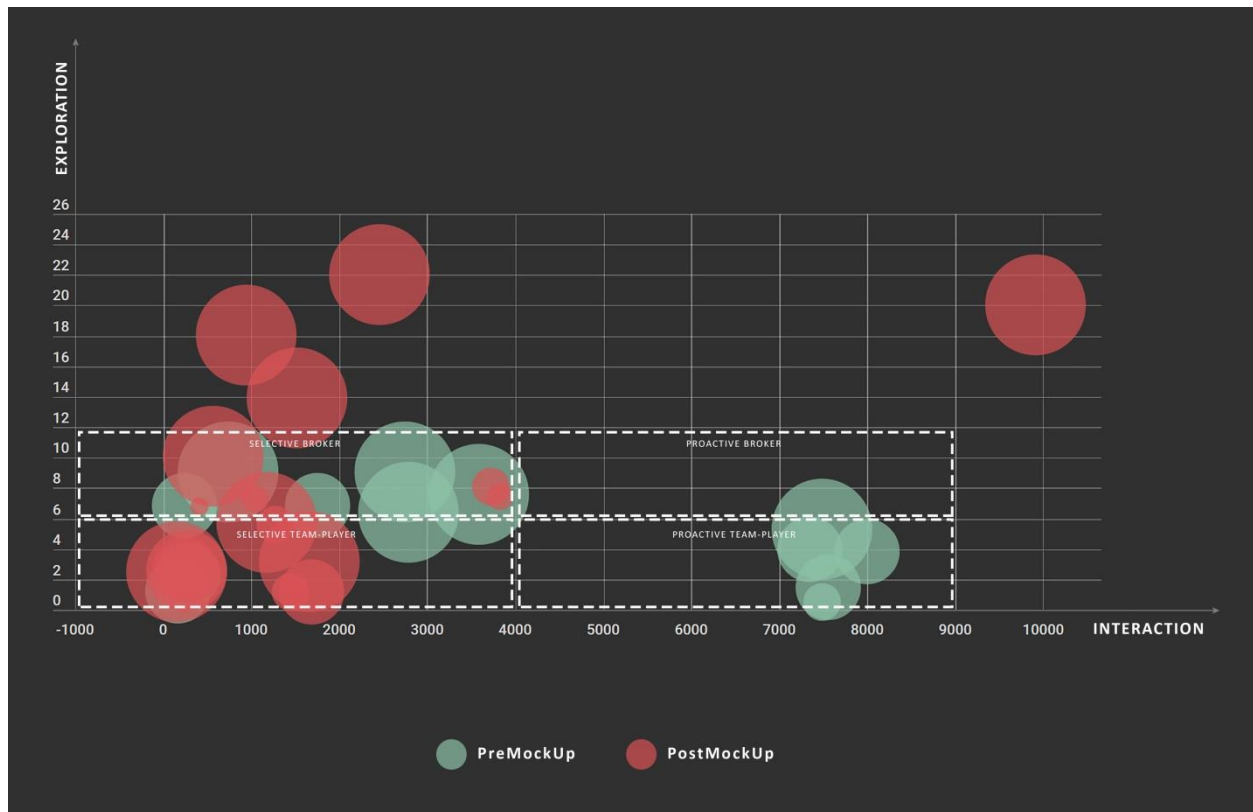
Figure (12) Change in participants' communication behavior after installing the mock up: Brokering behavior spiked.

Are there similarities and difference in how these three groups use the physical space? The data from location monitoring exhibited in Figure (13) revealed that, in average, brokers use more space than proactive team players, and proactive team players' space utilization is higher than selective team-players. Higher space utilization among brokers is a pattern consistent in both pre- and post-mockup layouts. In the pre-mockup, brokers' space utilization pattern is more continuous, whereas the majority of team-players move between one or two spots. This means explorers, with higher betweenness centrality, not only tend to travel more often and tend to use more resources in the workplace, but also, compared to team-players, they anchor in more spaces. They do not just run into people and conduct short conversations; they pause and establish meaningful ties. Location plots in pre-mockup also imply that the majority of brokers

`

prefer to 'go to people' in different locations rather than host them. This is an important trait especially when it comes to learning through peripheral participation. However, interestingly, the majority of brokers were at the higher levels of organizational hierarchy.

Pre-Mock up

Proactive Broker (0%)

Selective Broker (Avg 31.4%)

12%   16.7%   24%   33.3%   39.6%   62.5%

Peripheral and continuous

Proactive Team-player (Avg 21.9%)

10.4%   12.5%   20.8%   21%   27.1%   39.6%

Compressed and centralized
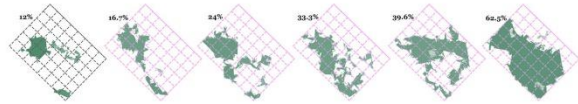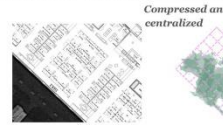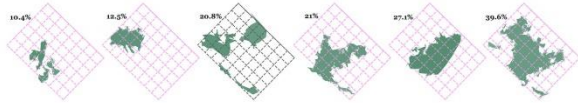
Selective Team-player (Avg 16%)

14.6%   16.7%   16.7%

Fragmented
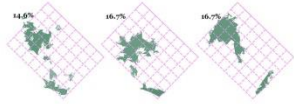
Post-Mock up

Proactive Broker (Avg 37.5%)

37.5%

Selective Broker (Avg 39.8%)

33.3%   35.4%   37.5%   37.5%   43.8%   51.1%

Central
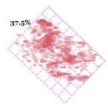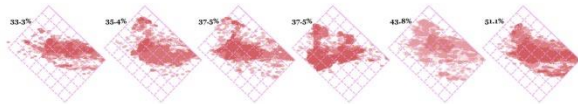
Proactive Team-player (0%)

Selective Team-player (Avg 35.3%)

14.6%   20.8%   35.4%   35.4%   37.5%   41.7%   45.8%   51.1%

Uniform
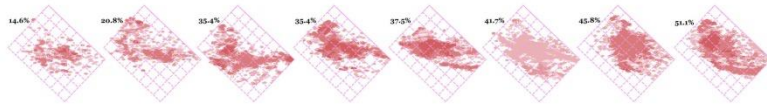
Figure (13) Participants' spatial behavior before and after installing the mock up: Increase in space-utilization

`

Perhaps the most interesting space-related finding is revealed when comparing the total space utilization between the pre- and post-mockup layouts. With an almost 15% increase, the average space utilization changed from an average 23.1% in the pre-mockup to 37.5% in the post-mockup. Furthermore, the new location patters are more uniformly distributed yet show greater concentration where paths cross. To summarize, in the new configuration, brokering activities almost doubled in quantity, average space utilization was increased by almost 15%, individuals' social networks grew larger in size, and finally, the interior crossroad emerged as a hub or anchor for the majority of brokers – which might mean that is the location where brokers interact with one another. Figure (14) provides a summary of the most important findings.

AVERAGE EMPLOYEE'S SIZE OF NETWORK INCREASED

AVERAGE EMPLOYEE'S CROSS-POLLINATION INCREASED

AVERAGE EMPLOYEE'S SPACE UTILIZATION INCREASED
(OVERALL AND IN COLLABORATIVE SPACES)

INTERSECTIONS BECAME PLACES FOR
SERENDIPITOUS ENCOUNTERS

Figure (14) Summary of most important findings

90

`
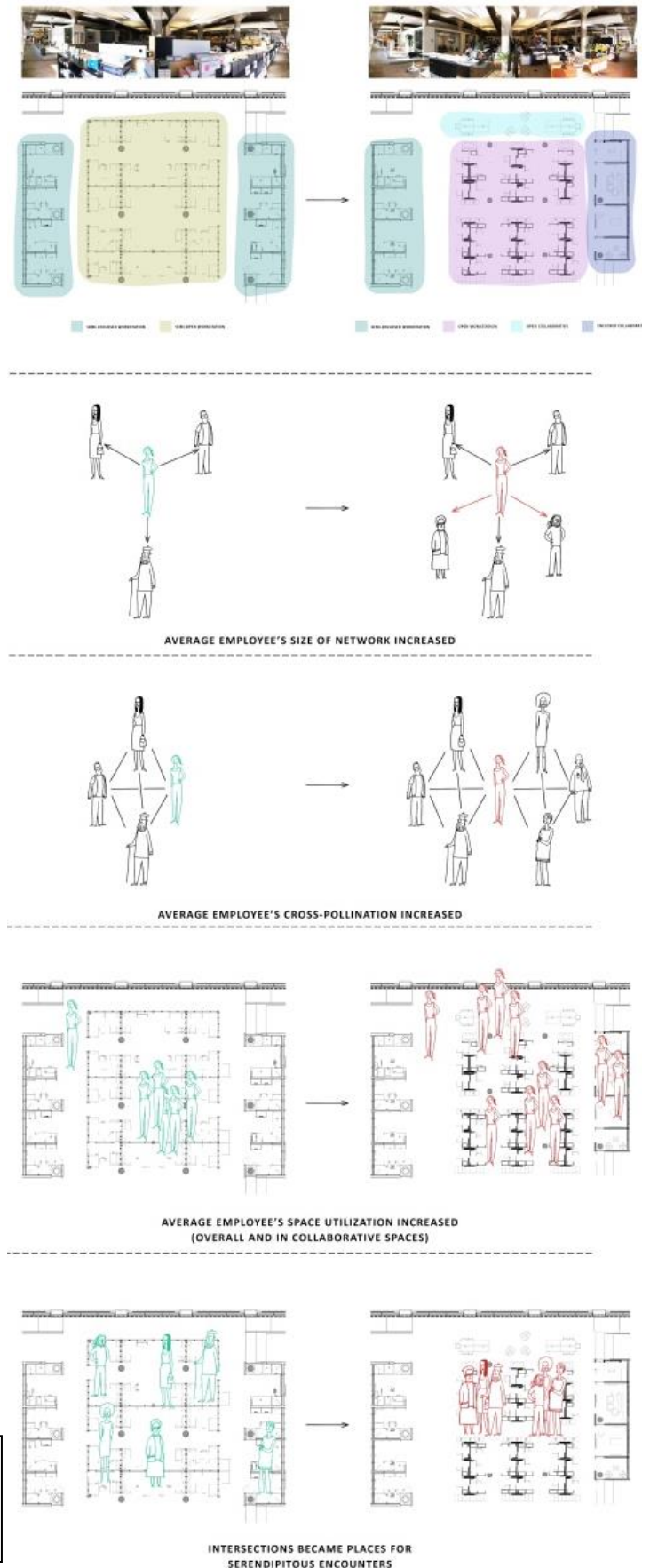
Although this analysis sheds light on different types of social interactions in the office, it does not distinguish between various boundary mechanisms. For example, although Figure (15) shows three individuals' increase in the space utilization, size of social network, and strength of ties from pre-mockup to post-mockup, it does not provide a window into the differences between different networks or patterns of space-use.
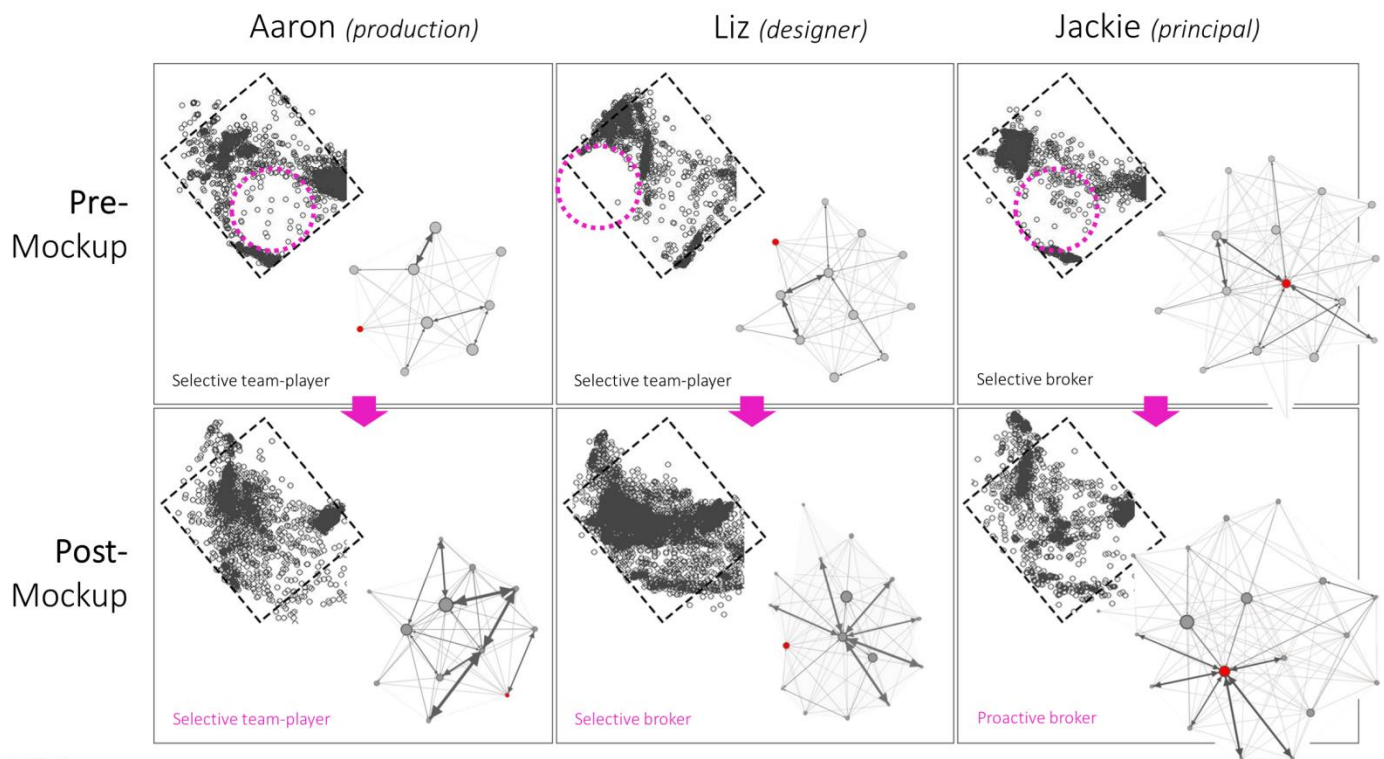
Figure (15) Change in participants' space utilization, spatial behavior, size of social network, and strength of ties is evident, yet without the ethnographic thick description, one is unable to distinguish between social and spatial patterns across the three social networks or location plots.

Providing cultural context and meaning for these behaviors requires using thick description (Geertz, 1973) through engaging participants in the process of making sense of the findings which included retrospective evaluation of the three phases of the design thinking

`

exercise. During separate face-to-face interviews, six participants were asked questions pertaining to the nature of learning and knowing processes before starting the office redesign, during the design thinking exercise, and after working in the one-to-one scale mockup for about six months. The findings from mapping social interactions and locations were also shared during the interview.

On the most basic level, all interviewees believed that both the office redesign effort and the new space itself shifted the culture of work in the organization. For example, Anthony mentioned "I think the change [in the physical space] was a catalyst for our change in our work culture" while Lori provided a more specific description of change in the work culture: "[after the redesign] the way we work has changed dramatically from a communications standpoint". Although most interviewees placed more emphasis on the practice of testing the mock-up rather than making it, they referred to the process of making as a necessary and inseparable part of change: "a lot of that upfront talking to people, discussing, forming the test environment was a big factor … in becoming more collaborative and integrated as groups".

How did the process contribute to change in learning and knowing practices? In Patrick's view, empathy was a key quality of the methodology: "The archetypes and ensuing role playing helped eliminate people's bias … it emphasized that there are many disciplines and roles in the office, with sometimes conflicting ideas." Eliminating bias and empathy was a recurring theme in most interviewees' responses. Yet, in Penelope's framing, the process goes beyond empathy and strives to build consensus – the moment that the ideas for change pass the test of imagination and become feasible: "One of the most powerful things that the exercise did, in my opinion, is that it got 65%, or whatever our participation level was, of the office engaged in thinking

`

differently about how they work … they felt like their voices were heard, yet they also understood that the design involves consensus. They got to dream about working differently and also got to real understanding of the reasons why some of the things they want are not feasible. It brought people together in a respectful way."

The thick description about the brokering behavior concluded from the social interaction mapping study also revealed an interesting result: there exist different types of peripheral participation being mindful participation here means the "process of being active participants in the practices of social communities and constructing identities in relation to these communities" (Wenger, 1998, p.4). After re-evaluating the mapping data through the lens of interviewees' comments, it became evident that although participants' size of the networks and brokering activities were increased in the new layout, the added interactions were mainly of peripheral character. In other words, the office redesign resulted in a greater number of people who peripherally participate in different practices and it did not grow the core part of existing communities of practice in size. Lori's description of her interactions in the new layout is a good example: "I think it's newer people that I have new relationships with … so P and I have known each other for a long time, we've worked here for 13 years so our relationship has grown over time but V … now we're constantly talking how to do this, how to do my timesheet, whatever the question might be … in this area there is a lot of interaction between the four or five of us."

Considering this, interviewees' differentiating between various types of peripheral participation was perhaps the most interesting finding of this activity. These practices varied in their goal and mode. Moreover, the new layout had an impact on three out of four of these

`

practices. Table (1) shows a categorization of interviewees' quotes pertaining to various types of peripheral participation.

Peripheral participation	Goal	Mode	Quote	Impact of the new layout
Type 1	Gaining mastery	Continuous exposure to practice	*"The number of people that I talk to now has significantly increased compared to before."* *"Because of how much we rely on senior knowledge here or even shared knowledge I think this [new layout] is definability easier for that process to work."* *"it's so much easier to access people, it's easier to see if they're available."* *"You can now start to integrate younger members with older members and vice versa"* *"P and I almost never worked on a project but we're collaborating all the time ... T is another example, I engage with him pretty frequently. I haven't work with him on a project in like 10 years ... [now and in the new layout] it's newer people that I have new relationships with."*	Mentors are now more accessible to newcomers
Type 2	Brokering and cross-pollination	Serendipitous as a result of full exposure to practice	*"The number of people that I talk to now has significantly increased compared to before."* *"One of the conversations that I've had with couple of people was that do you sit with your group or do you sit by your team and what's interesting about this is that I never sat immediately adjacent to anyone else outside of ACE or P|C, so now there are a lot of interiors people that are sitting around me and I feel I've been brought much more into the fold of knowing and understanding what they do, what they work on, seeing things, hearing what they're talking about, so I've learned a lot more about sort of their portion of the industry than I did when I wasn't sitting next to any of them."* *"The second hand hearing happens all the time. I'd ask K for information and maybe R over hear and add his two cents ... it helps accelerate the learning curve."* *"If I have to walk and talk to P, on my way back [because of the new layout] I'll stop and say oh C is working on something cool, what is that? I'll ask a question and see what she's working on."* *"I think the way we work has changed dramatically from a communications standpoint, not only communicating with team*	The chance of people and ideas bumping into each other is increased

94

			members, [but] like the immediacy of being able to talk to someone and the ability to overhear something that might be relevant to you so that you can jump in. and it feels less awkward to jump in a conversation that you weren't invited to in this environment than in the cubical [where] I needed to step out of my cube and walk over, like hey I heard you talking as opposed to just being hey guys and then you know you're in."	
Type 3	Occasional use of help and services	Selective exposure to practice	*"I always stand at my desk and I'm much more likely to go to talk to someone or just move around because I'm already standing. I can tell the difference when I sit, sometimes I drop my desk and sit and I have trash. It will sit on my desk until I get up again. When I'm standing, I throw it in the trash can. I think that's probably true for other things, like, I need to ask R a question, I'll wait if I'm not standing up, whereas if I was standing, I'd be like I'm gonna go and ask him. For me standing vs sitting makes [a difference in being] more active and more interactive."* *"A lot of interactions are project-based because we are busy, but I talk to people outside of our project ... I see people engage other people outside of their project based on shared interest or even maybe questions that come up and they need to ask someone that is not on the project ... I approach A and J on interior [design] questions if I don't know it."*	People are encouraged to reach out to each other for help
Type 4	Creating a new practice	Iterative exposure to the new practice	*"P and I almost never worked on a project but we're collaborating all the time ... T is another example, I engage with him pretty frequently. I haven't work with him on a project in like 10 years ... [now and in the new layout] it's newer people that I have new relationships with."*	Amount of interaction among core members for building new practice is not changed

Table (1) Thick description resulted in identifying four types of peripheral participation

Understanding the impact of physical space on brokering behavior as well as identifying the four types of peripheral participation are important findings pertaining to both realms of theory and practice: (1) they contribute to social theories of learning and knowing through

`

developing accounts of the community of practice perspective as they relate to the physical space; and (2) they make a widely used learning and knowledge strategy relevant to the physical space by the virtue of social and spatial analysis of workplace dynamics. Furthermore, this study showed that the process of making the physical space can be used as a strategic opportunity to shape the social domain of work pertaining to the core demands of knowledge economy – an economy built around certain learning and knowledge practices. Table (16) shows the various principles of the aforementioned process of making as were reflected in this study.
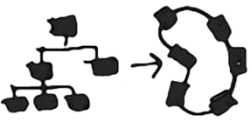
Empathy	Cycle of learning and prototyping	Change-oriented	Create ownership of design	Build consensus
Developed understanding with people from other disciplines and roles in office using archetypes	Created scale-mockup and conducted people-space analytics for evaluation	Made change in ways people use the physical space as a resource for various modes of communication	Expressed overall satisfaction with the new workplace	Created shared understanding about the amount and configuration of various space and furniture types in the new workplace
Emancipation from existing structure	Emancipating new perspectives and making new reality	Empowering	Local knowledge about work & workplace	Produce results while informing the theory
Created an environment in which participants freely challenged the existing workplace	Were encouraged to dream about the future and to imagine extreme schemes	Collective championship of change as opposed to relying on elite researcher or designer	Developed new habits and routines as a result of making and using the workplace	Four types of peripheral participation were identified

Table (2) Design thinking principles reflected in this study

96

`

5.   Conclusion

Richard Rorty (1991), the American neo-pragmatist philosopher, says that the quest for certainty should be replaced with the demand for imagination, that one should replace knowledge by hope. Rorty continues by saying that one should stop worrying about whether what one believes is well grounded and start worrying about whether one has been imaginative enough to think up interesting alternatives to one's present beliefs. So, in his view, concern about "building a better future" precedes the obsession about "correspondence to reality".

This is a rather radical view. Of course, researchers need to acknowledge and use *evidence* in their work, but researchers in *design-based discipline'* also need to be innovative about ways of generating and curating insights that go beyond that. One dilemma is that evidence often tells us about *what is* whereas design is often curious about *what if* and *what will be*. We could address this dilemma by using methodologies that help organizations to generate valuable, fresh insights that evoke imagination. These methodologies have three core qualities:

- They start with people, not the problem. And they use hybrid methods of empathizing with them to understand thoughts, emotions and motivations that drive their behavior. In this dissertation, I used a combination of qualitative and quantitative methods including interviews, focus groups, surveys, and social and spatial mapping.

- They are participatory, heavily value diversity of thoughts and perspectives, and are action-oriented. Inclusivity is important because having diverse fresh perspectives is a prerequisite for innovation, but that is not all. These methodologies also have a bias toward action, meaning that they do not just passively *listen* to the user, but they also empower and equip the user to take *action* and build a new reality. As the

user participates in shaping the new culture or experience, they become its owners, so designers do not need to *educate* them about their own building after the design is delivered.

- They rely on iterative experimentation and prototyping for building a version of the future rather than predicting it — this is a different view of knowledge. These methodologies encourage small and relevant experiments, which feed the cycle of building and testing and learning to eventually collapse the users' experience on something that they find valuable. If empathy is listening to people or the subject, then experimentation and prototyping is listening to the object of design.

Yet when it comes to who knows what, where knowledge-gems are and how to use them in organizations, methodologies need to be placed in the context of learning and knowing theories. Architecture of social learning and knowing is a way of understanding, framing, explaining and shaping the complex ecology of people, spaces, artifacts, information and practices in a way that is conducive to desired knowledge and learning outcomes. Architecture of social learning and knowing as explained in this dissertation has three main components:

1. A methodology inspired by action research and design thinking to guide the organization through the process of shaping its social and physical structures to empower and equip the organization to impact its learning-knowledge practices and/or to cultivate new ones. This means the question of impacting learning and knowing practices through the physical space should be replaced by the question of impacting learning and knowing practices through the *process of making* the physical space.

`

2.   A set of tools and techniques framed as people-space analytics and its paraphernalia, including social network analysis (SNA), spatial mapping, and interviews, to not only record change but also engage participants in the process of making sense of change.

3.   A theoretical lens or perspective emerged at the intersection of social theories of learning and knowing with architects' normative views and empirical evidence pertaining to people in work and learning environments. This lens is not only used to frame insights, but also used to create thick descriptions.

The following figure shows the process through which all three components were incorporated. The diagram is comprised of a series of divergent and convergent phases and puts more emphasis on the process of making the physical space.

INSPIRATION   IDEATION   IMPLEMENTATION   DESCRIPTION

| Divergent | Divergent | Convergent | Divergent | Convergent | Divergent | Convergent | Convergent |

Theoretical lens | Empathy | Define | Ideate | Prototype | Test | Thick description | Cultivating practices & contributing to the theory

Intersection of social theories of learning and knowing + architects' normative views + empirical evidence pertaining to people in work and learning environments | Survey and focus groups | Capturing challenges and opportunities in the form of archetypes | Ideating around space and furniture distribution and configuration | Creating on-to-on scale mock-up | Using people-space analytics tools and methods to test the mock-up | Using principles of ethnography to provide thick description | Identifying various types of peripheral participation in the physical space

Figure (1) Architecture of social learning and knowing of an organization developed through a process

`

In addition to the framing of the architecture of social learning and knowing, this research advanced the social theories of learning and knowing by introducing new constructs, expanded the action research discourse by incorporating the element of design into its framing, and contributed to the workplace literature by suggesting a shift from network view to community view in understanding workplace important outcomes.

Using the community of practice perspective, this study showed that in improving learning and knowing practices in a workplace, it is not the quantity of interactions that matter, but the emergence of strategic boundary encounters. In this study, and as a result of the change in the workplace, it was the type of interactions that were changed and not their quantity. As a matter of fact, after installing the mock-up, the quantity of interactions did not increase, yet more people manifested brokering behavior. On the methodological level, design thinking was discussed as a refined version of action research with a focus on the neo-pragmatic human inquiry and producing new systems from scratch. But perhaps the most important finding was that in cultivating new learning and knowing practices, the impact of making-process precedes the impact of product. This research showed that the new learning and knowing practices are often negotiated and produced during the participatory and emancipatory process of making the physical space. It is during this phase that people are empowered and equipped to think differently about different ways of conducting their work. The future research should examine the spatial and physical features of the workplace that remove, improve, replace, scale, or expand learning and knowing practices that are cultivated during the process of making.

References

- Allee, V. (2000). Knowledge networks and communities of practice. OD Practitioner: Journal of the national organization development network, 32 (4).

- Altman, I. (1975). Environment and social behavior: Privacy, personal space, territory, and crowding. Monterey, CA: Brooks/Cole.

- Altman, I. and Rogoff, B. (1987). Worldviews in psychology. In D. Stokols & I. Altman (Eds.), Handbook of environmental psychology. Vol. 1. 7-40. Toronto: John Wiley & Sons.

- Amin, A. and Roberts, J. (2008). Knowing in action: Beyond communities of practice. Research Policy, 38.

- An, Y.J. and Reigeluth, C.M. (2008). Problem-based learning in online environments. Quarterly Review of Distance Education, 9 (1), 1-16.

- Argyris, C. (1993) Knowledge for action. A guide to overcoming barriers to organizational change, San Francisco: Jossey Bass.

- Argyris, C. and Schön, D. (1978) Organizational learning: A theory of action perspective, Reading, Mass: Addison Wesley.

- Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

- Becerra-Fernandiz, I. and Sabherwal, R. (2010). Knowledge management: Systems and processes, NY: M.E. Sharpe.

- Beck, A. T. (1997). The past and future of cognitive therapy. The Journal of Psychotherapy Research and Practice, 6, 276-284.

- Berger, P. L. and Luckmann, T. (1966). The social construction of reality: a treatise in the sociology of knowledge. NY: Anchor Books.

- Birgeneau, R. (2005). The role of the university and basic research in the new economy. In G. Jones, P. Mccarney & M. Skolnik (Eds.) Creating Knowledge, Strengthening Nations. 167-195. Toronto: University of Toronto Press.

- Bourdieu, P. (1977). Outline of a theory of practice. Cambridge, UK: Cambridge University Press.

- Bourdieu, P. (1991). Physischer, sozialer und angeeigneter physischer Raum (Physical, social and adopted physical space). Stadt-Räume (City-Spaces). Die Zukunft des Städtischen (The future of the urban). M. Wentz. Frankfurt am Main: 25-34.

- Bourdieu, P. (1996). Vilhelm Aubert memorial lecture: Physical space, social space and habitus. Oslo, Department of Sociology, University of Oslo & Institute for Social Research.

- Brand, S. (1995). How buildings learn: what happens after they're built. New York: Penguin Books.

`

- Braun, H. and Grömling, D. (2005). Research and technology buildings. Berlin: Birkhäuser Architecture.

- Brown J. S and Adler P. (2008). Minds on fire: Open education, the long tail, and learning 2.0, Educause review.

- Brown J. S., Collins A. and Duguid P. (1989) Situated cognition and the culture of learning, Educational Researcher, 18(1), 32-42.

- Brown, J. S. and Duguid, P. (1991). Organizational learning and communities of practice: toward a unified view of working, learning, and innovation. Organization Science, 40 (3), 40-57.

- Brown, J. S., Collins, A. and Duguid, S. (1989). Situated cognition and the culture of learning. Educational Researcher. 18(1), 32-42.

- Brown, J. S. (2001). Learning in the digital age, the internet and the university: 2001 Forum, eds M. Devlin, R. Larson & J. Meyerson, EDUCAUSE, Boulder, CO, 71-86.

- Brown, J. S. and Duguid, P.. (1991). Organizational learning and communities of practice: Towards a unified view of working, learning, and innovation. Organization Science, 40 (3).

- Canter, D. (1991). Understanding, assessing and acting in places: Is an integrative framework possible? In T. Garling & G. Evans (Eds.) Environmental Cognition and Action: An Integrative Multidisciplinary Approach. New York: Oxford University Press.

- Chan J. K., Beckman S. L. and Lawrence P. G. (2007). Workplace design: A new managerial imperative, 49 (2), 6-22.

- Christensen et al. (2011) Disrupting class: How disruptive innovation will change the way the world learns, McGraw-Hill.

- Christensen, C. M., Horn, M. B., Caldera, L. and Soares, L. (2011). Disrupting college: how disruptive innovation can deliver quality and affordability to postsecondary education. Center for American Progress and Innosight Institute.

- Clancey WJ. (2008). Scientific antecedents of situated cognition. In: Robbinc P, Aydede M, editors. Cambridge handbook of situated cognition. New York: Cambridge University Press, 11-34.

- Clancey, W. J. (1997a). The conceptual nature of knowledge, situations, and activity. In P. Feltovich, K. Ford, & R. Hoffman (Eds.), Human and Machine Expertise in Context. 247–291. Menlo Park, CA: The AAAI Press.

- Clancey, W. J. (1997b). Situated cognition: On human knowledge and computer representations. NY: Cambridge University Press.

- Clark Center, Stanford University by Foster and Partners. (2003). Retrieved from http://www.fosterandpartners.com/projects/clark-center-stanford-university/

- Collins et al. (2006). A strategy for extracting and analyzing large-scale quantitative epistatic interaction data, licensee BioMed Central Ltd.

- Collins, A., Brown, J. S. and Newman, S. E. (1987). Cognitive apprenticeship: Teaching the craft of reading, writing and mathematics (Technical Report No. 403). BBN Laboratories, Cambridge, MA. Centre for the Study of Reading, University of Illinois.

- Cross, R., Laseter, T., Parker, A. and Velasquez, G. (2006). Using social network analysis to improve communities of practice. California Management Review, 49, no. 1.

- Cuba, L. & Hummon, D. M. (1993). Constructing a sense of home: place affiliation and migration across the life cycle. Sociological Forum, 8, 547-572.

- Darroch, J. and McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation, Journal of Intellectual Capital, 3 (3), 210-222.

- Davenport, T. H. and Prusak, L. (1998). Working knowledge: How organizations manage what they know, Harvard Business School Press, Boston.

- Davenport, T., De Long, D. and Beers, M. (1998). Successful knowledge management projects. Sloan Management Review, 39(2), 43 – 57.

- Day, J.D. and Wendler, J.C. (1998). Best practice and beyond: Knowledge strategies. McKinsey Quarterly, 1, 19-25.

- De Marsico, M., Limongelli, C., Sciarrone, F., Sterbini, A. and Temperini, M. (2014). Social network analysis and evaluation of communities of practice of teachers: A case study. In Proc. 7th Int. Workshop on social and personal computing for web-supported learning communities, SPeL, for Advances in Web-Based Learning, ICW.

- Dewey, J. (1929). The Quest for certainty. Publisher Minton Balch and Company.

- Dewey, J. (1938/1997). Experience and education. Macmillan.

- Dobbe, K. (2010). Fibonacci chimes. Retrieved from http://kevindobbe.com/kDobbe/Fib_Chimes.html

- Duffy, F. (2008). Work and the city. London: Black Dog Publishing Limited.

- Duncan, J. S. (1973). Landscape taste as a symbol of group identity: a Westchester county village. Geographical Review, 63, 334-335.

- Duncan, R., Weiss, A. (1979). Organizational learning: Implications for organizational design. Research in Organizational Behavior, Vol. 1, 1979: 75-123

- Ehmann, S. and Borges, S. (2012). Learn for life: New architecture for new learning. Berlin: Gestalten Verlag.

- Fiol, C. M. and Lyles, M. (1985). Organizational learning. Academy of Management Review, 10, 803-813.

- Fiol, C. M. (1994). Consensus, diversity and learning in organizations. Organiz. Sci., 5: 403-420.

- Flor, N. and Hutchins, E. (1991). Analyzing distributed cognition in software teams: A case study of team programming during perfective software maintenance. In J. Koenemann-Belliveau et al., eds., Proceedings of the Fourth Annual Workshop on Empirical Studies of Programmers. 36–59. Norwood, N.J.: Ablex Publishing

- Fontaine, M. and Lesser, E. (2002). Challenges in managing organizational knowledge', IBM Institute for Knowledge Based Organizations.

- Forman, E. Minick, N. and Stone, C.A. (1993). Contexts for learning. New York: Oxford University Press.

- Foucault, M. (1980). Power/Knowledge: selected interviews and other writings: 1972-1977, ed. by C. Gordon. New York: Pantheon.

- Foucault, M. (1984). Space, knowledge, and power. In P. Rabinow (Ed.), The Foucault reader. 239-256. London: Penguin.

- Freeman L.C. (1979), Centrality in social networks conceptual clarification, Social Networks, 1 (3), 215-239.

- Garfinkel H. (1967). Studies in Ethnomethodology 1st Ed, Polity.

- Garry L. Adams, Lamont, B. T. (2003). Knowledge management systems and developing sustainable competitive advantage, Journal of Knowledge Management, Vol. 7 Issue: 2, 142-154, https://doi.org/10.1108/13673270310477342

- Geertz, C. (1973). The interpretation of cultures. New York: Basic Books.

- Giddens, A. (1984). The constitution of society: outline of the theory of structuration. University of California Press.

- Giuliani, M. V. (2003). Theory of attachment and place attachment. In M. Bonnes, T. Lee and M. Bonaiuto (Eds.), Psychological Theories for Environmental Issues. 137-17. Aldershot: Ashgate Publishing Limited.

- Haggie, K. and Kingston, J. (2003). Choosing your knowledge management strategy, Journal of Knowledge Management Practice, June.

- Hanks, W. F. (1991). Foreword by William F. Hanks. In J. Lave & E. Wenger (Eds.). Situated learning: Legitimate peripheral participation. 13–24. New York: Cambridge University Press.

- Haque M., Zhen J. and Venturino E. (2008). An ecoepidemiological predator-prey model with standard disease incidence, 32 (7), 875–898.

- Hedberg, B. (1981). How organizations learn and unlearn. In P. Nystrom & W. H. Starbuck (Eds.), Handbook of Organizational Design (Vol. 1). London: Cambridge University Press.

`

- Heidegger M. (1927). Being and time. Wiley-Blackwell; New Ed.

- Heidegger, M. (1971). Poetry, language, thought. New York: Harper & Row.

- Herling R. and Provo J. (2000). Knowledge, competence, and expertise in organizations. Advances in Developing Human Resources, 2 (1), 1-7.

- Hertzberger, H. and de Swaan, A. (2009). The schools of Herman Hertzberger. Rotterdam: 010 Publishers.

- Hidalgo, B. and Hernández, B. (2001). Place attachment: conceptual and empirical questions. Journal of Environmental Psychology, 21, 273-281.

- Holmes, J. and Meyerhoff, M. (1999). The community of practice: Theories and methodologies in language and gender research. Language in Society, 28(2), 173-183.

- Hughes, J., Jewson, N. and Unwin, L. (2007). Communities of practice: A contested concept in flux. In J. Hughes, N. Jewson and L. Unwin (Eds.), Communities of Practice: Critical Perspectives. London: Routledge.

- Hutchins E. (1995). How a cockpit remembers its speeds, 19 (3), 265–288.

- Hutchins, E. (1991a). How a cockpit remembers its speeds. Ms. La Jolla: University of California, Department of Cognitive Science.

- Hutchins, E. (1991b). The social organization of distributed cognition. In L. Resnick, ed., Perspectives on socially shared cognition, 283–287. Washington, DC: American Psychological Association.

- Hutchins, E. (1994). Cognition in the wild. Cambridge, MA: MIT Press

- Inside Facebook's Menlo Park headquarters by Gensler. (2012). Retrieved from http://officesnapshots.com/2013/02/04/facebook-menlo-park-office-design/

- Sánchez-Cardona, I. et al. (2012). Procedia. Social and Behavioral Sciences, 46 ,1820 – 1825.

- Julian, J. (2010). Facilitating project performance improvement: A practical guide to multi-level learning. New York: American Management Association.

- Katoppo, M. L. and Sudradjat, I. (2015). Combining participatory action research (PAR) and design thinking (DT) as alternative research method in architecture, Procedia – Social and Behavioral Sciences, Vol. 184, No. 20, 118-125.

- Kolb, D.A. (1984):. Experiential learning: experience as the source of learning and development. Englewood Cliffs, NJ: Prentice Hal.

- Koliba, C. and Gajda, R. (2009). Communities of practice as an empirical construct: Implications for theory and practice." International Journal of Public Administration, 32.

- Koolhaas, R. (2016, May 19). Architecture has a serious problem. Interviewed by Mohsen Mostafavi. Retrieved from https://www.fastcodesign.com/3060135/rem-koolhaas-architecture-has-a-serious-problem-today

- Lang, J. (1987). Creating architectural theory: The role of the behavioral sciences in environmental design. New York: Van Nostrand Reinhold.

- Lant, T. and Mezias, S. J. (1992). An organizational learning model of convergence and reorientation. Organization Science. 3: 47-71.

- Lave, J. (1988). Cognition in Practice: Mind, mathematics, and culture in everyday life. Cambridge, UK: Cambridge University Press.

- Lave, J. and Wenger, E. (1991). Situated learning: legitimate peripheral participation. Cambridge: Cambridge University Press.

- Lemke, J. (1997). Cognition, context, and learning: a social semiotic perspective. In D. Kirshner & J. Whitson (Eds.), Cognition: social, semiotic, and psychological perspectives. 37-56. Mahwah, NJ: Lawrence Erlbaum Associates.

- Lemke, T. (1997): Eine Kritik der politischen Vernunft – Foucaults Analyse der modernen Gouvernementalität, Berlin/Hamburg: Argument.

- Lesser, E. L., Fontaine, M. A. andSlusher, J. A. (2000). Knowledge and communities. Boston: Butterworth-Heinemann.

- Lewicka, M. (2008). Place attachment, place identity, and place memory: Restoring the forgotton city past. Journal of Environmental Psychology, 28, 209-231.

- Lewis, C. A. (1979). Comment: healing in the urban environment. Journal of the Institute of American Planners, 45, 330-338.

- Liedtka J. and Ogilvie T. (2011). Designing for growth: A design thinking tool kit for managers, Columbia University Press.

- Light P. and Butterworth G. (1992). Context and cognition: Ways of learning and knowing. Hillsdale, NJ: Lawrence Erlbaum Associates.

- Madanipour, A. (2010). Whose public space? International case studies in urban design and development. Routledge.

- Madanipour, A. (2013). Knowledge economy and the city: Spaces of knowledge. London: Routledge.

- Malecki, C. K. and Demaray, M. K. (2006). Social support as a buffer in the relationship between socioeconomic status and academic performance. School Psychology Quarterly, 21(4), 375-395.

- Malecki, E. J. (2000): Knowledge and regional competitiveness. Erdkunde, 54, 334-351.

- Du Plessis, M. (2007). The role of knowledge management in innovation", Journal of Knowledge Management, 11 (4).

- McDougall, M., and Beattie, R. (1998). The missing link? Understanding the relationship between individual and organizational learning. International Journal of Training and Development, 2, 288-299.

`

- Merriam, S. and Caffarella, R. (1991). Learning in adulthood: A comprehensive guide, (1991). San Francisco: Jossey-Bass.

- Meyer, P. (2010). From workplace to playspace: Innovating, learning, and changing through dynamic engagement. San Francisco: Jossey-Bass.

- Meyerhoff, M. (2006). Introducing sociolinguistics. New York: Routledge.

- Mojtahedi, A. & Schermer, B. (2013). Placing social capital in the campus: Case study of the University of Wisconsin-Milwaukee, Proceedings of EDRA 44, May 2013, Providence, Rhode Island. pp. 113-121.

- Mojtahedi, A., Yoon, S.-Y, Hosseini, T. A. & Martinez, D. H. D. (2017). People-space Analytics: Case Study of Work Dynamics. Proceedings of 2017 AIA/ACSA Intersections Symposium, April, FL.

- Myers, K. M., and Wilson, B. G. (2000). Situated cognition in theoretical and practical context. In D. Jonassen, & L. S. M., Theoretical Foundations of Learning Environments. 57-88. New Jersey: Lawrence Erlbaum Associates, Inc.

- Newman, D., Griffin, P. and Cole, M. (1989). The construction zone: Working for cognitive change in school. Cambridge, MA: Cambridge University Press.

- Nonaka, I. (1991) The knowledge creating company. Harvard Business Review, 69, 96-104.

- Nonaka, I. and Takeuchi, H. (1995). The knowledge-creating company. New York: Oxford University Press

- Nyren, R. (2012). Facebook's new faces: Gensler designs Facebook's headquarters. Retrieved from http://m.interiordesign.net/projects/detail/2043-facebooks-new-faces/

- Oldenburg, R. (1999). The great good place: Cafés, coffee shops, bookstores, bars, hair salons, and other hangouts at the heart of a community. New York, NY: Marlowe and Co.

- Oldenburg, R. (2001). Celebrating the third place: Inspiring stories about the great good places at the heart of our communities. New York, NY: Marlowe and Co.

- Pawlowsky P (2000). Wozu Wissensmanagement, in: Wissensmanagement, Goetz, k., eds., Rainer Hampp Verlag., (in Germany). Probst G, Gibb.

- Pawlowsky-Glahn, V. and Egozcue, J. J. (2001). Geometric approach to statistical analysis on the simplex. Stochastic Environmental Research and Risk Assessment (SERRA) 15 (5), 384–398.

- Pentland, A. S. (2014). Social physics: How good ideas spread – the lessons from a new science. New York: Penguin Press.

- Pfeffer, J. 1. and Sutton, R. I. (1999). The smart-talk trap. Harvard Business Review. 77(3):134-42, 211.

- Piaget, J. (1954). The construction of reality in the child. New York: Basic Books.

- Powel, W. W. and Snellman, K. (2004). The knowledge economy. Annual Review of Sociology, 30, 199-220.

- Madanipour, A., Knierbein, S. and Degros, A. (2014). Public space and the challenges of urban transformation in Europe. New York and London: Routledge.

- Rampersad, N. (2004). Infinite sequences and pattern avoidance. UWSpace. Retrieved from: http://hdl.handle.net/10012/1155

- Reigeluth, C. M. (2005). New instructional theories and strategies for a knowledge-based society. In J. Spector, C. Ohrazda, A. Van Schaack, & D. Wiley (Eds.), Innovations in instructional technology: Essays in honor of M. David Merrill. Mahwah. NJ: Lawrence Erlbaum Associates.

- Remmers, B. (2011). Office design and knowledge economy. In C. Schittich (Ed.), In Detail: Work environments: Spatial concepts, Usage Strategies, communications. 27-34. Munich: Institut fur internationale Architektur-Dokumentation GmbH Co.

- Teare, R. (1997). Assessing information needs and external change. International Journal of Contemporary Hospitality Management, Vol. 9, Issue: 7. 274-284

- Rickes, P. C. (2009). Make way for millennials: how today's students are shaping higher education space. Planning for Higher Education, 37(2), 7–17.

- Rodgers, P. (2013). Articulating design thinking. Design Studies. 34 (4). 433-514.

- Rogoff, B. (1990). Apprenticeship in thinking: Cognitive development in social context. New York: Oxford University Press.

- Rorty, R. (1979). Philosophy and the mirror of nature. Princeton, NJ: Princeton University Press.

- Rorty, R. (1989). Contingency, irony, and solidarity. Cambridge: Cambridge University Press.

- Rorty, R. (1998). Truth and progress. Cambridge: Cambridge University Press.

- Rorty, R. (1999). Philosophy and social hope. London: Penguin Books.

- Russell, J. A. and Ward, L. M. (1982). Environmental psychology. Annual Review of Psychology, 33, 651-658.

- Saegert, S. (1987). Environmental psychology and social change. In D. Stokols & I. Altman (Eds.), Handbook of environmental psychology. 99-128. New York: Wiley.

- Saint-Onge, H. and Wallace, D. (2003). Leveraging communities of practice for strategic advantage. Boston: Butterworth-Heinemann.

- Scannell, L. and Gifford, R. (2010). Defining place attachment: A tripartite organizing framework. Journal of Environmental Psychology, 30, 1-10.

- Schneekloth, L. and Shibley, R. (1995). Placemaking: the design and management of places. New York: North Pine Press.

`

- Senge, P. M. (1990). The fifth discipline. The art and practice of the learning organization, London: Random House.

- Sennett, R. (2006). The Open City. Urban Age Newspaper Essay, Berlin. Retrieved from http://www.urban-age.net/0_downloads/Berlin_Richard_Sennett_2006-The_Open_City.pdf

- Silverstein, M. and Jacobson, M. (1985). Restructuring the hidden program: Toward an architecture for social change. In W. Preiser (Ed.), Programming the built environment. 149-164. New York: Van Nostrand-Reinhold.

- Skinner, B. F. (1974). About behaviorism. New York: Vintage.

- Slater, S. F. and Narver, J. C. (1995). Market orientation and the learning orientation. Journal of Marketing, 59 (July), 63–74.

- Star, L. and Griesemer, J. (1989). Institutional ecology, translations, and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social Studies in Science, 19, 387-420. William H. Whyte.

- Stokols, D. (1988). Transformational processes in people-environment relations. In J. E. McGrath (Ed.), The social psychology of time. 233-252. Beverly Hills, CA: Sage.

- Stokols, D. and Shumaker, S. A. (1981). People and places: A transactional view of settings. In J.Harvey (Ed.), Cognition, social behavior and the environment. 441- 448. Hillsdale, NJ: Erlbaum.

- Sullivan, C. C. and Horwitz-Bennett, B. (2010). High-performance workplaces: Integrating technology and architecture. Building Design and Construction, 51(1), 22-26.

- Thomas, D. and Brown, J. S. (2011). A new culture of learning: cultivating the imagination for a world of constant change. Kentucky: CreateSpace Independent Publishing Platform.

- Toker, U. (2006). Workspaces for knowledge generation: Facilitating innovation in university research centers. Journal of Architectural and Planning Research, 23(3), 181-199.

- Toker, U. and Gray, D. O. (2008). Innovation spaces: Workspace planning and innovation in US university research centers. Research Policy, 37(2), 309-329.

- Tonkinwise, C. (2010). A taste for practices: Unrepressing style in design thinking, DTRS 8 Proceedings of the 8th Design Thinking Research Symposium. 381-391. DAB Documents, Sydney Australia.

- Twigger-Ross, C. L. and Uzzell, D. L. (1996). Place and identity process. Journal of Environmental Psychology, 16, 205-220.

- Vygostsky, L. (1978). Interaction between learning and development. In M. Cole (Ed.), Mind in society: the development of higher psychological processes. 79-91. Cambridge, MA: Harvard University Press.

`

- Vygotsky, Lev. (1979). Interaction between learning and development. In M. Cole, Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.

- Waber, B. N., Olguin, D. O., Kim, T. and Alex (Sandy) Pentland, A. S. (2008). Understanding organizational behavior with wearable sensing technology. Academy of Management Annual Meeting. Anaheim, CA. August.

- Waber, B. N., Olguin, D. O., Kim, T. and Alex (Sandy) Pentland, A. S. (2010). Productivity through coffee breaks: Changing social networks by changing break Structure. 30th International Sunbelt Social Network Conference. Riva del Garda, Italy, July.

- Wapner, S. (1987). A holistic. Developmental, systems-oriented environmental psychology: Some beginnings. In D. Stokols & I. Altman (Eds.), Handbook of environmental psychology. Vol. 2. 1433-1465. New York: Wiley.

- Weisman, G. D. (1983). Environmental programming and action research. Environment and Behavior, 15, 381-408.

- Wenger-Trayner, E. & Wenger-Trayner, B. (2014) Learning in landscapes of practice: a framework. In E. Wenger-Trayner, M. Fenton-O'Creevy, S. Hutchinson, C. Kubiak & B. Wenger-Trayner (Eds.), Learning in landscapes of practice: boundaries, identity, and knowledgeability in practice-based learning. New York: Routledge.

- Wenger, E. (1998). Communities of practice: learning, meaning, and identity. Cambridge: Cambridge University Press.

- Wenger, E. (1998). Communities of practice: Learning, meaning and identify. Cambridge, UK: Cambridge University Press. Wenger, E. (2004). Knowledge management as a doughnut: Shaping your knowledge strategy through communities of practice. Ivey Business Journal, 1–8.

- Wenger, E. (2000). Communities of practice and social learning systems. Organization, 7 (2), 225-246.

- Wenger, E. (2000). Communities of practice: the key to knowledge strategy. In E. L. Lesser, M. A. Fontaine & J. A. Slusher (Eds.), Knowledge and communities. 3-20. New York: Routledge.

- Wenger, E. (2007). Communities of practice: a brief introduction. Weger-Trayner. Retrieved from http://www.ewenger.com/theory/

- Wenger, E. (2009). Social learning capability: four essays on innovation and learning in social systems. Social Innovation, Sociedade e Trabalho. Booklets 12 – separate supplement, MTSS/GEP & EQUAL Portugal, Lisbon.

- Wenger, E. (2010). Communities of practice and social learning systems: the career of a concept. In C. Blackmore (Ed.), Social Learning Systems and communities of practice. Springer Verlag and the Open University.

- Wenger, E. (2011). Communities of Practice: A brief introduction. Watertown, MA: Harvard Business Press. Wenger, E., McDermott, R., & Snyder, W. M. (2002).

`

Cultivating communities of practice (1st Ed.). Watertown, MA: Harvard Business School Press.

- Wenger, E. and Snyder, W. M. (2004). Communities of practice: the organizational frontier. In Harvard business review on teams that succeed. Boston: Harvard Business School Publishing Corporation.

- Wenger, E., and Snyder, W. M. (2000). Communities of practice: The organizational frontier. Harvard Business Review, 78(1), 139–145.

- Wenger, E., McDermott, R. and Snyder, W. M. (2002). Cultivating communities of practice: a guide to managing knowledge. Massachusetts: Harvard Business School Press.

- Wilkinson, C. (2015). Designing the theater of work. Retrieved from http://99u.com/videos/52099/clive-wilkinson-designing-the-theater-of-work

- Worpole, K. (2013). Contemporary library architecture: A planning and design guide. New York: Routledge.

- Wu, L., Waber, B. N., Aral, S, Brynjolfsson, E. and Pentland, A. S. (2008). Mining face-to-face interaction networks using sociometric badges: Predicting productivity in an IT configuration task. Proceedings of the International Conference on Information Systems. Paris, France.

`

CURRICULUM VITAE

AMIN MOJTAHEDI, PhD, M.Arch, Assoc. AIA

414.793.7774 | AMojtahedi@hga.com | Mojtahe2@uwm.edu

Writings: http://aminmojtahedi.blogspot.com/

Drawings: http://aminmojtahedi.tumblr.com/

Startup website: http://www.cherrugg.com/

EDUCATION

2010–2017	**PhD**, School of Architecture, University of Wisconsin-Milwaukee, GPA: 4.0/4.0
2007–10	**M.Arch**, School of Architecture, Art University of Isfahan, GPA: 3.67/4.0
2002–07	**B.S.**, Civil Engineering, Azad University of Mashhad

FOCUS

The architecture of social learning and knowing

Cultivating change through the process of making the physical space

Design thinking for work and educational environments

People-Space Analytics

RESEARCH, DESIGN, DESIGN THINKING, & TEACHING

2017: Sum.–Now	Teaching Assistant, IDEO U
2017: Spr.	Design Thinking Catalyst, Stanford d.school University Innovation Fellows
2016–Now	Design Researcher and Design Thinker, HGA Architects & Engineers, Milwaukee, WI
2014–16	Designer and Researcher, Workshop Architects, Milwaukee, WI
2014: Sum.–Now	Cofounder & CEO, AIM: Architecture Information Modeling
2013: Fall	Architectural Intern, the Kubala Washatko Architects, Cedarburg, WI
2010–Now	Faculty and TA, School of Architecture & Urban Planning, Univ. of Wisconsin-Milwaukee

ARCH 190: Expressions

ARCH 190/390: Fresh Ideas Lab: Imagining Environments for Innovation

ARCH 190: Design Thinking Studio

ARCH 302: Architecture & Human Behavior

ARCH 310: Architectural Design Studio I

ARCH 320: Architectural Design Studio II

`

2003–Now	Research-team Leader and Designer, The Wooden Village of Neyshabour, Iran
2009–10	Architectural Intern, Piramoun Architecture Office, Isfahan, Iran
2009–10	Adjunct Faculty, Department of Architecture, Harand Azad Univ., Iran
2008–09	Adjunct Faculty, Art House of Isfahan, Iran
2004–06	Chief Editor and Senior Art Director, Mashhad, Iran

PUBLICATIONS & PRESENTATIONS

2017 **Mojtahedi, A.** Architecture of Culture. UI4 Meetup, May, Stanford d.school, CA

2017 **Mojtahedi, A.**, Yoon, S.-Y, Hosseini, T. A., Martinez, D. H. D. People-space Analytics: Case Study of Work Dynamics. Proceedings of 2017 AIA/ACSA Intersections Symposium, April, FL

2016 **Mojtahedi, A.** Cultivating Culture Using Patterns of Place (part of the presentation series titled as "Hack Your Creative Culture with Stanford d.school and Google"). Global Entrepreneurship Summit, June, Stanford d.school, CA

2016 **Mojtahedi, A.** Where Knowledge Resides: Exploring Architecture of Learning and Knowing from the Community of Practice Perspective. Proceedings of ACSA (Association of Collegiate Schools of Architecture) 104, March, Seattle, WA

2016 Avdeev, I. & **Mojtahedi, A.** How Students Can Help Reinvent Higher Ed. SXSWedu, March, Austin, TX

2015 **Mojtahedi, A.** 12 Tips for Building an Innovation Space, Retrieved from http://epicenter.stanford.edu/resource/12-tips-for-building-an-innovation-space

2015 **Mojtahedi, A.** Architecture for Learning and Knowing in a Changing Landscape (Abstract). Proceedings of EDRA 46, May, Los Angeles, CA

2015 Schermer, B. & **Mojtahedi, A.** Designing with the Metaphor of Brain in Mind (Abstract). Proceedings of EDRA 46. May, Los Angeles, CA

2014 **Mojtahedi, A.** The Place of Community of Practice Theory in Environmental Design Research (Abstract). Proceedings of EDRA 45, May, New Orleans, LA

2014 **Mojtahedi, A.** & Schermer, B. Cultivating Communities of Practice by Design: Case Study of the UWM Research Commons (Abstract). SCUP-49: Plan for Transformation in Higher Education, Society for College and University Planning International Conference, July, Pittsburgh, PA

2013 **Mojtahedi, A.** A Pattern Language for SARUP's Café. Calibrations 4: School of Architecture & Urban Planning, University of Wisconsin-Milwaukee, WI

`

| 2013 | **Mojtahedi, A.** & Schermer, B. Placing Social Capital in the Campus: Case Study of the University of Wisconsin–Milwaukee. Proceedings of EDRA 44, May, Providence, RI |

2013   **Mojtahedi, A.** & Schermer, B. Placing Social Capital in the Campus: Case Study of the University of Wisconsin–Milwaukee. Proceedings of EDRA 44, May, Providence, RI

2013   Schermer, B. & **Mojtahedi, A.** Understanding Student Unions as a Resource for Campus Community, Proceedings of EDRA 44. May, Providence, RI

2013   **Mojtahedi, A.** & Tajik, F. Re-placemaking: Constructing a New System of Bonding with Places. Proceedings of EDRA 44, May, Providence, RI

2012   **Mojtahedi, A.** & Schermer, B. Placing Social Capital in the Campus: Case Study of the University of Wisconsin-Milwaukee. Proceedings of Environment–Behavior Research Association (EBRA): the 10th Int'l Symposium on Environment–Behavior Studies, October, Hunan, China

2012   **Mojtahedi, A.** & Tajik, F. Re-placemaking: Constructing a New System of Bonding with Places. Proceedings of Environment–Behavior Research Association (EBRA): the 10th Int'l Symposium on Environment–Behavior Studies, October, Hunan, China

2012   **Mojtahedi, A.** & Tajik, F. Patterns of place and community; Linking physical place and social capital in the campus (Abstract). IAPS Conference on Human Experience in the Natural and Built Environment: Implications for Research Policy and Practice, June, Glasgow, UK

2012   **Mojtahedi, A.** & Tajik, F. Re-placemaking; Constructing a New System of Bonding with Places (Abstract). Proceedings of EDRA 43, May, Seattle, WA

2011   **Mojtahedi, A.** & Tajik, F. Reconstructing a System of Bonding with Places (Abstract). Proceedings of the 9th Biennial Conference on Environmental Psychology, Eindhoven, The Netherlands

2011   **Mojtahedi, A.** Reconstructing a New Sense of Home: A Quest for Wholeness (Abstract). Proceedings of the 6th Int'l Conference of the Research Network "Private Urban Governance & Gated Communities", September, Istanbul, Turkey

2011   **Mojtahedi, A.** Establishing a New Bond with Home; Case Study on Migrant Students in the U.S. (Presentation). Proceedings of EDRA 42, May, Chicago, IL

2011   **Mojtahedi, A.** Reconstructing a New Sense of Home: A Quest for Wholeness. 16th Annual Student Forum Abstracts, UW–Milwaukee Urban Studies Programs, Milwaukee, WI

2010   **Mojtahedi, A.** Evaluating Sense of Place among Adolescents and Adults of Julfa Residential Complex in Isfahan (Abstract). Proceedings of EDRA 41, Washington DC

2008   **Mojtahedi, A.** Culturally and Socially Supportive Residential Design in Julfa. Proceedings of the First National Conference on Iranian Architecture, Kashan, Iran

2006   **Mojtahedi, A.** & Jalayer, M. Introducing a New Method of Sustainable Construction. Proceedings of the 2nd Int'l Conference on Environmentally-Compatible Forest Products, Porto, Portugal

2005	**Mojtahedi, A.** & Jalayer, M. Eco-Construction: An Earthquake Resistant Construction, Proceedings of the 1st Int'l Congress on Earthquake & Lightweight Construction. Qom, Iran
2005	**Mojtahedi, A.** & Jalayer, M. Seismic and Environmental Performance of Eco-Construction. Proceedings of the 12th Civil Engineering Student Conference, Tehran, Iran
2005	**Mojtahedi, A.** & Jalayer, M. Structural Response of Wood-Frame Buildings Subjected to Earthquakes. Emarat Magazine, No. 7 & 8, Mashhad, Iran
2004	**Mojtahedi, A.** & Jalayer, M. Introducing a Local Pattern of Eco-Construction. Proceedings of the 11th Civil Engineering Student Conference, Bandarabbas, Iran
2004	**Mojtahedi, A.** & Jalayer, M. Local Environmental Factors in Housing. Proceedings of the First National Conference of Environment and Construction Industry, Mashhad, Iran
2004	**Mojtahedi, A.** & Jalayer, M. How Building Assessment Systems Lead Sustainable Construction. Emarat Magazine, No. 6, Mashhad, Iran
2003	**Mojtahedi, A.** & Jalayer, M. Eco-Construction. Emarat Magazine, No. 5, Mashhad, Iran

HONORS & AWARDS

2015: Sum.	Winner, Scheinfeld Entrepreneurial Awards Competition
2015: Win.	Winner, 2nd Place, New Venture Business Plan Competition, Lubar School of Business, Univ. of Wisconsin-Milwaukee
2015	Environmental Design Research Association Scholarship for EDRA 46 Los Angeles
2014-15	UWM Distinguished Dissertation Fellowship, Univ. of Wisconsin-Milwaukee
2014-15	Winner, UWM Student Startup Challenge, Univ. of Wisconsin-Milwaukee
2014: Fall	Winner, 2nd Place, Elevator Pitch Competition, Collegiate Entrepreneurs' Organization, Lubar School of Business, Univ. of Wisconsin-Milwaukee
2007: Fall	Ranked 1st, Architecture Graduate School, Art University of Isfahan
2007: Sum.	Ranked 3rd, Architecture Graduate Entrance Exam, Azad University of Mashhad
2004: Fall	Ranked 1st (paper), 1st National Conference on Environment & Construction Industry, Iran
2004: Win.	Ranked 3rd (paper), 11th National Civil Engineering Students Conference, Iran

VOLUNTEER WORK

2017: Fall	Authentic Learning Environments, A Workshop for Shorewood High school, Univ. of Wisconsin-Milwaukee
2016: Fall	Perfect Pitch, A Workshop for Peck School of Arts, Univ. of Wisconsin-Milwaukee
2016: Sum.	UWM for health, A Brainstorming Workshop for three Health Colleges at the Univ. of Wisconsin-Milwaukee.

`

2016: Sum.	[Hack Your Creative Culture](), A University Innovation Fellows and Google Workshop for the 6th Global Entrepreneurship Summit, d.school at Stanford University
2016: Spr.	[Innovators' Expo](), Univ. of Wisconsin-Milwaukee
2016: Spr.	[How Students Can Help Reinvent Higher Ed.](), University Innovation Fellows Workshop for SXSWedu, Austin, TX
2016: Spr.	Design Thinking Workshop for the School of Engineering, Univ. of Wisconsin-Milwaukee
2015-16	Pre-design Committee, Lubar Center for Entrepreneurship, Univ. of Wisconsin-Milwaukee
2015: Fall	Design Thinking Workshop for the School of Business, Univ. of Wisconsin-Milwaukee
2015: Fall	Design Thinking Workshop for the School of Human Ecology, Univ. of Wisconsin-Madison
2015: Fall	Design Thinking Workshop for Mayor Barret's Entrepreneur Week, Milwaukee, WI
2015: Fall	Design Thinking Workshop for Student Org Kickoff, Univ. of Wisconsin-Milwaukee
2015-16	PhD Students Representative, School of Architecture, Univ. of Wisconsin-Milwaukee
2014-16	Student Co-Chair of the Pre-Design Committee, UWM Student Union Project, Milwaukee, WI
2014-16	Co-Chair of the Student Advisory Committee, UWM Student Union Project, Milwaukee, WI
2014: Fall & Win.	Reviewer, Environmental Design Research Association
2013: Fall & Win.	Reviewer, Environmental Design Research Association
2013: Sum.	Preliminary Study for the UW-Milwaukee Housing Project, Milwaukee, WI
2004-06	Organizing Committee Chairman, Azad University of Mashhad, Iran
	Seminar on Sustainability & Architecture
	Seminar on Engineering Research Methods
	Seminar on the Contemporary Architecture of Mashhad

WORKSHOPS, MEMBERSHIPS, & CERTIFICATES

2016: Fall.	NSF I-Corps program
2015-Now	ACSA (Association of Collegiate Schools of Architecture)
2015-Now	Stanford d.school's University Innovation Fellows
2014-Now	Assoc. AIA
2014-2015	AIAS, Univ. of Wisconsin-Milwaukee
2014-2015	UWM Grad School Fellow
2013-14	Northwestern Mutual Life Insurance Campus Connection Master Class, Milwaukee, WI
2013-14	Constructed Environment Knowledge Community
2013	Social Learning Theory & Community of Practice by Étienne Wenger, Grass Valley, CA
2013	The Big Learning Event, Madison, WI
2012	Physical Space on Campus: A Summit on Building Community, Madison, WI

`

2010–Now	Environmental Design Research Association (EDRA)
2012–2015	The Honor Society of Phi Kappa phi
2009	Certificate of the 2nd Architecture and Sustainability Conference, Mashhad, Iran
2007–09	Iranian Concrete Institute, Student Membership
2006	Certificate of the 2nd Concrete Symposium, Mashhad, Iran
2006	Certificate of the 2nd Specialized Seminar on Shear Walls, Mashhad, Iran
2004–05	Green Earth Research Institute, Iran

SKILLS

Design Thinking

Design Research

Teaching

Drawing

Architectural Research and Design

    Pre-design, Schematic Design, Post-Occupancy Evaluation

Software

    SketchUp

    Adobe Premiere

    Adobe Photoshop

    Gephi

    Climate Consultant