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CHAPTER 20

THE EFFECT OF WORKPLACE DESIGN ON QUALITY OF LIFE AT WORK

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Abstract

Since the 1980s, research has studied the ways in which people are affected both 'objectively' and 'subjectively' by their physical environment at work. At that time, the concept of Quality of Work Life (QWL) evolved to promote improvements in the Quality of Life (QoL) of workers, in which the effects of workspace design and environmental features on worker morale and productivity were emphasized.

QoL research has developed a variety of ways of measuring how well human wants and needs are met. This chapter examines how meeting building users' environmental needs at work contributes both to better workspace design and to an improved QoL for workers. Studies of environmental quality at work indicate effects on a number of dimensions affecting workers' QWL. As research knowledge accumulates on environmental quality (EQ) – the range of ways in which workers are affected and respond to environmental conditions – the connection is made between EQ, QWL and QoL. Both objective and subjective measures are used to assess all three, and people's perceptions are a critical factor in both the person-environment relationship and the QoL experience.

One approach to assessing EQ is to measure functional comfort, that is, the degree to which workspace features either help occupants get work done or make their work more difficult. A functionally uncomfortable environment causes workspace stress and reduces QWL.

Finally, the chapter outlines a need-based framework that uses functional comfort to measure EQ and summarizes the ways in which workspace EQ supports QoL by improving QWL.

Why Quality Matters

This chapter argues that people's Quality of Life (QoL) is directly affected by their quality of work life (QWL), which is in turn influenced by the quality of the work environment. First, we explore some definitions of these terms and demonstrate how environmental psychology plays a key role in both QWL and QoL. Then, we outline a model that combines several well-established theories of the relationship between workers and their physical environment in order to show how the quality of workspace as perceived by users, contributes to and predicts their QWL, and consequently their QoL. In conclusion, we offer an approach to collecting empirical data from workers that can be used to diagnose the quality of the physical work environment. The results of data analysis can be applied to the 'treatment' of environmental problems and barriers so as to improve users' experience and make them more effective at work, as well as more satisfied with their QWL.

The concept of Quality of Life (QoL) has been defined as "the degree to which the experience of an individual's life satisfies that individual's wants and needs (both physical and psychological)" (Rice 1984). The World Health Organization defines QoL as the "individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, standards and concerns" (WHO 1994). Several definitions of QoL in this volume make reference to the natural environment (see Chapters 8 and 10), and some consider the larger scale of urban and cultural environments (see Chapters 12 and 27). In this chapter, we apply QoL concepts to environments for work.

Evidence suggests that measured QoL outcomes are both predictors of and result from QoL: "Happiness and a feeling of well-being will also result from QoL. When one rates his or her life as having quality, one will concurrently have a sense of self-esteem and pride regarding his or her life. It must be noted that a confounding scenario seems to be apparent with each of these consequences of quality of life in that each can contribute to, as well as result from quality of life" (Meeberg 1993). The ideological importance of Quality of Life is that it promotes the idea of supporting people to live in ways that are best for them in the environments they occupy. Individual assessment of QoL varies according to perceptions, personal needs, individual differences, preferences, culture and expectations. Lack of quality, however, may be perceived in more uniform ways.

Quality of life is a holistic concept composed of the cumulative contributions of a range of different life domains such as work, family, housing, neighborhood, religion, and social networks (Rice et al. 1985). The quality of each life domain can be assessed separately and will vary according to activity, place, social role and human relations as well as cultural values and individual expectations. Perceived quality of life results from an infinite number of cumulative life experiences; the degree to which people's wants and needs are satisfied in each domain determines the distribution of their QoL (Rice 1984).

One domain of life experience is the built environment that people occupy and the series of interior and exterior environments in which they behave, interact, perform activities and react. In western cultures, it is estimated that people spend 90% of their time indoors and, consequently, "Beyond their biological effects, [places] make us feel uncomfortable and ill-at-ease, energetic and stimulated or relaxed and at peace…They can work so deeply into our being that they affect our state of health" (Day 2002). The field of environmental psychology has spent many decades studying the effects of various types of built and natural environments on occupants – on their health, comfort, safety, attachment, behavior and attitudes. By showing the degree to which people are affected by the environment, the quality of each environment can be said to have a direct impact on people's QoL.

Notions of QoL depend largely on an understanding of human needs. Much environmental psychology research examines how aspects of their physical environment succeed or fail to meet people's needs. Human needs have been classified in many different ways, beginning with Maslow's (1954) hierarchy. The categories in this hierarchy form a pyramid ranging from that which is most basic to survival to the less basic but nonetheless essential; they include physiological needs, safety, esteem, love, and self-actualization. The more people's needs are met, the better their QoL. The debate on needs also applies to the physical environment and how the environment affects human behavior, using a similar premise: the more a specific built environment meets the needs of its occupants, the more effective or successful it is considered to be.[1]

[1] It should be noted that the needs model has been criticized on the grounds that it is premised on the human user as a passive recipient of environmental stimuli, rather than on the human user as an active agent with a reciprocal effect on his/her environment (Vischer, 1985).

Quality of Work Life

"Quality of Work Life is that part of overall quality of life that is influenced by work. It is more than just job satisfaction or work happiness, but the widest context in which an employee would evaluate their work environment" (Varghese and Jayan 2013). QWL is a sub-category of QoL research that has been studied independently since the late 1970s (Davis and Cherns 1975; Hackman and Suttle 1977; Lawler 1982). For QoL researchers, "Efforts to improve the quality of work life of employees may also affect their sense of quality of life" (Elizur and Shye 1990). As with QoL, people's QWL is affected by their work-related goals, desires, expectations and needs, and how well these are fulfilled. The concept of QWL developed from a concern for the negative impacts of work on employees' health and well-being, and the urge to improve the quality of the work domain by making changes in the design and conditions of work.

Quality of Work Life is a dynamic multidimensional construct focusing on worker well-being. It is concerned with workers' productivity, yet also addresses their emotional need to feel satisfied with their experience of work. However, QWL is not the same as job satisfaction (Lawler 1982). QWL is a philosophy or a set of principles based on a view of employees as the most important and meaningful resource in the organization, who should be treated with dignity and respect (Straw and Heckscher 1984). QWL combines factors related to the job itself, such as job satisfaction, salary, and relationships with colleagues, with intangibles, such as overall life satisfaction and feelings of well-being (Danna and Griffin 1999). The eight factors that affect workers' QWL are fair compensation, health and safety, self-development, growth and security, social integration, constitutionalism, life space and social relevance (Walton 1991). A model of needs in the work domain includes job requirements, work environment, supervisory behavior, ancillary programs, and organizational commitment. Work domain needs can be fulfilled through resources, activities, and outcomes resulting from participation in the workplace (Sirgy et al. 2001). Later, the physical workspace was added to QWL as a factor affecting job satisfaction and productivity (Cummings and Worley 2005).

Space-related needs in the work environment have been identified by concepts such as Preiser's (1983) habitability framework and Vischer's (1989; 1996; 2005) functional comfort pyramid according to which different workspace qualities can be ranked. Functional comfort is discussed later in this chapter; it is based on the habitability framework, which connects buildings and settings with users, and occupants' needs with the work environment. Habitability is a

relative concept that may differ from one culture to another: "Habitability defines the degree of fit between individuals or groups and their environment, both natural and man-made, in terms of an ecologically sound and humane, built environment" (Preiser op.cit.). Habitability requires that the physical environment meet three categories of users' needs: health and safety, functional and task performance, and psychological comfort. Improving habitability through a better fit between the occupant and the workspace means a better quality work environment and improved QWL. As QWL is considered a key factor in the sustainability and viability of organizations, finding ways of improving employees' QWL is an investment in human capital and in the viability of the organization (Sheel et al. 2012). Aspects of the work environment that have been found to affect QWL include the job or task, physical conditions, such as the building design, materials and technology, as well as economic and social aspects, such as administrative policies and the work-life relationship (Cunningham and Eberle 1990; Elizur and Shye 1990).

A poor QWL often means increased stress at work. Workers in North America spend at least fifty per cent of their indoor time in the workplace, and ways of reducing stress is a concern shared by managers, designers, environment-behavior researchers and environmental psychologists (Bagnara et al. 2001). The term "workspace stress" has been coined to distinguish the stress caused by functionally uncomfortable (unsupportive) workspace (Vischer 2007). Higher levels of stress at work are related to increased insomnia, anxiety, depression, job dissatisfaction, decreased organizational commitment, reduced job performance, and absenteeism (Woo and Postolache 2008). Studies indicate that workspace stress levels can be reduced by according more environmental control to occupants (Csikszentmihalyi 1990; Karasek and Theorell 1990; Kaplan 1983, Walton 1980; Lawler 1975). Environmental control can take mechanical and instrumental forms, such as light switches, furniture adjustments, and thermostats, or social-psychological forms, such as access to information about workspace decisions and participation in workspace design and planning. Offering occupants greater environmental control is known as environmental empowerment and contributes to employee well-being (Vischer 2005; Vischer and Malkoski 2015).

There is significant evidence that workers waste time and energy coping with poorly designed workspace, which reduces the time and energy they invest in work (Vischer 2008). In addition to the negative impact of absenteeism, due to illnesses such as respiratory infections, eye strain, and back and neck pains, the stress of functioning in an unsupportive or adverse physical

environment has behavioral effects. These include low morale, reduced motivation, employee turnover, and inadequate work performance as a result of performing tasks slower and making more errors – all factors that affect organizational productivity (Vischer 1989, 2003, 2008; Haynes 2007; Damain 2004; Heerwagen et al. 2004; Sundstrom et al. 1994).

In contrast, numerous studies have demonstrated the positive effects on both worker morale and productivity of occupying workspace where ambient conditions, such as lighting, temperature and sound levels, as well as furniture comfort, aesthetics and architectonic details, are managed appropriately for the tasks being performed (McCoy and Evans 2005; Vischer and Fischer 2005; Damain 2004; Brill and Weideman 2001; Fisk 2000; Monk 1997). Studies have found that lighting, ventilation rates, access to natural light and the acoustic environment are significantly related to workers' satisfaction and productivity (Humphreys 2005; Veitch et al. 2004; Becker 1981). In addition, workers' attitudes and behaviors are affected by ambient conditions, such as indoor air quality, illumination, temperature, and views (Larsen et al. 1998; Veitch and Gifford 1996). Natural elements, such as views of nature and indoor plants, have a positive influence on mental fatigue and a restorative value (Kaplan 1995; Kaplan et al. 1988; Haber 1977).

Well-being and emotional health are also affected by ambient conditions at work. For example, natural light in the workspace makes people happier and more motivated (Hameed and Amjad 2009; Heschong et al. 2002). Improved light and temperature, indoor air quality, ergonomic furniture and lighting are also linked to worker health (Dilani 2004; Milton et al. 2000; Veitch and Newsham 2000). It has been suggested that 16–37 million cases of colds and flu per year could be avoided by improving indoor environmental quality in US office buildings (Fisk et al. 2002; Milton et al. 2000).

Space layouts and furniture also affect QWL. Numerous studies, as well as popular journalism, have reported on the (usually adverse) effects of what are called 'open-plan' layouts (Konnikova 2014; Rashid and Zimring 2008). In the 1990s, the populart cartoonist Scott Adams made fun of office cubicles in his 'Dilbert' cartoons. However, with few exceptions, little effort has been made in these critiques to identify exactly what is meant by 'open plan' – a term that was first used in the 1940s to denote workspace layouts that were widely spaced and screened by plants, tall furniture, and, later, moveable partitions. Contemporary workspace design is characterized by a rich variety of open and partially enclosed layouts, depending on the culture and values of the

organization as well as on the type of work people are doing. Increasingly, the private individual office is a space-consuming anachronism as managers prefer to work collaboratively with their groups and teams, and co-workers prefer to co-locate and move around as needed during the workday. From a design and facilities management perspective, some form of open-plan configuration is essential in order to keep pace with the constant moves and changes of the modern office. As a result of changing technology, updated business practices, and project-based communication and collaboration, contemporary furniture products and office design concepts aim to accommodate the changing business environment (Tarricone and Luca 2002).

Open-plan workspace supports some important QWL values, such as more egalitarian space allocation, more communication, and more collaboration opportunities. Studies have shown that an open work environment encourages mutual support behaviors, fostering cooperation and engagement with co-workers (Mubex 2010; O'Neil 2008). Rapid and reliable communication is critical in today's business environments and the speed and accuracy of task performance has a direct impact on productivity (Quilan 2001; Fleming and Larder 1999). However, dense open-plan configurations cause distractions due to noise, and task performance can be affected by poor visual and sound privacy (Chu and Warnock 2002; Evans and Johnson 2000). Workplace distractions may reduce employee productivity by up to 40% and increase errors by 27% (Bruce 2008).

Users' ratings of quality in green or sustainable buildings show little variation from their priorities in conventional buildings with regard to the performance of work (Lee and Kim 2008; Paul and Taylor 2008; Abbaszadeh et al. 2006). While users working in buildings certified as green or sustainable generally report better indoor air quality, thermal comfort, and overall satisfaction levels, there are few significant differences between sustainable and conventional buildings when it comes to ratings of interior layouts, noise, and interior lighting. Generally, green-certified and green-intent buildings tend to be perceived more positively by occupants than conventional buildings in general ways, whereas for specific conditions, the differences are not clear-cut. Occupants' ratings may be influenced by their knowledge and expectations of how green buildings are intended to improve occupants' health, comfort and productivity (Leaman and Bordass 2007).

Models of Environmental Quality at Work

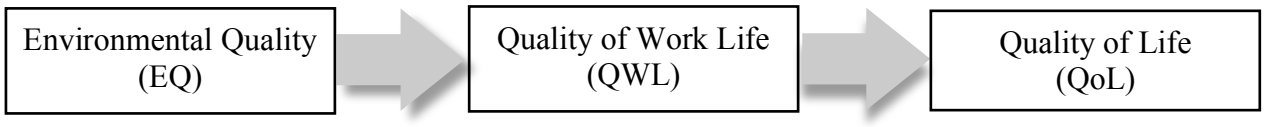
Environmental Quality (EQ) is a general concept applied to assessing user experiences of the physical environments they occupy; it has frequently been applied to research on users' needs in work environments (Elzeyadi 2001; Khattab 1993; Rapoport 1990). EQ is a key element in QWL and therefore an important determinant of workers' QoL. One approach to assessing EQ is post-occupancy evaluation (POE). POE is a general term for a range of types of study aimed at collecting and analyzing data from building occupants in order to measure EQ and the user impact of various building features. Objective POE measures address building performance related to air handling systems (ventilation and temperature) and lighting, and may include energy use, workspace reconfiguration of interiors, and preventive maintenance. Study results are typically compared to published standards and building code requirements (Kerce 1992). Subjective POE measures rely on data on occupant perceptions, which are related to users' needs and therefore to perceived quality (Blishen and Atkinson 1980). Like POE, EQ is assessed in objective and subjective terms. Rapoport (1977) distinguishes between physical and perceived qualities of built environments, where physical includes material aspects that are measurable using physical instrumentation, such as indoor air quality, light, sound and temperature. Material and immaterial qualities as perceived by occupants are measured using social and behavioral measurement tools such as surveys and interviews. The quality of a built environment can be determined in terms of its instrumental, latent, and symbolic levels of meaning (Rapoport 1988). At the instrumental level are the physical properties and functional qualities of the environment, enabling occupants to perform their tasks. The latent level refers to psychological, socio-cultural, and socio-psychological qualities, such as privacy, safety, territoriality, way-finding, and personalization (Fischer 1997; Ornstein 1992; Becker 1990). The symbolic level comprises the meanings and values of spatial elements in terms of users' traditions, beliefs, historical values, pride, and culture (Rapoport 1983; Doxtater 1994; Turner 1990). As these and other theoretical models suggest, user perception is a crucial factor in the person-environment relationship and essential to defining quality: "Most managers know that environmental quality does not exist outside the context of users' perceptions" (Vischer 1989).

Building Performance Evaluation (BPE) evolved from POE to take a more comprehensive approach (Preiser and Schramm 1997, 2012; Preiser and Vischer 2004). According to the BPE model, POE has a role in each stage of the life cycle of a building because each stage affects

building performance and occupants' experience of quality. The BPE process model of building delivery and life cycle integrates the perspective of all parties involved at each stage - including owner or tenant, space programmer and designers, contractor and construction team - and includes commissioning and eventual occupancy.

The goals of POE and related efforts to measure EQ are overall quality improvement: that is to say, a better managed and more cost-effective process resulting in a better quality building and more effective and satisfied users. This broad-brush approach to quality assessment has emerged out of several decades of post-occupancy studies, which have traced the causes of building performance and occupancy problems to decisions made early on in the process, often in the erroneous assumption of reducing short-term costs. The same intention can be found in the Leadership in Energy and Environmental Design (LEED) category 'Integrative process' in which points can be gained from involving designers, builders and specialists in different ways to solve problems early on in the process, leading to more cost-efficient and sustainable outcomes (USGBC 2014).

Figure 1 illustrates how EQ – as measured by POE and BPE type studies – has a direct effect on QWL and thereby on QoL.



In keeping with the concept of users' needs described above, a common approach to measuring EQ uses occupants' satisfaction ratings of different building features. However, it can also be argued that an overarching need for people at work is to be able to perform their tasks as effectively as possible. Asking workers to assess their environment in terms of its functionality and the ease or comfort of task performance provides both a user-based diagnostic measure of workspace quality and a direct indicator of EQ. The concept of functional comfort addresses how well users perceive their tasks and activities to be supported (or unsupported) by the physical environment in which they work. Collecting and analyzing functional comfort feedback from building occupants provides an empirical measure of how well people can get work done and is thus a more focused indicator of EQ than a general satisfaction rating. Vischer (1989) defines environmental quality as "the combination of environmental elements that interact with users of the environment to enable that environment to be the best possible one for the activities that go

on in it". Assessing EQ in this way provides an indicator of both user satisfaction (likes and preferences) and user effectiveness (productivity) that affect overall well-being and QoL.

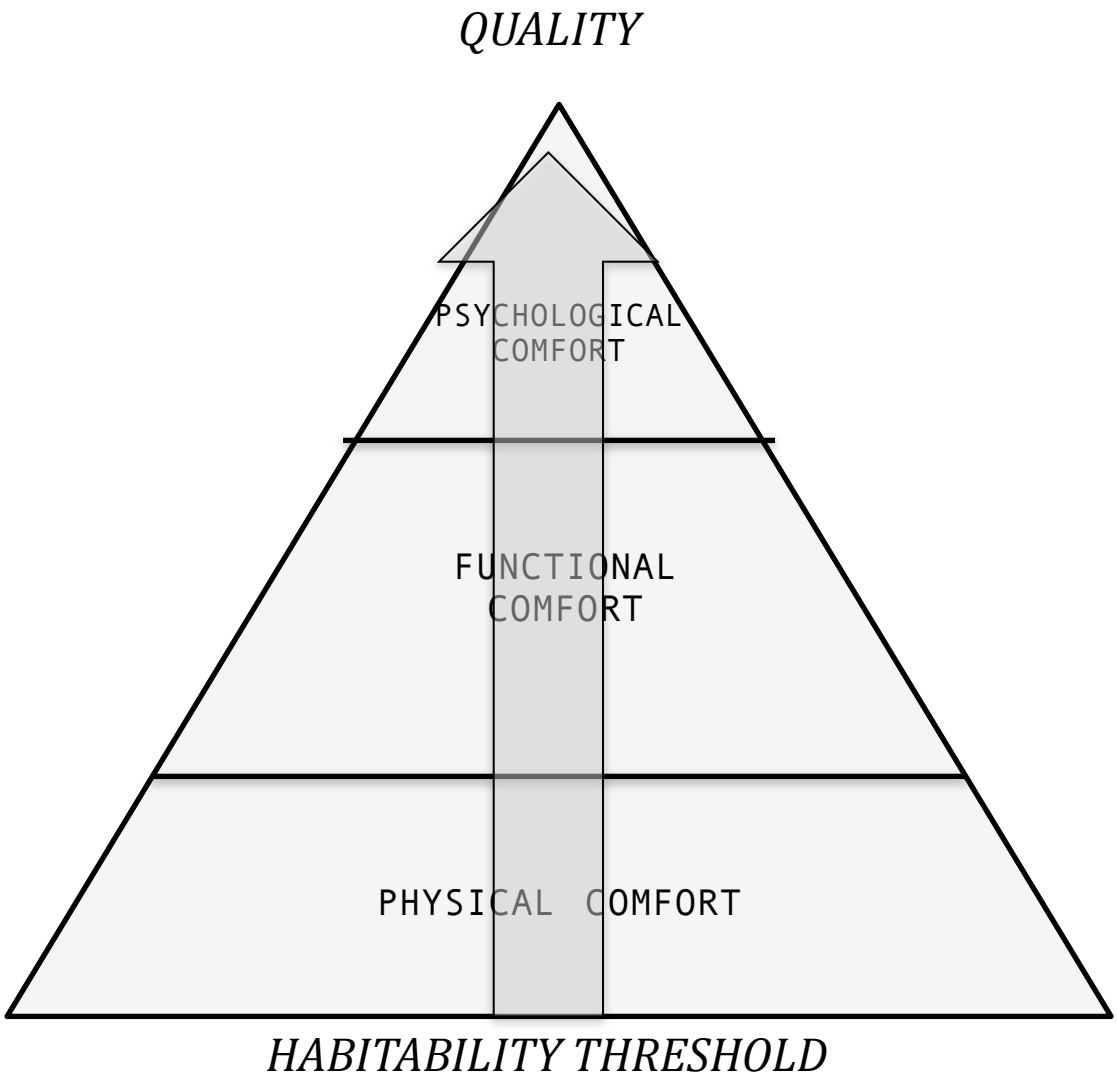
While users' functional comfort is a useful and practical empirical indicator of EQ, it is not the only one. However, unlike satisfaction and other measures of human behavior, functional comfort ratings provide a diagnosis of workspace quality that is not limited to users' preferences and can therefore be used to identify and correct practical problems of workspace design and management. In the next section, we will explain more about functional comfort and how it is measured, as well as how study results can be applied to problem-solving and better workspace design. We present the concept of functional comfort in the broader context of the environmental comfort model, in which users' physical comfort and their psychological comfort play an important part.

Functional Comfort and Environmental Quality

Defining EQ in terms of the functional comfort ratings that occupants attribute to and experience in their workspace facilitates the assessment of this aspect of QWL and ultimately of workers' QoL. Functional comfort is one measure of environmental quality: people who can do their work efficiently and effectively, without stress and with a sense of environmental support, occupy a good quality environment and experience it as comfortable. While workers' comfort experiences are filtered through cognitive processes, emotions, expectations, personality traits, learned behaviors, and past experiences, their perceptions of comfort are based both on how they use the physical features around them and on their deep and detailed knowledge of their work and the requirements of their tasks.

The workspace comfort or workability pyramid referred to previously is shown in the diagram below (Vischer 1989, 1996, 2005).

Figure 2: Workspace Comfort Pyramid



First published in Vischer (1989).

The model indicates that physical comfort is the basis of occupants' workspace experience and sets the minimum standard for basic habitability. If physical comfort is not adequate, people feel that their health and well-being might be in danger and, in some cases, such as indoor air contamination, they cannot or will not perform their work. Most modern office buildings meet basic health and safety standards and rarely threaten occupants' physical comfort unless there is a system malfunction or a threat of danger, such as a fire. While most building standards protect occupant safety and health – and even comfort – they do not ensure functionally comfortable workspace, that is, an environment that supports the tasks that people are performing, whether these are computer-based, interactive, focused, collaborative, or specialized.

Workspace that is designed to be functionally comfortable supports people's tasks, whereas uncomfortable workspace causes workers to expend their energy on overcoming environmental barriers to task performance, thus causing stress. All work environments can be classified somewhere on the functional comfort continuum, ranging from very supportive and comfortable at one extreme to unsupportive of work and stressful at the other. The degree to which tasks are supported is measured through structured feedback obtained from building users. Extensive research on functional comfort has shown that a limited number of environmental dimensions directly affect task performance. These include:

- Thermal comfort, ventilation and indoor air quality
- Lighting and the illumination environment
- Windows and daylighting
- Acoustic comfort and noise management
- Access to privacy for concentration and confidentiality
- Workstation dimensions, storage, enclosure and lay-outs
- Access to collaborative and shared spaces
- Cleaning and maintenance
- Safety and security.

Each dimension can be evaluated in more than one way. For example, a wide range of different types of lighting are available, most of which perform more than adequately in modern buildings. However, whether lighting is comfortable or not depends on whether the lighting provided is appropriate to the tasks people are performing. Long hours of screen-based work require low background levels of lighting that is not too bright or direct, whereas judging visual displays,

graphic tasks, and selecting colors and materials all require direct and color-sensitive light fixtures. As experts on their tasks, the workers themselves assess whether their work is supported or not by the lighting they have, thereby providing data on the functional comfort and EQ of their work environment.

While the exact nature and number of functional comfort dimensions varies slightly among organizations and types of work, the adequacy and convenience of building support spaces such as coffee areas, elevators and washrooms also have an impact on functional comfort. When these and other critical environmental supports are insufficient or absent, workers experience fatigue and discomfort and may have difficulty communicating. They spend more time completing their tasks and there is a higher risk of making mistakes; their quality of life is reduced. Sustained functional discomfort leads to stress (Vischer 2007).

As with all notions of quality, including EQ, office workers' perceptions of ambient environmental conditions, such as lighting and temperature, have a psychological component. For example, if indoor temperatures are too warm, workers start to suspect indoor air quality and become concerned about pollution. Occupants have strong feelings about windows even though they do not necessarily use natural light to see. Background noise levels that are distracting to some go unnoticed by others. The symbolic meanings identified by Rapoport (described above) also play a role in psychological comfort. From a behavioral perspective, the three measurable determinants of psychological comfort are territoriality, privacy, and control. A sense of territory is associated with a feeling of belonging and ownership; privacy is best understood as the need to exercise control over one's accessibility to others; while environmental control exists on at least two levels, mechanical or instrumental control – access to tools that enable users to control conditions, such as a thermostat to control temperature – and empowerment – participation in decision-making by those who occupy and use workspace. Workers need to feel they have control over intrusions and distractions. Depending on how the need for privacy is defined, physical enclosure is a less influential factor than intangibles such as managing interactions with co-workers and social contact. Where technology enables people to work from a variety of locations, territorial appropriation is no longer limited to physical space and traditional definitions of place: employees find other ways of taking ownership.

Nevertheless, what workers want and like is not always the same as what they need to get their work done. For example, most people will say they want and like private individual places to

work with a minimum of distraction, whereas what teams need to work effectively are open, flexible, collaborative environments. Consequently, the ways in which data on functional comfort are sought from building occupants must be tested and validated as measures of comfort – or quality – rather than measuring individual wants and preferences. Measuring functional comfort through occupants' ratings of key environmental elements serves as a diagnostic tool of workspace quality and should not be confused with subjective satisfaction ratings, which are better indicators of users' psychological states.

Using Functional Comfort to Measure Environmental Quality

Environmental quality can be measured through carefully acquired feedback data using a survey instrument designed to measure functional comfort. Results enable researchers, managers and designers to assess the quality of various environmental attributes in terms of the degree to which they support or not the tasks being performed. This means that a comparative quantitative indicator is available for key dimensions of the work environment; it can be used to ascertain how well workspace helps occupants work as well as to set priorities for environmental problem-solving and workspace change.

The best way to find out how comfortable or uncomfortable workers are is to ask them, as they are the experts on the performance and requirements of their tasks. However, it is important to ask them the right questions, and in such a way as to know exactly what their answers mean. The functional comfort survey is a short, standardized questionnaire that has been used to measure various types of workspace since the early 1990s. It is both reliable (can be used in different kinds of building) and valid (collects data that measure users' experiences of actual building conditions). The questions invite respondents to rate how comfortable they are on critical dimensions of functional comfort. Survey results help to identify both positive and supportive building conditions as well as those that might cause workspace stress. The data from the questionnaire survey provide constructive feedback that diagnoses workspace functionality, comfort and quality in precise locations. The results are designed to measure workspace as a tool for work, and feedback has been collected from buildings in North America, Europe and

Australia.[2] Measuring functional comfort is one of many tools available to assess EQ. Using an existing survey system means that planners can benchmark data to use for comparing and understanding results.

Once survey data have been collected, they must be analyzed, the results interpreted, and useful conclusions developed to aid in correcting problems and guiding space design and planning. Many surveys collect data on demographic differences, such as age, gender and job type. However, in using occupant feedback as a diagnostic tool, demographic distinctions are less relevant than location differences such as proximity to windows, type of desk or furniture, and temperature and ventilation conditions. Assessing functional comfort requires user ratings of environmental conditions that affect task performance rather than data on who users are and what they like and dislike.

Functional comfort assessments and the results of other evidence-gathering activities have been used to measure EQ in a range of workspace design and planning situations, including:

- setting priorities for building maintenance and renovation,
- responding to long-term employee complaints,
- promoting continuous improvement,
- comparing user assessments from different buildings, floors, areas, and pre- and post- change,
- establishing benchmarks for workspace quality over time.

The results of such assessments provide a valid and reliable indicator of environmental quality and facilitate the evaluation of workers' quality of life. Obtaining reliable feedback from occupants who are knowledgeable about their tasks offers a firm basis for new workspace design and a constructive opportunity to engage and involve occupants in situations of workspace change.

Designing a Better Workspace to Improve Users' QoL at Work

The theoretical model outlined in this chapter posits that identifiable elements of the physical environments in which people work can be assessed in terms of EQ and thereby affect QWL and ultimately contribute to QoL. Implicit in this argument is that there is a direct link between environmental design and QoL. Studies of workspace that has been strategically designed to support workers' tasks and activities demonstrate increases in all levels of workspace comfort,

[2] Previously published in Vischer (1996; 2005).

especially where the planning and design process has met psychological comfort needs by including opportunities for feedback and empowering users' participation in the planning process. Improved functional and psychological comfort gives rise to a sense of ownership. Feeling supported leads not only to better work performance and improved client and co-worker relations, but also to more commitment and loyalty to the organization, which results in reduced staff turnover and higher morale. Measuring occupants' levels of functional comfort produces information that can be applied to space changes and building renovations as well as to the design of new space.

As a critical component of QWL, EQ is also a key predictor of QoL. Collecting feedback from users that allows a diagnostic approach to be taken to building performance also generates information that can be applied to improving people's QWL and QoL. Diagnostic information on workspace quality is needed to shape the interior environment to provide improved support to what users are actually doing. This means that once physical comfort is assured in terms of occupants' health and safety, workers should occupy an adaptable workspace where lighting levels are adjustable, various configurations of desks and chairs and meeting spaces are possible, and where environments support constructive and flowing collaboration as well as focused concentration and privacy. As the workspace comfort pyramid (Figure 2) indicates, once work tasks and activities are functionally supported, there are opportunities for increasing psychological comfort, such as more individual and team control over workspace through easily reconfigurable territorial definition, a sense of security, and aesthetic advantages. As indicated by the arrow in the diagram, the vector propels towards quality improvement – that is, more EQ – as more needs at the three comfort levels are met. This approach to psychological comfort makes the connection to less tangible components of the work environment which are related to human needs and affect workers' QWL. These may include opportunities for autonomy and responsibility, employer-employee relations, organizational culture and values, opportunities for reward and advancement, and a social support network (Herbst 1962; Lawler 1975; Walton 1980).

As this chapter makes clear, QoL includes health, comfort, and satisfaction of needs. As a "systematic framework through which to view work aimed toward improving the lives of individuals", QoL can be assessed in three ways: as a "sensitizing notion that provides reference and guidance", as a "social construct", and as an "organizing concept" or "unifying theme" (Keith and Schalock 2000). QoL is commonly used as an indicator of total well-being based on

how people feel about different aspects of their lives. Objective measures of QoL are preferred by public agencies and policy-makers, as they translate into codes and standards that can be applied and their effects assessed. Subjective QoL measures are preferred by students of social and behavioral psychology, who use self-report data from validated research instruments. Subjective or perceived QoL typically contains 'cognitive' and 'affective' components: cognitive feedback is often based on individual judgments and can be subsumed as an element in need satisfaction, whereas affective feedback is typically more emotional and can be considered an element of human happiness (Kerce 1992). While satisfaction means comparing objective conditions to one's internal standards, happiness is an appraisal of an emotional experience (Cheng 1988). Andrews and Withey (1976) believe that it is "only when both types of measures (subjective and objective) are concurrently measured will it be possible to know how demonstrable changes in living conditions are affecting peoples' sense of life quality and, conversely, whether changes in people's sense of life quality can be attributed to changes in external conditions."

Numerous POE, BPE and other studies of user-environment fit have focused on need satisfaction in terms of users' own ratings of how well the occupied space meets their expectations and internalized standards. The implicit assumption is that if users state that their needs are met and that they are satisfied, then the built space they occupy is a success (e.g. Marans and Yan 1989; Humphreys 2005; Veitch et al. 2007; Schakib-Ekbatan et al. 2010). In this paradigm, meeting needs as a criterion for building quality is conflated with meeting needs as an indicator of quality of life, although the former measures building performance and the latter measures the user experience. While other types of study use objective or instrumental measures of EQ - such as measuring indoor air contaminants, humidity levels, luminance and illuminance, and other ambient conditions - results still have to be interpreted in the context of the real or assumed comfort experience of occupants in order to have meaning. In this chapter, we have argued for measuring QWL – and therefore QoL – by testing levels of functional comfort as rated by occupants. This can be construed as a subjective measure of EQ because measuring tools are designed to elicit occupants' feedback on their experiences of the environment. However, the functional comfort paradigm is designed to apply the results of data analysis to assessing a building's EQ and diagnosing building problems with a view to improvement, so can also be considered objective.

Field studies of EQ in work environments often highlight differences between instrument measurements of building performance or quality and occupants' judgments and perceptions (Leaman and Bordass 1999; Sekhar et al. 2003). For example, a workplace where temperature is measured at 20°C by a thermometer may be rated 'cold' by occupants – perhaps because the majority are seated near windows or under ceiling diffusers or simply dressed in light clothing. Hence, there may be variation in what is objectively satisfactory and what is satisfactory from users' perspectives in measuring both EQ and QoL. However, by considering the rating as a diagnosis rather than a judgment and seeking out the reason why users have assigned a 'cold' rating to an objectively 'warm' environment, it becomes possible to identify the cause of the problem and therefore its solution.

"From the occupant's point of view, the ideal situation is an indoor environment that satisfies all occupants (i.e. they have no complaints) and does not unnecessarily increase the risk or severity of illness or injury" (Bluyssen et al. 2003). However, the many parallels between QoL and EQ research – and specifically the emphasis on satisfaction of human needs – support the argument that EQ is a valid and measurable indicator of QoL and that, in this context, measuring people's satisfaction is as valid an indicator of EQ as functional comfort ratings. Nevertheless, whereas measuring functional comfort is a diagnostic tool for assessing building performance through specific outcomes such as task performance and effectiveness, eliciting occupants' satisfaction ratings is an approach better used as a predictor of QWL and QoL at work.

In finding out more about the complex relationships between people at work and the environmental tools they need, a more rational and substantive basis is being developed for informed design decisions that lead to more supportive workspace. In parallel, more is being discovered about how people experience QoL at work and the degree to which they feel their needs are being satisfied. These are two interestingly complementary approaches for future research.

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