The indoor environment: OPPORTUNITIES AVAILABLE, OPPORTUNITIES MISSED

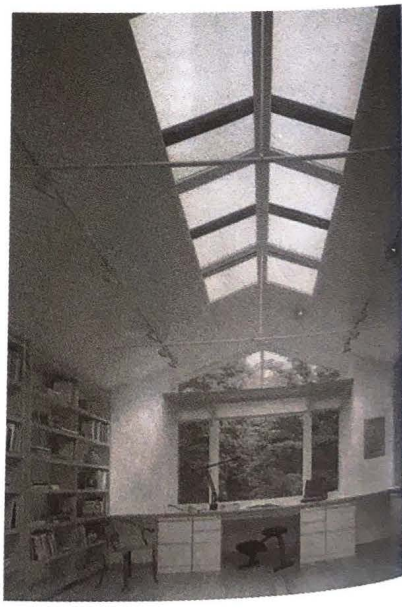
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Síntesis: El ambiente interior es importante para la conducta humana personal y social. En la complejidad actual, en un mundo altamente técnico, pasamos a menudo más de 90% de nuestro día en interiores: en casa, en el trabajo, en la escuela. Incluso la mayoría de los sistemas de transporte constituyen un ambiente interno. Mientras muchas disciplinas restan o simplemente ignoran las implicaciones de esta significativa exposición interior, la investigación sustancial ha demostrado el valor (y los costos potenciales) asociados con rasgos del ambiente físico interior. Este papel proporciona un esquema y demuestra ligas o relaciones entre los rasgos físicos del ambiente interior y la conducta humana tales como la creatividad, el trabajo en equipo, y el liderazgo.

Mientras existe poca investigación directamente relacionada sobre esas conductas, con rasgos específicos del ambiente físico, en cambio hay muchos estudios empíricos que demuestran oportunidades conductuales explícitas inherentes al ambiente físico. La investigación sugiere que los rasgos físicos comunican significados generacionales, culturales y de género, y visto así tienen influencia potencial sobre la conducta. Algunos rasgos les permiten a los ocupantes controlar la entrada del medioambiente permitiendo exposiciones optimizadas. Cuando tales rasgos son necesitados pero están ausentes, el resultado puede ser la experiencia de tensión (estrés) - a costa de la creatividad personal, la interacción exitosa, o del desarrollo de liderazgo.

Categorizar los componentes del ambiente físico como organización espacial, detalles arquitectónicos, condiciones del ambiente, recursos y vistas, proporciona un esquema para evaluar el ambiente diseñado. La creatividad requiere concentración de pensamiento y reflexión; el trabajo en equipo demanda una comunicación fácil y accesible; el desarrollo de liderazgo requiere comunicación y motivación. Los rasgos físicos y los componentes pueden apoyar la creatividad, el trabajo en equipo, y el liderazgo proporcionando oportunidades disponibles, con significado y control para sus ocupantes, o pueden representar solamente oportunidades desaprovechadas.



The indoor environment is important to human personal and social behavior. In today's complex, highly technical world we often spend more than 90% of our day indoors: at home, at work, at school. Even most transportation systems constitute an indoor environment. While many disciplines discount or simply ignore the implications of such significant indoor exposure, substantial research has demonstrated the value (and potential costs) associated with features of the physical indoor environment.

This paper provides a useful framework and demonstrates links between the physical features of the indoor environment and human behavior such as creativity, leadership, and teamwork. Understanding such links is essential to successful design. Designers carefully approach the design of homes, schools, and offices so that the occupants can move easily within them, and so that the styles and colors match client preferences and follow current trends. Designers create spaces and places to take advantage of new technologies and address thermal comfort and air quality, to include necessary resources, and to take advantage of magnificent views. The categories of components of the designed environment include spatial organization, architectonic details, ambient conditions, resources, and views. For the design of work environments of offices all of these components are vital, and are the context for creativity, leadership, and teamwork.

Figure 1 is a useful illustration of the complexity of this framework.

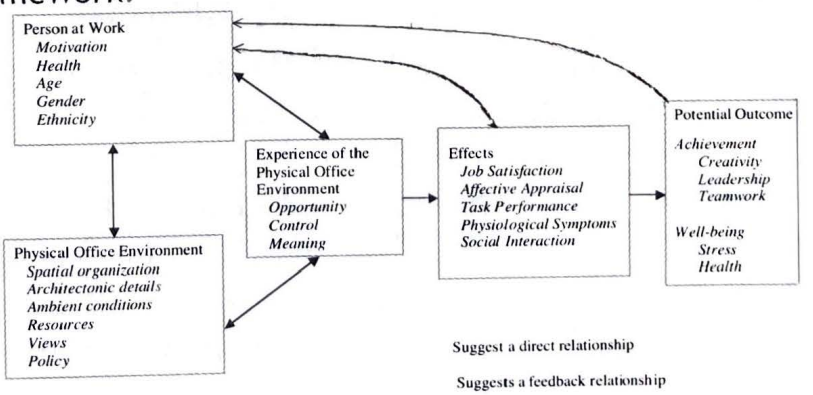


FIGURE 1.

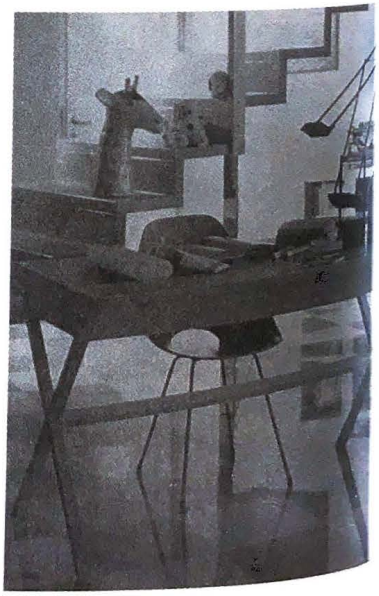
The physical environment of the office plays an important role in both the level of achievement and the level of stress experienced at work.

The Person at Work

People experience the physical work environment differently based on their age, gender, ethnicity, abilities, and personalities. Not only do people of different ages have different physical requirements, there are also generational issues to be resolved. While mature employees often hold the wisdom and the history of the organization, as people age their vision, hearing, and physical abilities change. These changes may require different lighting, acoustical, thermal, and ergonomic conditions than younger workers. Likewise, older workers may have different preferences for styles or trends, and even different motivation for working than their younger counterparts.

Gender differences play a significant role in how people experience an environment. Women tend to be more socially oriented and more likely to prefer collaborative work than men. Women employees are more likely to be concerned with on-site childcare or job-sharing. Due to their differences in size and dress, men and women may have different furniture and thermal requirements.

Increasingly the work world is ethnically diverse. Such diversity is important to the development of multiple perspectives, but diverse ethnicities may also have uniquely differing requirements from the physical environment. Some cultures are highly collaborative while others tend to support individualism, and thus may have uniquely different spatial requirements. Likewise, artwork appropriate to one ethnicity may be offensive or inappropriate for another.



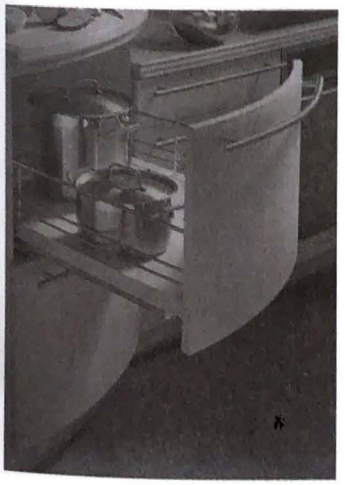
Much attention has been accorded the value of employing workers with disabilities. But many designers equate such disabilities only with wheelchair users. Certainly accommodating the wheelchair user is appropriate and

important; however in any population abilities vary widely. Because employees come and go in a work organization, that population and their abilities are also quite fluid. An equitable office environment will accommodate multiple and unique physical, sensory, and cognitive abilities.

Employee personality will influence the employee's experience of the work environment. While the study of the human personality is complex and its description is beyond the limits of this paper, consider just one example: that of the introvert and extrovert personality. Responding to distractions and the need to focus on the task at hand, not only will their spatial and acoustical requirements be quite different, their access to each other in an office can have significant impact on their ability to do the work.

The Physical Designed Environment

Elements of the physical office environment can be categorized as spatial organization, architectonic details, ambient conditions, resources, and views. It is the designer's responsibility to articulate these elements with the intention of supporting the worker and the work. When successful, the physical environment provides functional opportunities to accomplish the work, becomes a place of meaning, and allows the occupant a measure of control to support autonomy and independence.



Spatial Organization. Spatial organization determines the level of enclosure, adjacencies, density, and territoriality within the office. The organization of space encompasses the size, shape, allocation, and division of space, including furniture configuration and circulation routes. Spatial organization can influence functionality and efficiency for environmental and job satisfaction and task performance. Likewise, spatial organization may offer opportunities for a

myriad of activities, or inhibit them. Spatial organization can convey meaning: the location, size and shape of the office often denote status, fairness, or equality. The height of the wall and availability of a door may provide a sense privacy and control. When the designed office does not meet the occupant's needs and expectations, the result may compromise worker ability and achievement.

Architectonic Details. Architectonic details are the fixed or stationary aesthetics of the workplace. They include ornaments or materials intended to embellish the environment but not necessarily involving structural organization. These elements of the physical environment are often overlooked, but as some case studies[1] suggest, decorative styles, surface treatments, signage, color and artwork, contribute to job satisfaction. However, interpretation of architectonic detail relies heavily on how it is used, rather than a specific item of use: not everyone has the same stylistic preferences, or appreciation for the same artists. Architectonic details are opportunities for the occupant to express identity and purpose.

Ambient Conditions. Ambient conditions are the most researched area of the physical office environment. This includes illumination, heating, ventilation, and sound. Significant research indicates ambient conditions in the office environment can affect the occupant's experience of the place. Thermal conditions, air quality, noise, and lighting can influence job satisfaction, task performance, physiological symptoms and social interaction. Whereas, there are published «ideal» temperature ranges and lighting levels (for specific tasks), there is some controversy about the value of the published narrow range of environmental conditions constituting a single comfortable temperature or level of light. Perhaps more important is that people prefer variable



[1] *Becker & Steele, 1995.*

temperatures and lighting levels that they can control.[2] Healthy, comfortable ambient conditions may indicate or predict performance and satisfaction with the physical environment. They also indicate a clear connection between the physical environment and the psychosocial issues relevant to work performance.

One survey of 2000 office workers examined the relationship between the physical office environment and psychological well-being, finding that adverse environmental conditions, especially poor air quality, and noise affected worker satisfaction.[3] Extremes of ambient conditions may compromise the ability of the occupant to think and to interact with others, and thus negatively impact job satisfaction and performance.

Resources. Physical features of the work environment include resources: accessibility to and functional characteristics of equipment and services that support occupants' ability and satisfaction with work. Resources include equipment such as computers, copiers, and telephones. Resources also include access to facilities management services, physical fitness areas, parking facilities, and food service. Interviews of office workers[4] revealed that of the nine qualities that encouraged creativity, 52% of respondents stated that it was very important to have «access to the necessary resources, including facilities, equipment, information, funds, and people». Likewise, the office may be conceptualized as a tool, not just as a place to house tools[5]. In this instance, the office (the building, its furniture and equipment) is just one part of a larger information-handling system whose «goal is to add value to information in a managed process».

[2] *Gerlach, 1974; Kuller &Laike, 1998; Veitch & McColl, 1995; Veitch & Newsham, 1998.*
[3] *Klitzman and Stellman, 1989.*
[4] *Amabile, 1988; 1993.*
[5] *Brill* et al., *1984.*

Views. Views are the observable features visible within or from the work area, including what can be seen in adjacent workspaces and what can be seen from windows. Views may be natural (i.e., rivers, plants, sky) or built (corridors, other buildings, a parking lot), and views may be intimate (into a small garden) or panoramic (from a tall office building across the landscape). Views are evaluated based on scale and content. While there is little evidence that views influence worker achievement, some outdoor views may have restorative value and thus counteract stressful work[6] alleviating effects of both physical and psychosocial stressors. Views, such as those from the corner office, may relate to status.[7] Views from a hospital room have meaningful, restorative properties, shortening recovery time for surgery and reducing pain medications.[8]

Experience of the Indoor Office Environment

It is unlikely that the office environment could cause any specific behavior, but it does offer opportunity, control and meaning that influence the occupants' behaviors. The physical environment of the office offers functional opportunity: support of the goals and performance of an individual or team effort. Requirements of team functioning include opportunities to communicate and to collaborate. Both activities are essential to creative teamwork. Communication, the sharing of ideas, suggests some interaction between team members. Collaboration, the blending and developing of ideas, suggests openness, acceptance and respect for other, new ideas. The physical environment can support creative achievement by providing opportunities for communication and collaboration.



Functional opportunity is the potential for exercising behavioral options offered by the physical environment to its occupant.[9] As a group of people assigned to a task evolve as a team, as

[6] *Heerwagen, 1990; Kaplan, Talbot, and Kaplan, 1988.*
[7] *Becker and Steele, 1995, Brill et al., 1984*
[8] *Ulrich, 1984; 1993.*
[9] *Shehayeb, 1994.*

they develop as system with common goals, purposes, and responsibilities.[10] From this system comes the ability to think and act collectively. It is in this collective that fertile imaginations are likely to be challenged and stimulated, producing solutions to interesting and complex problems.

The physical environment supportive of teamwork includes features that provide functional opportunities for such collective behavior. As such, the social environment is key to group or team performance and that includes positive communication – allowing collaboration to occur.[11] Most collaboration begins as a consequence of unplanned and unintended interaction; if so, a floor plan and furniture arrangement that allows team members close proximity, propinquity, and sustained interaction may be the functional opportunities for capturing those ideas.[12] It is from collaboration that leadership skills emerge and develop.

Control. Control refers to autonomy, independence, and motivation in decision-making. Control of the features and properties of a physical work setting is manifest in at least two ways: autonomy and motivation. Autonomy is the mastery or ability to take action, to alter or regulate the environment. Motivation is the compelling reason for taking action; it is the internal process that makes people does what they do even if the path is difficult. An individual or team's ability to make unique, creative leaps in decision making requires intrinsic motivation to influence their area of focus and to have the opportunity to take independent, autonomous action.

Meaning. The elements of physical office environments are imbued with meaning. An individual or team will display symbolic artifacts unique to them as a means of self-expression. Such symbols provide a cognitive consistency between the self image and the physical environment; the

[10] *Ainger*, et al., *1995; Schrage, 1995; Sundstrom and Altman, 1989.*
[11] *Amabile, 1993.*
[12] *Kraut, Galager, Fish and Chafone, 1992.*

occupants may seek opportunities to reinforce that consistency. Also, if such self-expressions are cues or encouragement for future performance, we can infer that the physical setting does influence creativity and achievement and that this influence may be, in part, derived from the opportunity to exhibit such artifacts. Beyond artifacts on display, meaning may be derived from the quality, style, management, and maintenance of the environment.

Effects of Experience on Work

The effects of environmental experience include some levels of job satisfaction, task performance, health and well-being, motivation, affective appraisal, and social interaction. Job satisfaction is how one feels about the task at hand. Task performance is the measured or evaluated effectiveness or efficiency of the activities required of the job. Motivation is the underlying reason a person does the work. Affective appraisal refers to our judgments of things as pleasant, attractive, valuable, likeable, preferable, repulsive, and so on. Physiological symptoms include strength and good health as well as injury, disease, and impaired immune function. Social interaction includes both the system of formal exchange of information from authority to employees, as well as, informal, unregulated communication between co-workers.

Job satisfaction. While every satisfied employee may not necessarily be highly productive, a dissatisfied employee is more likely to be late, to be absent, or to quit when the opportunity arises. Dissatisfied employees are also likely to perform less well than their more satisfied counterparts and more likely to experience work-related stress.



Task Performance. Tasks in an office environment may include typing, filing, talking (on the telephone or face to face), thinking, writing, or any of a myriad of activities related to the job. Task performance is one measure of employee

productivity and evaluation of this performance is frequently used in hiring, firing, and promotion.[13] The inability to perform the tasks required of the job may be due to inappropriate workload, job pressure, insufficient control, and a lack of social support which can be exacerbated by inadequate functional opportunities: inefficient workplace, inappropriate or inaccessible resources. The physical environment is a risk factor for stress if it impedes the performance of individuals, teams, or groups in the organization.

Motivation. A person may be intrinsically or extrinsically motivated or simply not motivated. When intrinsically motivated, actions are chosen for enjoyment of the behavior itself. When extrinsically motivated, actions are taken to achieve a positive outcome or avoid a negative one. A person's performance is a function of that person's self-determination leading to increases in performance of a desirable behavior. Many studies have demonstrated that workers are more likely to be intrinsically motivated when they feel they belong to a collective with responsibility and freedom to learn from their performance.[14] Likewise, extrinsic motivation by bribes or punishment, are not particularly effective. Employees perform best when they perceive that their compensation is fair and reasonable. Incentives perceived to be out of sync with the job might prove to be counterproductive. [15]

Affective Appraisal. Our judgments of things as pleasant, attractive, valuable, likeable, preferable, repulsive, and so on (Farschci & Fischer, 2000) may be positive or negative. Stress in the office environment may result from negative affect. Cooper and Robertson (1990) found that people who are dissatisfied with their jobs are also likely to be dissatisfied with the indoor work environment; and when dissatisfied with their job and the indoor environment, report a very low level of productivity or job performance.

[13] *Brill* et al., *1984*.
[14] *Horgen, Joroff, Porter, & Schon, 1999*.
[15] *Jones & Moffett, 1999*.

Physiological Symptoms. Individual workers may have physiological symptoms resulting from exposure to some features and properties of the physical office environment. The duration and intensity of exposure to noise, thermal extremes, poor lighting, and pollutants may be highly distressing and cause injury, disease, impaired immune function, as well as disease risk factors such as elevated blood pressure and neuroendocrine stress hormones. Physiological symptoms may also be exacerbated by multiplicative effects of such exposures combined with task demands, low job control, or a predisposition toward negative affect.[16] Just as features and properties of the physical work environment can support good health, they can also be physically injurious.

Social Interaction. Many studies have investigated the relationship of the physical environment and social interaction. The level and kind of social interaction requirements in an office may vary according to individual preference and job description. Settings may be sociopetal, facilitating social interaction, or sociofugal, inhibiting such interaction.[17] Social interaction with co-workers and supervisors may be essential to task performance and critical to job satisfaction. Social interaction includes both the system of formal exchange of information from authority to employees, as well as, those systems «that are not officially recognized; rich networks of informal communication supplementing and sometimes circumventing the regulated channels; and decision processes [that] flow through the organization independent of the regulated system».[18] The quantity and quality of social interaction may be supported or inhibited by the properties and features of the office in which multiple levels of communication can occur. Occupants who cannot control the level and kind of social interaction may be more vulnerable when exposed to other stressors.[19]

As designers it is our responsibility to consider each of these social and environmental factors as we work with

[16] *Evans & Johansson, 1994.*
[17] *Osmond, 1957.*
[18] *Mintzberg, 1979, p. 46.*
[19] *Wineman, 1982.*

organizations to optimize their success. The spaces and products we design can offer opportunity and probability for achievement, or our designs may only provide missed opportunities. It is clear that what we do has great potential for influencing achievement in the office. That achievement may be the creativity of high performing teams, or innovative powerful leadership. Missed opportunities may be invisible, causes of stress among workers may be misdiagnosed, or go undiagnosed. Opportunities available go unrecognized; but without such opportunities, successful attempts at creativity, leadership, and teamwork will be compromised. Though complex, the designed indoor environment should at least offer the opportunity for organizational success.

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