I have a never-waning interest in “what makes people tick.” In fact my initial undergraduate education was in cognitive psychology followed by graduate work in clinical psychology. I was, and remain, deeply influenced by the role Bob Newhart played as a psychologist in his eponymous TV series. I quit the clinical program when I realized that listening to people’s problems could get tiring over time. I realized I had a flair for research. About that time I discovered the SARUP Environment-Behavior Studies program, which evolved as a great fit because I could apply psychological research to problem solving in the context of design. I graduated with my M. Arch. and PhD in Architecture. Because the education I received was multi-disciplinary, I have had a broad perspective on the intersection between people, work, technology, and physical workspace.

My professional career started with a stint at BOSTI (with the late Mike Brill), a consulting group whose claim to fame was “measuring” workplace productivity.” I then worked in academia for a few years (University of Wisconsin) but have spent the majority of my career in the office furniture industry. Professionally, my passion has been to pursue the connection between the design of space and human behavior (“workspace” broadly defined to include not only office facilities, but learning and healthcare spaces). I have sought to uncover the design features that make people more successful at their jobs, help teams create better outcomes, or even influence the success of entire organizations. As part of this process I have written two books and authored over 50 articles on this topic.
In my furniture industry roles I have: worked in product R&D, built a consulting business (measuring workspace performance and providing change management services), and more currently work in marketing, directing research projects to learn more about how workspace design affects employee performance and business outcomes. This research is translated into written materials shared broadly and through the 100 or more public presentations I conduct around the US each year. What we learn is also applied to guide the direction of new furniture products (such as the NEOCON Gold award winning Generation™ chair line and Innovation award-winning Antenna Workspaces™ systems furniture line).

My research has had a long-running theme of trying to understand “how” the physical space affects (and can be affected by) behavior. What are the underlying mechanisms, the element(s) of design that act on people and organizations? Early on, my research was greatly influenced by Karasek’s “job/demand control” model (Karasek and Theorell, 1990) which shows increased health and performance of employees when they have greater control over their work tasks - especially for very demanding “high strain” jobs.

In this model, control is defined by the level of autonomy and decision latitude inherent to the design of the job. Karasek’s research shows that the risks of low levels of job control are not trivial. His large-scale epidemiological studies directly connect low job control to increased stress and higher incidence of coronary heart disease (CHD) and mortality rates, and also have job satisfaction and performance implications.

In the early 1990s it occurred to me that this model of job control, which was largely the province of the world of organizational psychology, could be broadened to include the aspects of technology and in particular the design of the physical workspace. I wondered if, like job design, the design of the physical workspace itself could be leveraged to provide another element of control to the employee, the workgroup or even entire departments or organizations. I realized that environmental control could be the “missing link,” the mechanism that explains why some work places are more healthful and productive, and other spaces are less effective. Thus I began a journey to seek out and examine the benefits of environmental control and identify the elements of furnishings, layout and types of workspaces, and architecture of space that might form the mechanisms of control. This paper describes

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1Incidentally, of the over 3000 jobs they analyzed, the number-one lowest strain profession of all is architecture.
What I found along the way and how these ideas can be applied to design.²

What is Environment Control and Why is it Important?

Environmental control is the capability of individuals, groups or entire organizations to modify features of the physical workplace, and choose location, time, and type of workspace, to better support their work goals (O’Neill, 1998; 2007). In this holistic model, the concept of environmental control includes: knowledge of how to act on workspace capabilities that provide control (provided through programs and training), policies that support control through choice of location and time of work, and design characteristics of the workspace and technologies that enhance control (see illustration, Figure 1). The crux of my research has been to show that enhanced environmental control is related to improved individual and organizational performance, and healthful work.

Control can be provided through a wide variety of architectural, interior planning, and furniture design features: on-site infrastructure (movable partition walls, touchdown spaces, hoteling, huddle rooms, war rooms, flexible meeting spaces), off-site arrangements (individual telecommuting, remote tele-centers, satellite offices), furnishings in the primary workspace (movable storage units, seating, adjustable shelving, task lighting, monitor arms, etc.) (Earlywine and Ratekin, 2010; O’Neill and Wymer, 2010).

Technology in the form of portable communication and computing devices enable people to work from a wide variety of locations and times (Hinds and Kiesler, 2002).

Training can provide employees with knowledge of how to modify workspace features or make good choices about which spaces to use.

Workplace management policies and programs can provide employee choice over the time and location of their work; formal guidelines reinforce “permission” of employees to make those choices.

A growing body of research shows strong beneficial links between degree of environmental control and outcomes such as: psychological stress, group and individual performance, speed of business processes and even sick building syndrome (Carayon and Smith, 2000; Gifford, 2007; Lee and Brand, 2005; O’Neill and Evans, 2000; Sundstrom, Town, Rice, Osborn and Brill, 1994). These studies show that the benefits of environmental control transcend age, generational affiliation, gender, and other demographic characteristics.

### Model of Environmental Control

This holistic model assumes a dynamic, goal-directed system that adjusts itself using feedback from the outside world. In this system, people, technology, workspace and policies are sub-systems that continually adjust, and re-align to best achieve work and business goals. Environmental control is the adaptive mechanism that allows this adjustment to occur.

In Figure 2, the arrows indicate the direction of influence between one element of the model and another.
When high level objectives change, in response, business processes change, group goals and processes change and individual work tasks and goals evolve. Obviously these changes do not happen in lockstep but they do occur as a series of transactions within the system. Environmental control is the means by which the components of the system (business units, groups and individuals) can modify their use of workspace and technology to keep in alignment with organizational objectives as they change. The better the opportunities for control, the more effectively the organization can adapt to change, which will enhance the overall alignment of the system and ultimately business performance.

External Business Drivers: This is a dynamic model, in which external forces such as demands from customers and markets, and other larger demographic, social and economic drivers shape the business objectives of the company.

Organizational Objectives: The business objectives, in turn, shape the underlying programs for products and services and activities in support of those objectives.

Behaviors and Perceptions: Over time the objectives of the organization change in order to maintain alignment with market and customer demands. These changing objectives can also drive changes to organizational structure, and affect behaviors and perceptions such as employee engagement (feelings of belonging and connection to the organization), collaboration, learning and mentoring, and psychological stress.

Programs, Policies and Training: The model of environmental control also considers policies and formal programs that give employees choice over the location and time of their work - and employee and manager training on how best to use these programs.

Technology: Technology plays a significant role in providing employees control over how, where and when they conduct their work. While this model addresses this aspect of the workplace as a part of the model and recognizes its centrality to the concept of environmental control, the focus of this paper is primarily on the role of physical workspace.

Adaptive Mechanisms: The mechanisms of environmental control provide the means by which existing spaces and features within can be used and modified to meet business and work process needs and thus keep the business and work processes, and workspace, in alignment with organizational objectives.
These mechanisms occur in different ways at three organizational levels, Organization (Facility; entire organization or business unit), Group (Meeting spaces; team and share work modes), and Individual (workspace; focus work mode).

**Organization**

Examples at the organization level include: on-site and remote locations that support employee choice over time and location of work, flex work programs with unassigned workspaces, and architectural design features that support expansion and reuse of space as needed.

**Group**

Recent research suggests there are several types of collaborative work modes that workers move between over time (O’Neill and Wymer, 2009; O’Neill and Wymer, 2010; O’Neill, 2010). In this research, “share” is a collaborative work mode that can occur in individual or group spaces and centers on the casual exchange of ideas with a small number of colleagues. Sharing is a means of transferring knowledge between employees, and can include learning and mentoring.

Team is a group work mode related to specific work goals that occurs in formal and informal meeting spaces. Examples of mechanisms for control at the group level include: providing a variety of types, sizes and locations of meeting spaces, and furnishings, computing and communication technologies that provide flexibility within meeting spaces. For group work, a variety of meeting spaces scattered throughout the facility can be used to support a wide range of formal and informal collaborative modes. The transition of work between individual and group work can be facilitated—or hindered—by the location and adjacencies between individual and collaborative spaces.

Team effectiveness can also hinge on the ability to isolate certain activities from outside interference, such as problem solving meetings or sensitive advance R&D areas. Both the integrative and differentiating functions can be supported by individual and group control over the use of, and access to, collaborative spaces.

The space should support the ability to self-manage the use and reconfiguration of meeting spaces and boundaries between the group and other parts of the organization,
Designing for Choice and Control

depending on business requirements. Boundaries can be represented through variations in lighting, color, and movable furniture elements such as screens, panels and storage elements. Storage can substitute as an architectural element that provides more flexibility in reconfiguration of space (environmental control) than the permanence of fixed walls.

Individual

“Focus” is an individual work mode that occurs within a primary workspace that supports concentration and reduces interruptions. Work in this mode is primarily “heads down” (O’Neill and Wymer, 2009; 2010). Some examples of workspace features that provide control at the individual level include: flexibility of furniture, tables, tack boards, white boards, monitor arm, and lighting, tools to organize work materials, ease of adjustment of storage and display features, and ease of rearranging furnishings.

Figure 2. Model of environmental control
Research Conducted on Environmental Control

Organizational/Building Scale

This section describes research in which large-scale implementations of flexible workspaces were conducted in an attempt to enhance environmental control at the organizational level. The participants include office settings from the consulting, financial services, and manufacturing industries. Two studies examined call centers.

The effects of providing environmental control at the business unit scale of a professional services organization were examined (Huang, O’Neill, and Schleifer, 2008). The company consolidated 1135 employees from four buildings into one, using new furniture and interior design concepts intended to optimize the flexibility of the interior space and support collaboration. A facility policy of having a 3:1 ratio of unassigned to assigned workstations was implemented in the experimental workplace, and a variety of different types and sizes of meeting spaces for collaborative work were provided. A workspace reservation program was implemented, and combined with training on ergonomics and new “rules of behavior” for using this space. It was hypothesized that the workspace policy and program, and flexible design concepts would increase employee and business performance.

Responses were collected from three groups of professional and administrative employees, including a control group. Outcome measures were collected two months prior to the intervention and three and six months post-intervention. The study reported a 5.6% reduction in business process time and cost for employees who moved to the experimental workspace, and a 10.5% reduction in business process time and cost for those who moved to the new workspace and received additional ergonomic training.\(^3\)

A study of about 1000 call center agents within a financial services company by O’Neill (2007, p. 121) assessed the effects of a move to a more open (and collaborative) work environment on agent performance. Key measures included: job control, communication, collaboration, sense of community, retention rates (voluntary separations), and three aspects of agent performance, number of calls handled.

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\(^3\)Business process time was measured by creating a detailed process map which included activity time at each step, wait time and rework, tools and participants. Employee compensation information was used to yield an overall cost per minute at each step. With this approach we were able to calculate an overall time and cost for the process.
AHT (average handle time per call), and ACW (time to complete work after call has ended). The study reported significant improvements in job control and collaboration for employees who moved to the new space. The study found that employees who moved to the new space had a 2.8 percent lower rate of voluntary separations than did employees in the control group, over the 12-month period of the study.

A study examining the effects of a building consolidation project for the headquarters campus of a global shipping company (O’Neill, 2007, p. 141) included 720 participants working within 18 corporate departments; they were moved from four widely separated buildings into one existing location. A primary outcome was the time and cost of their “business case approval” process. Data was collected on the time and cost of conducting this process before, and after, the move to the consolidated space. After the move, the time and cost of the “business case approval” process was reduced by 32 percent, with an annual cost savings in labor dollars for this one process, of $120,000 per year.

In a research project for a manufacturing company the effects of implementing a flexible workspace program that involved the creation of a 25 percent proportion of “unassigned” cubicles for 750 professional employees (in 22 departments) as part of a building consolidation project (O’Neill, 2007, p. 170) were measured. This strategy was intended to enhance the amount of control that individuals had over the location of their work since they could move to different locations within the building and work within unassigned spaces. It was also implemented to lower fixed facility costs.

Data were collected at two points in time from an experimental group (those who relocated to the new facility with the unassigned spaces) and from a control group with an equivalent number of employees who did not move. There was a 7.5 percent decrease in process cycle time for one business process that contributed $375 of cost savings to the business each time the process occurs for an annualized $4,000 of cost savings. Several of the predictors of cycle time for this process are related to environmental control, including: availability of meeting space, and support for the shift from individual to collaborative work.

Another study examined different workspace strategies within two call centers of a telecommunications company O’Neill (2007, p. 205). The two locations varied in the openness of workspace furnishings and the interior architectural space itself. The data collected included: a workspace assessment survey, automatic call distributor
(ACD) data (length of call times, length of after-call work time, percentage of calls resolved on first call), customer satisfaction scores on agent performance, agent job satisfaction scores, claims costs, and lost work days at each site.

The comparison of the two sites revealed: as workspace support for collaboration increases (more and better quality meeting rooms), first call resolution measures improved. As adjustability of workstation features and perceptions of job control increased, external measures of customer satisfaction with agent performance improved. As perceived group cohesion increased, “after call” work time decreased (less after-call work time is more desirable).

The model (see Figure 2) suggests linkages between adaptive mechanisms at the organizational level and outcomes related to work behaviors and performance. This review shows a great deal of empirical support for the model across a variety of industries and work types.

**Group Work/Collaborative Spaces**

Most knowledge work is now performed by groups of people and various types of teams, as opposed to individual efforts. Recent research shows that knowledge workers engage in three distinct work modes, which vary from individual to several types of group work throughout the day (Formway, 2005; Gensler, 2008; O’Neill and Wymer, 2009).

In a study of sales professionals, environmental control (as measured by ability to control physical access to the group space) was a significant predictor of group effectiveness. For computer technical support workers, this measure of environmental control was a significant predictor of individual performance and work group effectiveness (O’Neill, 1995a).

In a study of team work spaces, O’Neill and Duvall (2006) found enhanced sense of belonging for employees when they were shifted from a traditional cubicle environment to a more open concept that included the addition of collaborative spaces. The design of the team space was in the form of a neighborhood which allowed the groups within to shift their boundaries and relocate individuals within the overall workspace as the assignments and work processes of the groups shifted over time.
**Individual Work/Primary Workspace**

At the individual level, research suggests that environmental control over workstation components, especially those that permit control over visual access by others, have a direct relationship to performance (O’Neill, 1994). Measuring the impact of giving individuals control over lighting in their environment, Moore, Carter and Slater (2004) found that the option for control over lighting in individual workspace may account for higher occupant satisfaction than actual differences in luminance.

A laboratory experiment examined the effects of interior workstation adjustability—and the effects of training in how to use that adjustability—on physiological stress and motivational performance levels under high workload (O’Neill and Evans, 2000). They hypothesized that more control (through adjustability or internal workstation features such as: seating, storage and display tools) and training would have the most desirable impact on these outcomes. Statistically significant findings of the study suggest:

- Given the opportunity through workstation adjustability, people will exert control over the work environment.
- Physiological signs of stress (as measured by epinephrine and urinary cortisol levels) are reduced when people have workstation adjustability and the training to use it.
- Motivational performance is enhanced when people have workstation adjustability and the training to use it.

Taken in concert with prior field work on adjustability in the workplace, the results from this laboratory study lend support to the claim that control in the form of adjustability of workplace features is an important element in stress and performance motivation. The findings of this study and others also underscore the critical role of proper training.

**Application**

In this section I provide two case studies showing how the concepts of environmental control can be, and have been, applied to furnishings and space planning in work environments.
Case Study

With only a 40% utilization rate of their office space, the facilities team of this Fortune 500 healthcare company wanted to eliminate underused space and reduce cost (O’Neill and Wymer, 2010). Strategic considerations also drove this project. The facilities team wanted to improve the efficiency of employees moving between locations—and thus their work effectiveness. This was done by creating a wider vocabulary of individual and meeting spaces, thus expanding the choice of appropriate work locations available.

Due to the dispersed locations of people, the facilities team also recognized the need to keep employees connected to each other—and to the organization—by providing spaces and technology that engage employees.

To accomplish this goal, assigned and unassigned individual and group spaces were created to provide a wide variety of choice and control to employees and work groups. These spaces consist of huddle rooms (small casual meeting spaces), team meeting rooms, focus/share work spaces located near larger meeting rooms, and “drop in” individual work spaces designed for either higher or lower levels of interaction (share work mode). The adjacencies between these spaces were also carefully considered in laying out the space. As a result of this program, the team reported several key benefits related to meeting cost and strategic goals:

1. The new layout helps people move smoothly and efficiently between dispersed locations and provides greater choice of the right type of workspace for the job at hand.

2. Unassigned “heads-down” work areas foster a pleasant experience and minimize disruption as employees move between work spaces within the building.

3. A variety of work settings was created while reducing space and costs:
   - 150,000 square feet avoided or eliminated
   - $3.7 million total annual cost savings
Case Study

This on-line company’s “Great Place to Work” initiative drove the need for new workplace solutions (O’Neill and Wymer, 2010). Corporate leaders wanted a workspace that appeals to all generations, is flexible and ready to adapt, provides an open environment for sharing ideas, and provides control to teams, to scale the space to their needs.

Team workspaces were designed to be flexible and scalable, allowing teams to change and move elements themselves. The workspace includes collaborative areas for teams, hoteling, projects, privacy, alcove chats, and storage. The design encourages collaboration and communication while supporting individual and team work. As a result of these changes, the organization realized cost benefits and better support for team work:

1. Teams can modify the workspace to meet their needs, providing control and reducing cost of “moves, adds and changes.”

2. Modular furniture components are used across business units, lowering warehousing needs.

3. Hoteling and visitor spaces allow people to sit with their own teams, eliminating dedicated real estate.

Conclusions

Fundamentally, environmental control is about giving people the workspace design, furnishings, technology and policy tools that provide choice over how to work, as opposed to being controlled by the space and organizational policies. Thus, I propose environmental control as a key capability that organizations should invest in through programs, policies, training, technology and the physical work environment. These approaches should be integrated, that is; brought to bear in a coordinated fashion for the greatest and most cost-effective benefit. By making control a central component of strategy, organizations may enhance their competitive advantage.
Looking forward, it may be possible to apply architecture and design concepts to enhance control in novel ways. A key idea is that the provisioning of control should be transparent to the user (Formway, 2005). The features and functions of the workspace that provide control (through adjustability and movement) should conform to the needs of the user as automatically, or intuitively, as possible. Research shows that training on how to adjust furnishings and work tools can amplify the positive effects of user control.

However, facilities, workspaces and furnishings designed from the outset to provide automatic adjustability, or at least make it obvious, could bypass the need for training. Design that embeds knowledge of how to manipulate the space or adjust furnishings and work tools could bring the benefits of environmental control more quickly to a greater number of workers without the cost and delay of training programs.
References


