The physical work environment and its relationship to stress

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Abstract:

How we work and the environments in which we do it are changing rapidly. At the same time, workplace stress is rising, with high costs for individuals and organizations. In this chapter, we review research findings about the relationship between the physical work environment and stress to summarize the current state of knowledge. Using this summary, we propose evidence-based recommendations of ways in which the physical environment might be adjusted to reduce stress for employees.

Keywords: work environment | productivity | employee stress | workplaces

Book chapter:

Introduction

The prevalence of workplace stress continues to rise, with studies showing that in the US alone, work-related stress costs US$500 billion in lost productivity annually (Mental Health America, 2017). Similarly, more than 49% of Australian employees are estimated to be suffering from stress at work, costing employers over AUD$10 billion per year (APS, 2014; Medibank, 2008). The cost of stress is not just financial. Stress at work increases absenteeism and turnover, decreases job satisfaction, and reduces productivity (Harter, Schmidt, & Hayes, 2002). Additionally, the consequences of work stress are of significant public interest because of their association with ill health (Stansfield & Candy, 2006). Clearly, stress is a phenomenon we need to understand more about.

Although there are many potential stressors for employees, from dealing with ongoing change (Spector, 1986) to daily expectations for performance (Alarcon, 2011), one area that has recently attracted the attention of researchers and organizations is the physical work environment. Evidence suggests the physical work environment plays a powerful role in influencing stress, with alterations to design, materials, and layout resulting in better or worse outcomes for

employees (Kim, Candido, Thomas, & de Dear, 2016; Nijp, Beckers, van der Voorde, Geurts, & Kompier, 2016). For example, high levels of noise emanating from the physical environment result in fatigue, tension headaches, and irritation (Ryherd, Persson, & Ljungkvist, 2008). Indeed, poor acoustics are a significant stressor, having been shown to elevate heart rates to levels associated with a heart attack (Ising & Kruppa, 2004; Tiesler & Oberdörster, 2008). As these examples illustrate, one's environment can play an important role in stress-related outcomes.

In this chapter, we review research findings examining the relationship between the physical work environment and stress. We begin with an overview of stress, including ways it is commonly defined and measured in the workplace. Next, we review the research on aspects of the physical work environment that influence stress, summarizing the literature and discussing the implications. Next, we propose evidence-based recommendations for using the physical environment to reduce employee stress. Finally, we conclude with suggestions for future research directions within the field.

Stress

Early conceptualizations of stress refer to it as a response by the body to a demand for change (Selye, 1955). More recently Folkman (2013) notes that stress is a relationship between the individual and the environment, where personally significant events are seen as overwhelming one's personal resources to cope with that situation. Stressors within the workplace result in strain which has subsequent effects on health and wellbeing (Ganster & Rosen, 2013). Stressors in the workplace refer to environmental events and work characteristics (for example in the Physical Work Environment, ergonomics) that result in either direct physical effects, or psychological reactions (Ganster & Rosen, 2013). Strains refer to the psychological, behavioural, and physiological reactions to environmental demands, threats, and challenges (i.e. stressors) and can result in a range of physical and psychological responses including anxiety, poor sleep, and increased blood pressure (Ganster & Rosen, 2013; Griffin & Clarke, 2011).

As noted, stressors may produce strain in one of two ways: physiological or psychological. Directly, some environmental factors such as noise, temperature, and ergonomics can lead to physical problems with associated physiological strain (Ganster & Rosen, 2013). For example, noise in the workplace has been associated with changes in heart rate variability and blood pressure (Kristiansen et al., 2009). Stressors may also have an indirect effect, and many studies of work-related stress also focus on how environmental conditions or events lead to cognitive and affective reactions that influence subsequent strain (Griffin & Clarke, 2011), rather than causing a direct physical consequence.

Workplace stressors lead to strains that include psychological responses such as fear, tension, and anxiety, as well as physiological responses such as increased cortisol and adrenaline or psychosomatic responses such as sleep disturbance, headaches, and fatigue (Ganster & Rosen, 2013). These responses can lead to changes in the immune, cardiovascular, and metabolic systems such as increases in blood pressure, body mass index, waist to hip ratio, and cholesterol. These sorts of health changes indicate strain, being associated with greater rates of

cardiovascular disease, diabetes, depression, mental health disorders, and all-cause mortality (Ganster & Rosen, 2013).

Because of these complex and diverse reactions to stress, the measurement of stress is undertaken in a number of different ways. These ways include physiological reactions such as changes in cardiovascular activity (e.g. heart rate variability (HRV) and blood pressure), arousal indicators such as sweating, alterations to the immune system (e.g. epinephrine and norepinephrine), and the hypothalamic-pituitary adrenocorticol axis (e.g. cortisol), and changes in metabolic system indicators (e.g. body mass index, waist to hip ratio, and cholesterol) (Ganster & Rosen, 2013; McCoy & Evans, 2005).

Measurement of psychological effects from stress are generally less objective, including self-report assessments of affect, fatigue, tension, workload, and anxiety or depression (McCoy & Evans, 2005). Further, some researchers suggest that task performance can be used as a measure of psychological stress; that is, if performance drops, we can infer the effect of stress (McCoy & Evans, 2005). In sum, stressors can result in both psychological and physiological responses, resulting in strains that have both short-term and long-term health consequences (Ganster & Rosen, 2013). Since there are a range of factors within the physical work environment that can produce different mental and physical reactions amongst employees, designers and managers need to be aware of the factors that lead to stress and strains.

The physical work environment

The physical work environment in organizations includes the nature and arrangement of all the material objects and stimuli that people encounter in their organizational life (Davis, Leach, & Clegg, 2011; Elsbach & Pratt, 2007). While the physical work environment can powerfully influence employee stress, these effects are frequently not taken into consideration when undertaking workplace design. Workplace design decisions are more likely to be made with a focus on reducing escalating real estate costs (Nijp et al., 2016) or enhancing performance and collaboration (Kim et al., 2016). Indeed, the nature and design of work environments have altered dramatically, including practices such as open-plan offices, hot-desking, and shared office spaces. This has resulted in decreasing levels of visual and auditory privacy, reduced space per employee, and increased levels of noise and distraction (Davis et al., 2011; Kim et al., 2016).

Changes such as these are likely to have implications for stress on employees. A range of dimensions of the physical work environment, including a lack of access to views, increased noise, higher temperature, poor office layout, and a lack of nature-like surroundings, have been linked to increasing stress. Research has shown that environmental stress can reduce work performance by 2.4–5.8%, reducing motivation, and increasing tiredness and distractibility (Lamb & Kwok, 2016). Below, we summarize the ways in which different dimensions of the physical work environment may act as stressors resulting in physiological and psychological responses of strain.

Environmental sources of strain

Light and view

Physiological stress

Lighting levels, access to views and proximity to windows have been demonstrated to have direct physical effects on employees (Rashid & Zimring, 2008). For instance, natural light in offices decreases headaches and seasonal affective disorder (Franta & Anstead, 1994), decreases accidents and improves sleep quality (Luo, 1998), and decreases eyestrain (Rashid & Zimring, 2008).

Psychological stress

Psychologically, well-lit offices have been shown to increase positive mood (Heerwagen, Johnson, Brothers, Little, & Rosenfeld, 1998). Lighting effects, such as warm white light, positively influence social relations and reduce interpersonal conflicts (Baron, Rea, & Daniels, 1992). Likewise, perceptions of high-quality office lighting led to employees reporting more pleasant moods and having improved wellbeing at the end of the work day (Veitch & Newsham, 2000). A study by Leder, Newsham, Veitch, Mancini, and Charles (2016) found that employee-reported satisfaction with lighting was influenced by window access and levels of glare within the workspace, supporting previous findings about the importance of access to daylight and outside views (Frontczak et al., 2012; Yildirim, Akalin-Baskaya, & Celebi, 2007).

Summary

Visual cues appear to be a key stressor which contribute to the stress experienced by employees at work. The effects of light on workers have been of interest to researchers since the time of the original Hawthorne experiments (Izawa, French, & Hedge, 2011). Based on the evidence we have highlighted, lighting levels and access to natural light have an influence on employees' stress at work.

Noise

Physiological stress

Noise is amongst the most often cited complaints from employees regarding the physical work environment (Kim et al., 2016). Research has linked workplace noise exposure to physiological consequences of elevated cortisol levels (Kristiansen et al., 2009), changes in HRV and blood pressure (Chang, Jain, Wang, & Chan, 2003; Kristiansen et al., 2009). Noise has also been linked to increased sickness in employees (Kristiansen, 2010). Frequent self-reported exposure to disturbing noise at work is associated with increased risk of long-term sickness absence among office workers (Chou, Lu, & Huang, 2016; Clausen, Kristiansen, Hansen, Pejtersen, & Burr, 2013).

Psychological stress

Distraction and inability to concentrate is the most often noted complaint in relation to modern workplaces (see Elsbach & Pratt, 2007; Kim & de Dear, 2013). Noise has been demonstrated to

cause annoyance (Rashid & Zimring, 2008) and decrease task performance (e.g. Cohen, 1980; Glass, Reim, & Singer, 1971). Distractions in open-plan offices lower cognitive performance (Yadav, Kim, Cabrera, & de Dear, 2017), as well as increasing levels of annoyance and mental workload (Zaglauer, Drotleff, & Liebl, 2017). All these factors have been identified as stressors in previous research.

Summary

In essence, auditory factors are also important as a stressor in the physical environment at work. While excessive noise has been a clear safety issue in industrial settings over an extended period (Nelson, Nelson, Concha-Barrientos, & Fingerhut, 2005), the above evidence suggests that noise is also an issue contributing to stress in modern office environments.

Temperature

Physiological stress

Sick building syndrome, which has been described as occupants experiencing acute health- or comfort-related effects linked to the amount of time spent in a building, has been consistently correlated with room temperatures above 22°C (e.g. Reinikainen & Jaakkola, 2001). Research also reveals that workers' performance on fine motor tasks and tasks requiring sensitive movement drops when temperatures are too cold (McCoy & Evans, 2005).

Psychological stress

In terms of psychological effects, research notes temperature as a significant stressor in office buildings that are either too hot or too cold (Rashid & Zimring, 2008). Research has shown that higher temperatures increased perceptions of crowding (Griffit & Veitch, 1971), which has been shown to contribute to aggression (Stokols, 1972). Cool offices can improve the performance on some cognitive tasks and reduce fatigue; however, extreme cold within the workplace will reduce performance on complex tasks (McCoy & Evans, 2005).

Summary

Drawing on another of the five senses (touch), the evidence suggest that temperature can be a significant stressor. Given the requirements for modern office buildings to be air-conditioned, difficulties in achieving and maintaining ideal temperatures throughout the workplace mean that resultant temperature extremes can contribute to a range of strains for employees.

Furniture and the arrangement of space

Physiological stress

A key development in recent office furnishings is the implementation of workstation modifications based on research highlighting problems with excessive sitting (Chia, Chen, & Suppiah, 2015). Indeed, workers spend up to 80,000 hours seated during their working life,

leading to numerous health issues, including diabetes, cardiovascular disease, and obesity (MacEwen, MacDonald, & Burr, 2015; Neuhaus, Healy, Dunstan, Owen, & Eakin, 2014).

An experiment by Chia and colleagues (2015) randomly assigned groups of office workers to two different conditions: an office chair and a seat-cycle. After four weeks, the groups switched conditions. The results showed significant improvements for resting systolic blood pressure, resting heart rate, and sleep quality (Chia et al., 2015) for the seat-cycle group. However, using a stand-up desk all day may produce different health issues. Prolonged standing has been associated with musculo-skeletal pain and venous insufficiency (McCulloch, 2002).

Researchers have demonstrated a relationship between open-plan office design and health complaints including headaches and respiratory infections (Hedge, 1982; Klitzman & Stellman, 1989). Increased density within the workplace has also been shown to lead to greater risk of infection (Bodin Danielsson, 2010). Male and female occupants may experience the work environment differently, with researchers noting differences in satisfaction with the ambient environment, stress levels, and sick leave (Bodin Danielsson, Chungkham, Wulff, & Westerlund, 2014; Kim & de Dear, 2013).

Psychological stress

The layout of equipment and the degree to which enclosures and barriers (such as walls, desk dividers, and meeting rooms) are present in the workplace can influence levels of density and psychological comfort (Elsbach & Pratt, 2007). Open-plan offices, for example, generally have few enclosures or barriers, leading to issues with privacy, noise, and distraction (Kim & de Dear, 2013). Further, the level of density and crowding within the workplace can exacerbate issues relating to distraction, concentration, and productivity. Increasing the numbers of enclosures and barriers has been shown to increase satisfaction (e.g. Brennan, Chugh, & Kline, 2002), performance on simple tasks (e.g. Oldham, Cummings, & Zhou, 1995), task feedback, and trust in management (Zalesny & Farace, 1987). This would appear to support research on shared desk environments, where Morrison and Macky (2017) found that the perception of supervisor support decreased in environments where employees did not have allocated desks. Some research has suggested that increased stress levels in open-plan offices may be related to disturbance and a lack of personal control (Bodin Danielsson, 2010),

Further, while a greater number of enclosures and barriers assists with visual privacy, it may not assist with auditory privacy (Maher & von Hippel, 2005). Cain (2013) suggests that solitude is an essential ingredient in innovation, an important outcome sought in many organizations today.

Summary

Clearly our sensory experience of spaces is important. There are direct physiological effects based on ergonomics; however, the arrangement of space and our ability to arrange space to fit the necessary working conditions can also be seen as a stressor.

Natural factors

Physiological stress

Research has shown that exposure to nature resulted in decreased heart rate and decreased systolic and diastolic blood pressure (Park et al., 2007). In addition, studies have also found that the presence of plants and nature-like surroundings reduced cortisol for participants (Park et al., 2007), and supported improved autonomic control (measured using heart rate variability). The overall results of these studies suggest that there is a systemic relaxation effect experienced by individuals who have contact with plants and other natural features. These results have also been found when nature is simulated in indoor environments, with potential confounding factors such as weather, climate, sounds, and smells removed (Gladwell et al., 2012; Laumann, Garling, & Stormark, 2003).

Workplace air quality can have significant effects on workers' stress. In experimental conditions where researchers enhanced air quality, employees were found to have fewer headaches, respiratory complaints and slept better at night (Allen et al., 2016). Allen et al. (2016) argue that changing the quality of air in the physical work environment (at a cost of about $40 per person) had a $6,500 per year increase in employee productivity. Air quality is affected by levels of carbon dioxide (CO_2), as well as air-borne pollutants (Orwell, Wood, Tarran, Torpy, & Burchett, 2004). Other researchers confirm that high levels of CO_2 have resulted in reduced performance and productivity (Seppänen, Fisk, & Lei, 2006). Other studies have also demonstrated a reduction in sick building syndrome symptoms when air quality is increased (Seppänen, Fisk, & Mendell, 1999).

Psychological stress

In a field experiment introducing plants to three different workplaces, Nieuwenhuis, Knight, Postmes, and Haslam (2014) found that subjective perceptions of air quality, concentration, and workplace satisfaction improved for employees, as well as objective assessments of productivity. In addition, exposure to nature has been shown to have the capacity to improve attention (Berman, Jonides, & Kaplan, 2008). An explanation of plants' beneficial effects centres on the evolutionary explanation that a green, planted environment reflects the natural world and thereby supports human physiology (Orians & Heerwagen, 1992).

Summary

The proliferation in recent years of vertical gardens and green walls on both the exterior and interior of commercial office buildings attests to the recognition of the importance of the effects of natural environments for individuals in urban settings (Nieuwenhuis et al., 2014). The inclusion of nature within the workplace can reduce the effects of a range of environmental stressors.

Interventions to reduce stress in the physical work environment

Having outlined the ways in which the physical work environment creates stress, in this section we propose ways in which the environment can be modified to reduce employee stress. There is no question that physical work environments can have powerful effects on individual behaviour

(Knight & Baer, 2014), and while the direct physiological effects are relatively straightforward (e.g. provide adequate lighting to reduce eye strain), the mechanisms through which psychological effects emerge are not clearly established. Oseland (2009) emphasizes the importance of considering how spaces support the psychological needs of employees, and previous research has established the importance of psychological reactions to the physical work environment. Further, the effect of stressors within the physical work environment is additive, and as such while the individual effect of one stressor such as noise or lighting may be low, the cumulative effect of stressors on employees may be significant (Lamb & Kwok, 2016). These considerations are important for both researchers and practitioners in examining the effects of physical work environments on stress.

Light and view

The use of high-quality lighting in the workplace will improve both mood and wellbeing (Veitch, Newsham, Boyce, & Jones, 2008), as well as enhancing social relations and reducing interpersonal conflicts (Baron et al., 1992). Providing all employees with access to natural daylight and outside views across the workspace may also reduce physiological strains, including headaches, eyestrain, and seasonal affective disorder. The provision of adjustable lighting such as task lighting to provide employees with personal control is also recommended (Danielsson & Bodin, 2008). In order to balance the access to views, the provision of barriers such as internal walls needs to be carefully considered in the design of the workplace.

Noise

Jahncke, Hygge, Halin, Green, and Dimberg (2011) found that open-plan office noise evoked cognitive and affective responses that led to reduced motivation and performance. Being able to control noise appears to moderate some of the negative effects experienced by employees (Danielsson & Bodin, 2008; Glass et al., 1971), likely due to the effects of the influence of personal control. Noise in the workplace can be managed through barriers such as walls, dividers and acoustic furnishings, wall treatments and fabrics, while hard surfaces such as concrete and timber floors can increase noise. As such, and particularly with the continued rise of open-plan workplaces (Kim et al., 2016), acoustic design is an essential factor to ensure that the effects of noise are minimized where possible. Giving employees access to a range of different spaces within the workplace to select to conduct their work will increase the perception of personal control, allowing employees to control the amount of noise exposure experienced during their work. The types of workspaces that facilitate this control are discussed later in this section.

Temperature

As modern air-conditioning systems develop, the ability for employees to control and adjust temperature within different areas of the work environment is increasingly available. The installation of such systems should be a key consideration for employers in refurbishing or fitting out new work environments.

Furniture and space

Cain (2013) has recently been involved in a project to create retreat spaces for introverts within the workplace. Refuge spaces allow employees to access a place where they can retreat from distraction to restore their mental and physical state. These types of spaces, as well as different furniture configurations with specific considerations for visual and acoustic privacy, are becoming increasingly important for employees to undertake focused work and reduce psychological stress.

In addition, modified workstations including stand-up desks, treadmill desks, and seat-cycling chairs are an increasingly prevalent feature in offices in an attempt to address the physical consequences of sitting for long periods. Careful consideration should be given to decisions around density, desk-ownership and where people work in relation to others who are important in their work team in the layout of the workplace having regard to the type of work being conducted and the needs of individual teams and employees.

Natural factors

Proponents of introducing greenery to the workplace argue that natural environments restore people's capacity for directed attention, whereas built environments tend to deplete this capacity (Kaplan, 1995). Natural environments exert less demand on directed attention and encourage more effortless brain functions, thereby allowing the capacity for attention to be restored. Thus, after an interaction with natural environments, one is able to perform better on tasks that rely on directed-attention abilities (e.g. data analysis, problem-solving tasks). According to this view, plants in the workplace should enhance employees' directed-attention capacity and therefore enhance their concentration and productivity levels. Despite these findings, Coon et al. (2011) argue further research is needed into the physiological mechanisms that arise with exposure to nature.

The benefits of working in physical work environments that are characterized by the inclusion of indoor plants, and/or views of greenery, are supported by evidence of the benefits of nature on employee attitudes and outcomes. Some researchers suggest humans have an innate need to be connected with nature, termed biophilia (Wilson, 1984). However, as housing density, commute times, and office hours increase, employees are spending less and less time in natural environments, placing greater emphasis on the inclusion of nature-like surroundings in the workplace.

Incorporating nature into the workplace can take many different forms, including living green walls, indoor trees, and planter boxes. Even where there aren't windows onto nature, and it isn't possible to bring in plants, some of the same effects can be achieved. Simulated views of nature, using high definition televisions, have also been shown to create positive effects, reducing physiological stress by lowering heart rates and blood pressure (Brown, Barton, & Gladwell, 2013).

More generally, research findings suggest that environment designers should take account of the cognitive, affective, and behavioural reactions of employees to achieve the outcomes desired by organizations of their employees (Sander, Caza, & Jordan, 2019). For example, physical work environments that are poorly designed in terms of layout and acoustics will likely contribute to

levels of noise and distraction that make it difficult for employees to focus and concentrate, resulting in cognitive and affective outcomes that increase strains.

Likewise, environments that utilize unattractive materials, furnishings, and design will contribute to strain by increasing negative moods and perceptions of a lack of beauty (Wilson, 1984). The beauty of the workplace and its effects on employees may be a critical factor in reducing stress. With respect to the experience of a sense of beauty, scholars have shown that aspects of the physical work environment such as use of beautifying natural materials, colours, views, and lighting can influence mood and creativity (e.g. Ceylan, Dul, & Aytac, 2008; Larsen, Adams, Deal, Kweon, & Tyler, 1998). Indeed, it has been suggested that the aesthetic experience of beauty is a universal human response (Wilson, 1984).

Lastly, the physical work environment has been suggested to represent the body language of the organization (Doorley & Witthoft, 2011). If the design of the environment lacks functional and attractive spaces and items that convey a sense of welcome and meaning in terms of the organization's purpose, employees are unlikely to feel a sense of connection to the organization. Studies have shown that by not allocating permanent desks, employees report a decrease in the perception of supervisory support, indifference to co-workers, and reduced commitment to the organization (Morrison & Macky, 2017). When employees do not feel supported by the organization and are indifferent to their co-workers, they are likely to experience psychological strain.

While there are a broad range of physical and psychological stressors within the work environment, the ways in which employees react to those stressors may vary significantly based on individual differences and needs. Further, the importance of the ways in which aspects of the physical work environment influence psychological reactions is highlighted by Oseland (2009), who emphasizes the importance of considering aspects such as the variety, layout, purpose, and furnishing of spaces to ensure the psychological needs of employees are supported.

Indeed, previous research has shown that there is significant between-person variance in how individuals respond to the physical work environment (Sander et al., 2019), with individual perceptions of the working environment influencing responses to stress (Sohail & Rehman, 2015). For example, noise-sensitive individuals are more distracted by noise than insensitive individuals, with noise-sensitive subjects not only evaluating environmental noise as more annoying, but they also experience higher levels of strain than noise-insensitive individuals (Sandrock, Schütte, & Griefahn, 2009).

While this may seem unsurprising, the wide-scale adoption of open-plan and shared-desk work environments (Kim & de Dear, 2013; Kim et al., 2016) suggests that the importance of between-person variation is often not considered by those that design office space. That is, to suggest that all employees will respond in the same way to changes in the physical work environment ignores the basic foundation of psychology in relation to between-person differences.

This generally has not been considered by organizations in the design of their physical work environments and the subsequent effects this has on both physiological and psychological stress. As such, organizations should consider creating workplaces with a range of different spaces

within the physical work environment that cater to different individual needs and the requirements of different types of work. For example, instead of one large open-plan work area, several smaller work areas could be provided along with café areas and meeting points for noisier collaborative work, as well as visually and acoustically private workspaces for employees to select based on their personal requirements.

As noted earlier, a sense of personal control may moderate the psychosocial stress, with increasing perceptions of personal control being shown to moderate stressors within the work environment (Danielsson & Bodin, 2008). As such, giving employees the ability to adjust factors within the workplace, including glare, light levels, furniture, temperature, and levels of privacy, may reduce the effects of environmental stressors.

Future directions

In this chapter we have summarized current knowledge about the ways in which the physical work environment influences stress. We have outlined the implications of these influences, and suggested ways in which the physical work environment might be modified to reduce employee stress. As employees spend increasing amounts of time at work, and levels of stress continue to rise, the environments where work is conducted are increasingly under focus.

Given that individuals respond to stress in a number of different ways, a diverse range of measures is required to record these responses. Researchers need to be aware that a single measure of stress may not give a complete picture of the ways in which stress is affecting an individual. Similarly, studying discrete aspects of the physical work environment, such as plants or noise, is likely to give an incomplete understanding of the complex ways in which reactions to the physical work environment influence stress.

Although many studies have examined effects of specific environmental features, they have frequently done so in atheoretical or theoretically incommensurate ways (Davis et al., 2011). So considering the work environment from an efficiency perspective (looking at workflows), will be different from a work environment designed for cost savings (focussing on the amount of space individuals need to work), will be different from a workplace designed to encourage innovation, will be different from a workplace designed to reduce stress. To this end, we encourage researchers in the field to incorporate a reliable and widely applicable means of assessing employees' reactions to their physical work environment. By focusing on the important role of individual reactions to the physical work environment and doing so using a consistent theoretical framework, future researchers may accumulate a body of knowledge of the ways in which reactions to the physical work environment influence stress.

Psychological reactions can provide the link between concrete features of the environment and employee behaviour, they can explain how features such as equipment, colour scheme, and office layout influence behaviour and reactions to that environment. In relation to focus, we know that employees need to focus on their tasks. Research has also shown that workplace environments vary in their ability to support focus, based in part on how much distraction is introduced into the space and how much support the space provides for individuals to adjust the level of distraction they experience (Lee & Brand, 2005). Using this knowledge, a well-designed

workspace should reduce stress. For example, noisy workplaces disrupt cognitive processing, leading to significant deteriorations in concentration (Banbury & Berry, 2005) and resulting psychological stress. As such, investigating how levels of privacy, cognitive distraction, and environmental control in the physical work environment influence focus and psychological stress is an important next step. This research could lend itself to an experimental design where the environment is manipulated to assess its impact on an employee's ability to focus.

Scholars have noted that a sense of territory and control within the physical work environment is associated with a sense of belonging (Brown, Lawrence, & Robinson, 2005). Given that many employees now have much smaller spaces and less control over them (Davis et al., 2011), the effect of modern trends in efficient office design are worth investigating in terms of how they support or detract from a sense of connectedness or belonging. Density, spatial layout, furniture placement, and design may all contribute to a sense of connectedness or of isolation, thus increasing cognitive and affective stress responses. This type of research may lend itself to being conducted as action research examining reactions in actual workplaces.

Conclusion

This chapter reveals the numerous ways in which elements of the physical work environment can result in stress for employees. The outcomes of this stress can have significant negative effects on employee health and wellbeing as well as reducing task performance, job satisfaction, and productivity. We have suggested ways in which the physical work environment might be modified to reduce stressors for employees. With work-related stress costing employers billions of dollars per year, coupled with the continued rise of higher-density open-plan workplaces, understanding the effects of the physical work environment on stress is more important than ever.

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