A Theoretical Framework and Analytical Discussion on Uncongenial Physical Workplace Environment and Job Performance among Workers in Industrial Sectors

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Abstract

The purpose of this research is to explore the theoretical framework of the physical workplace environment and its effects on job performance. Early researchers have classified five factors of the workplace environment that can affect job performances: sound, temperature, air, light and colour, and space. These findings though largely still contradictory; still play a major role in the determinants of workers’ job performance. Therefore, a recommendation of a better and congenial physical environmental design has been suggested by describing a new kind of work centre, acoustic privacy and general kind of work setting.

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1. Introduction

Recently, studies in environmental psychology have put much focus on the effects of physical working environment on job performance. Working in a safe and healthy physical workplace environment will support the work being carried out by the employees. Technological advancement and developments open

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new possibilities for creating conditions concerning noise, air, temperature, light, and space, in which are optimized for the employees’ performance. Organizations that take advantage of these opportunities definitely are rewarded with more motivated and productive employees. Moreover, recent studies on physical workplace environment reveal the uncongenial physical working environments do decrease the quality of a job, especially among workers in industrial sectors. The uncongeniality and misfit of physical working environment indeed affect not only the motivation of the worker, but also the satisfaction, social relation, performance and health of the employees.

The physical environment at work is crucial to employees’ performance, satisfaction, social relations and health. It is can be considered not only as a collection of physical stimuli (will be discussed in this paper), but also as a physical structure (size, furniture, hallways, etc) and as a symbolic artifact (the meaning or image of the work setting). The physical stimuli at a workplace environment can be classified into five different factors, namely: sound (noise, music), temperature (heat, cold), air (pollution, freshness), light and colour (sunlight, incandescent, fluorescent, windows, views), and space (density, arrangement of work stations). When the work environment is worse, which is caused by the poor physical stimuli, employees will experience more distress, and eventually this will affect their job performance. The primary studies of Hawthorne’s findings reveal the impact of the physical changes that misfit with the employee thus; affect on employee’s performance at a work place. Consequently, a minimal or maximal alteration of the factors in the workplace environment such as lighting might lead to the improvement or decreasing of worker’s performance. Exposure to noise, for instance, was observed to have harmful effects not only on the hearing, in which later could impair the job performance, but also on the endocrine glands, indicating that a physiological stress response was involved. Therefore, the uncongenial or uncomfortable workplace environment in this paper refers to the mismatch between what people need to perform their tasks and resources the physical environment provides, such as sound, light, space, temperature and air.

Work or job performance illustrated in this study refers to the productivity itself, as well as to the time spent in the office, attendance, and resignation rate. Therefore, the purpose of this paper is to discuss analytically the effects of uncongenial physical workplace environment on job performance, as the results on the findings itself are still contradictory. Moreover, the paper also seeks to explain the factors of the physical environment that decrease job performance, and to propose better ways of organizing physical environment at a workplace.

2. A theoretical model of workspace stress

Lazarus and Cohen (1977) classified workspace stressors into three distinct categories, namely; 1) cataclysmic phenomena or sudden, powerful events that affect many people, such as natural disasters; 2) powerful events that only affect fewer people, such as family crises, and 3) daily hassles or repetitive problems of daily life, such as work frustration and commuting. This concept of ‘daily hassles’ need to be distinguished from other major life events, as ‘daily hassles’ alone closer to the person’s daily experience (Kanner, Coyne, Schaefer, & Lazarus, 1981). The stress produced by our ‘daily hassles’ is generated by stable, repetitive or chronic conditions that may annoy an individual employee on a regular basis. Therefore, this concept of ‘daily hassles’ stress is useful in the study of the physical environment on people’s behavior, specifically referring to work behavior related to job performance.

The study of the ‘daily hassles’ in the working environment, has resulted in discovery of five influencing factors: noise, air, temperature, light and color, and space. McCoy and Evans (2005) characterized how physical environment could interfere with the attainment of work objectives. These stressors; noise, air, temperature, light and color, and space in the work environment affect an individual employee’s performance adversely in a high intensity level or prolonged exposure. This is when the
stressor delay the abilities to process and to understand the number and predictability of ‘signals’, in which increase with task complexity. However, this environmental stressor also could influence physiological processes, produce negative affection, limit motivation and impede social interaction.

Moreover, a mismatch between the demands placed on workers and the physical environment in which they meet those demands is by definition stress-generating. The definition of misfit refers to the environment places inappropriate or excessive demands on users, specifically employee, in spite of their ability to adapt and adjust their work behavior (Alexander, 1970; Herring, Szigeti, & Vischer, 1977; Preiser, 1983; Zeisel, 2005). McCoy and Evans (2005) also emphasized on the temporal dimension of ‘daily hassles’: any environmental element that is recognize as temporarily annoying cannot be regarded as a stressor, compared to the same element that causes annoyance over time. Vischer (2007) claimed that the sustained impact of adverse environmental elements may also cause a delayed reaction, affecting performance immediately after the eradication of the stressor elements in the working environment. See the below figure 1 for the illustration of the physical workplace environment (stressors).

![Physical Environment Conditions (Stressors) that affect the worker. Source: Berry, (1998)](image)

Fig. 1. Physical Environment Conditions (Stressors) that affect the worker. Source: Berry, (1998)

3. Analytical discussion on physical workplace environment and job performance

The competitive environment in the workplace is constantly changing and there appears to be an absolute basis for an individual worker to be present or absent during the work day. Many workers especially those in industrial sectors find that their workplace is no longer a second home for them although much of their time is spent in the office, and thus leads them to resist or feel forced to accommodate with the uncomfortable environment. Absence from the workplace can occur for many reasons such as official leave (training), medical reason, annual leave, emergency leave and so on. Often these several of reasons of workers to release themselves from the hectic working place to the place that can soothe their burden not on the work load, but on the stressful condition.

Some of the workers at industrial sectors more exposed to hazardous environment at their workplace such as construction worker, factory worker, highway worker, bus operator and to name a few. The exposure to the hazardous environment can make the workplace ungenial and thus, might affect their concentration and attention. Hence, the ungenial workplace environment might reduce the efficiency in performing daily tasks by reducing employee’s attention span to the tasks assigned to them.

Moreover, ungenial workplace environment such as noisy (much on unfamiliar sound), too low or high temperature, stuffy office, lack of natural light or even cramped working space might affect individual performance and quality. Though the job performance is measured on quantity basis, but for some jobs, it is relies on the workplace setting in which it gives undeviating impact to the workers’
performance and quality of the job being done. In this paper, five main factors of uncongenial working environment, namely; sound, temperature, air, light and color, and space will be discussed analytically in relation to the decrease of job performance among workers in industrial sectors. Each one of the factor will be discussed separately with the arguments from several research findings on the related area of study.

3.1. Sound and job performance

Airports, factories, mines, construction sites and those industrial sectors involves in heavy equipment or machinery can all be noisy places and exposing employees to conditions can affect their job performance quality. According to Berry (1998) sound is a perceptual effect produced by wavelike changes in air pressure. The frequency of the wave motion, which is measured in cycles per second or cps, is interpreted as pitch by human sensory mechanisms. Sound including noise and music can serve two main purposes; noise which is unwanted sound and desirable sound which is called euphony (Gifford, 1996). Sound can be regarded as noise or euphony depends on the individual employee and also employees’ situation. As not all noise at a workplace can be regarded as unpleasant as well as euphonic to certain employees. Noise on the other hand is a psychological concept involving more than perception of sound. Loudness or sound intensity is measured in decibels (dB). (Berry, 1998)

On the other hand, research also indicates that noise does operate as a stressor to individual employee. This finding has been confirmed by Melamed, Fried and Froom (2001) and McLean and Tarnopolsky (1977). They reveal that exposure to high levels of sound might lead to cardiovascular disease, endocrine and digestive reactions especially in complex jobs not in simple jobs. Millar and Steels (1990) claim that, subjects who were exposed to intense (93dB) noise showed more vasoconstriction, thus, with greater physiological arousal, compared to a control group working in a quieter condition. Hence, the study done by Cohen and Weinstein (1981) also stated that working at noisy industrial sites show detrimental health effects, especially cardiovascular disease. These, of course, have major effects on the performance on employee’s daily tasks. Once the health of the worker is being jeopardized by the noise at working place, eventually he goes absent or goes on medical leave for an extended period, which might affect the quality of job performance of worker. This is particularly, for a job that emphasis on the quantity of the product being produced at certain time such as sales officer.

If only noise works as a stressor in the working environment, therefore it could be understood by looking at two main functions of the stressor in the working environment. Firstly, intermittent noise is more disruptive than continuous noise. It means that, the irregular sound could serve as the source of intermediates throughout the completion of the daily tasks. Thus, exposure to the unfamiliar and alien types of sound (noise) discontinuously, is the main concern for employees not able to give attention and concentration in a work task. Secondly, the effect of continuous noise depends on its intensity and on the task (Berry, 1998). Some level of noise seems to improve performance and reversely noise disrupts on tasks. It is clearly justified by Cohen and Weinstein (1981) that low-level of noise will somehow improve performance, such as monitoring and high-level noise disrupts on performance. This can be view from the above table explaining the intensity of sound in decibels (dB).

Moreover, the effects of noise merely on the complex tasks are more prevalent compared to its effects on a simple one. Thus, Broadbent (1971) explains the effects of low and high level noise on job performances and tasks by using the “inverted U” arousal concept. This is to explain how noise interferes with work. This effect can be depicted in figure 2. Exposure to moderate level of noise would probably increase the job performance of workers, however experiencing high intense of noise would reduce the productivity of performance.
Nevertheless, to understand the relationship and its effects, Aamodt (2004) had classified seven factors determining possible noise effects on job performance; difficulty of task, continuity of noise level, continuity of noise, frequency of sound, predictability of noise, necessity of noise and sensitivity of noise. Regardless of whether noise gives a high impact on individual job performance or vice versa is still contradictory, as different individual perceive noise differently. Some other factor that might have taken into consideration in the study area is personality differences, in which this factor needs a thorough study in order to understand the relationship and its impact on job performance.

### 3.2. Temperature and job performance

Temperature plays significant role in workplace environment, especially how the human body tries to maintain an ideal temperature. A theory of effective temperature proposed four components, namely; air, temperature, humidity, airflow and temperature of objects in the environment. It indicates that how hot or cold in our environment really makes us feel (Aamodt, 2004). As depicted in the table 1 below, the higher the humidity, the warmer the air temperature feels, thus the higher the effective temperature.

In addition, the effective temperature is affected by the heat radiation from other objects in the working environment. For instance, sitting with a group of people will make someone feel hotter than sitting alone. Moreover, both humidity and air temperature interact reciprocally with the body’s system of radiation and evaporation. When the humidity is high, our body will lose the ability to release heat through evaporation and when the air temperature is higher than our body temperature, the body is unable to radiate heat.

Table 1. Effective temperature as a function of air temperature and humidity. Source: Aamodt, (2004)

| Air Temperature (°F) | Humidity (%) |
|----------------------|-------------|
|                      | 41  | 50  | 59  | 68  | 77  | 86  |
| 100                  | 41  | 52  | 64  | 78  | 96  | 120 |
| 80                   | 41  | 52  | 63  | 75  | 90  | 111 |
| 60                   | 40  | 51  | 62  | 73  | 86  | 102 |
| 40                   | 40  | 51  | 61  | 72  | 83  | 96  |
| 20                   | 39  | 50  | 60  | 70  | 81  | 91  |
| 0                    | 39  | 50  | 59  | 69  | 77  | 86  |
In relation to the above discussion, the effects of temperature on job performance can be classified specifically into three main categories of job performance, namely; cognitive, physical and perceptual. Research indicates that high temperatures can affect employee’s performance, especially tasks involved on cognitive, physical, and perceptual tasks. Research conducted by Beshir, El-Sabagh, and El-Nawawi (1981) explained that exposure to heat will deteriorate employee’s perceptual tracking task. It is indicated that, employee’s performance did not greatly decrease after 90 minutes at 68-degree; however it is show decrease significantly in performance within 30 minutes after exposure at 86-degree.

Moreover, according to Fine and Kobrick (1978), a long exposure to 95-degree temperature with 88% humidity in 7 hours will lead to errors being made repeated twice on cognitive tasks compared to a control group working in a moderate temperature of 75-degree with 25% humidity. Hence, Ramsy (1995) in his review found that employees that were exposed to temperatures above 86-degree will suffer from poor performance in perceptual motor tasks.

Furthermore, we will not be able to understand the influence of temperature on job performance by studying the temperature of the air alone, as the effects of temperature itself are complex and temperature alone is multifaceted. The effects of these two variables can only be understood by studying intensely the type of work being done, the amount of clothing worn and also the length of time spent whether in high or low effective temperature. Thus, diverse effects and results on temperature and job performance will be gained effectively.

3.3. Air and job performance

Recently, considerable concern has been expressed over the effects of airing pollutants in offices, which might lead to the uncongenial working environment; thus, subsequently affect job performance among employees. The air in the work place especially its ingredients can play a significant function in relation to the work behaviour, specifically job performance. Does air affect individual employee job performance? The answer depends on the ingredients of the air itself such as air ionization and carbon monoxide, and it is sometimes poisonous to some people though it is odour free.

According to Ossama, Gamal and Amal (2006), indoor air environmental quality is very important to the health, comfort as well as the job performance among employees. As far as it is concerned, indoor pollutant levels frequently exceed outdoor levels and most of the time an individual worker might spend up to 90% of time alone indoors. Some of the most potentially hazardous indoor pollutants are radon, asbestos, inorganic, environmental tobacco smoke, organics, biological and non-ionizing radiation. Some other pollutants such as odours and dusts can cause significant discomfort, feelings of unpleasantness, thereby leading to a decrease in productivity and job performance (Ossama et al., 2006). One study reported that malodorous air will not impaired performance of simple tasks, but definitely impairs performance of a complex task (Gifford, 1996). Moreover, our oxygen-carrying capacity of the blood will be restricted as we are being continuously exposed to carbon monoxide and some other air pollutants. It is true when a job requires prolonged alertness, but generally involves low stimulation, therefore individual performance may be affected by moderate exposure to the carbon monoxide.

On the other hand, the air ionization held two different finding reports on its effect on job performance. The reaction and motor-coordination of the workers were significantly faster when they were exposed to over 4,000 per cubic centimetre of ion concentration (Gifford, 1996). Another study also found improvement in basic perceptual-motor tasks, when there were high negative ions present. This is so true about the importance of air while completing certain tasks, when a study conducted by Williams (1998) revealed that the use of oxygen-enriched (hypoxic) air increased the ability of fire-fighters to perform physically demanding tasks while using SCBA. In the absence of fresh air among fire-fighters, it might reduce the efficiency of physical tasks performance.
Therefore, the components of air including carbon monoxide and bad odor, may affect job performance. Extremely low concentration of negative ions may affect basic cognitive processes; however exposure to the air pollutants in the long term-run, differentials in an individual physiological sensitivity as well as the psychological mediators would probably help researchers to understand why some individuals are easily affected but not the others. (Gifford, 1996)

3.4. Light, colour, and job performance

Light is essential and could be the main source to daily routine in the workplace. Workplace without proper and sufficient light might alter the main course of the job efficiency and quality. According to Gifford (1996) recent research on light primarily found that, the effects of light on job performance merely depends on four factors; sources (sunlight, incandescent, fluorescent, sodium vapor), fixtures (ceiling, desk, floor lamp), amounts (illumination) and also the arrangements (angle at which it strikes the work surface, uniform versus nonuniform). Whether exposure to more or less light affected the job performance, it is still need to be explained empirically.

Studies have agreed that, illumination, is the amount of light needed in the workplace much depends on the nature of the tasks being performed, either outdoor at the field or indoor in the building itself. Or even in the day, or at night. Thus, it requires different illumination in which, it might increase or decrease the performance. Research also confirmed, inadequate lighting is a source of distress, thus lead to poor job performance when the employee expose to uncomfortable working environment in which, there are too high glare, or dim bulk, or a lack of natural light in the office. (Schultz & Schultz, 2006)

On the other hand, colour has been suggested to increase productivity and performance, reduce accidents, and raise employee morale and yet to play roles in the workplace by simply providing a more pleasant working environment and at the same time can be aid in safety practices. Some equipment is paint in certain colour as a coding device. Such as fire equipment is red, danger areas is yellow, and first aid station is green. This is seems to be true, the colour itself differ in their reflective properties. However, this claim has no empirical evidence and no validity. According to Schultz and Schultz (2006), researchers’ especially industrial and organizational psychologists have little to say about the effects of colour on employee behaviour, especially job performance.

3.5. Space and job performance

Workspace relatively refers to the density and arrangements. It can have a profound impact on individual employee’s performance. This is true when research conducted by Brill, Weidemann, Olsen, and Keable (2001) proved that the productivity and performance of workers in an open offices, which is no cubicles as a privacy work station are no better than those who in acoustically in private workspaces in a long term period. The individual workstation that is too cramped and crowded, apparently will lead to a stress and other psychological impact. An individual employee might feels insecure and lack of motivation and freedom, expectantly in a short term effects and it might leads to very stressful condition, in which decrease in the quality of job performance. Brill et. al. (2001) also identified two major factors that could impact job performance: 1) enclosure and layout, or 2) the arrangement of the elements in an individual’s workspace.

There are few studies compared on the actual performance of a job in different work space arrangements. Results from a laboratory study might tell us that little space might jeopardize individual performance especially a type of work that involves physical mobility and interaction (Gifford, 1996). This is because, in that situation, an individual worker literally, may trip over each other as they try to do
their jobs. Moreover, when there is less space available, too closer together, and enclosures are present, the results are higher turnover and withdrawal rates.

Workplace arrangement or spatial arrangement in the office gained a great attention in environmental study. The major concern of the spatial arrangement is the beneficial of an open-plan office. There are mix findings; in which, some employees totally react negatively towards the open-plan office, while those react positively were comes from dingy, cramped former offices or those who prefer social communication of work than enjoy the work itself. The same concern agreed by Gifford (1996), he stressed that those whose work requires confidentiality and supervisory-professional employees are unhappy with an open-plan offices. When spatial arrangements are inadequate, employees adapt to bad situation or uncongenial work space, or even do not realize their surroundings could be better. This is what researchers named it as environmental numbness: unfortunate form of adaptation. Moreover, the size of the office, desk, couch or even plant, are another important dimension in work space concern that supposedly taken into account their effects on employees performance.

Therefore, employee performances are much importantly affected by spatial arrangements, though this naturally occurring spatial arrangement has few documented effects on performance. In fact, many open-plan offices reduce desirable communication and at the same time increase undesirable communication. On the other hand, the experiences of junior and senior employees in the organization have to be studied intensively, as this might leads to the different findings on the effects of workspace on job performance.

4. A proposal for the congenial physical workplace environment

According to Visher (2007), environmental comfort can be classified into three categories: physical, functional, and psychological. Physical comfort in the workplace environment includes hygiene, safety, and accessibility without which a building is uninhabitable. These are considering as basic human needs, especially in the office. Functional comfort refers to the ergonomic support for users’ performance of activities and work related tasks. Hence, a proper lighting illumination for screen-based work, ergonomic furniture size, enclosed room for privacy meeting and discussion, and partition for individual work station might help to ensure the functional comfort. Moreover, psychological comfort basically results from feelings of belonging, ownership and control over workspace. The idea of environmental comfort suggests that, in the absence or weakness in any one of these three factors; physical, functional and psychological can be compensated for by strength in another factor. Therefore, an optimal result of environmental support (congenial physical workplace environment) for the work or job performance is most likely to occur when the physical workplace environment is assured at all three comfort level: physical, functional, and psychological factors.

Realistically, organizations have the opportunities to revolutionize the physical environment conditions in the office, in which to make it comfort and congenial to all employees. Taking into account the three factors of comfort environment: physical, functional, and psychological, organizations need to examine the surroundings and make the working environment in a better shape includes:

- Analyze the discomfort physical environment and areas that affected employees. Redesign the space to facilitate more comfortable and efficient work environments.
- The use of sound and visual barriers and adding of absorption materials to ceilings and walls. The workplace furniture and work surfaces can be away from line-of sight distractions. Moreover, ‘white noise’ can be used for the investigation purposes.
- Softer illumination for the individual workstations and in the office building. In order to reduce glare, mixing of indirect lighting and directly targeted lighting to illuminate points of focus and for the personal computer, add antiglare filters to older computer screens.
5. Conclusion

Sound including noise and music can serve two main purposes; noise which is unwanted sound and desirable sound. Sound regarded as noise or desirable depends on the individual employee and also employee’s situation. Noise also works as a stressor in the working environment, and therefore it could be understood by looking at two main functions of the stressor in the working environment. Firstly, intermittent noise is more disruptive than continuous noise and secondly, the effect of continuous noise depends on its intensity and on the task.

A theory of effective temperature proposed four components, namely; air, temperature, humidity, airflow and temperature of objects in the environment. It indicates that how hot or cold in our environment really makes us feel. This is as true as the temperature plays significant roles in work place environment, especially how the human body tries to maintain an ideal temperature. Moreover, the effects of temperature on job performance can be classified into three main categories, namely; cognitive, physical and perceptual.

The air in the workplace, especially its ingredients can play a significant function to the work behavior, specifically job performance. However, it depends on the ingredients of the air itself, such as air ionization and carbon monoxide, and it sometimes poisonous to some people, though it is odor free. Some of the most potentially hazardous indoor air pollutants are radon, asbestos, inorganic, environmental tobacco smoke, organics, biological and non-ionizing radiation. Some other pollutants such as odors and dusts can cause significant discomfort, feelings of unpleasantness, thereby leading to the decrease in productivity and job performance.

Studies had agreed that light illumination in the workplace much depend on the nature of tasks being performed, either outdoor at the field or indoor in the building itself. Or even in the day, or at night. Thus, it requires different illumination in which might increase or decrease the performance. Research confirmed that, inadequate lighting is a source of distress. On the other hand, researchers’ especially industrial and organizational psychologists have little to say about the effects of color on employee behavior, especially job performance, though it has been suggested to increase productivity and performance, reduce accidents, and raise employee morale.

Workspace relatively can have a profound impact on individual employee performance. Therefore, employee’s performance is much importantly affected by density and spatial arrangements, though this naturally occurring spatial arrangement has few documented effects on job performance.

In sum, the effects of uncongenial physical environment in the workplace on job performance remain unclear in the available literature. Although job performance is the result of an employee’s motivation and ability, in which to cope and to adapt with the situational constrains, the uncongenial environment could not be neglected as it somehow leads to the behavioral disturbance. The situational constrains constitute of the variables such as noise, air, light, temperature and sound, are the major physical conditions that should gained more attention in the field of environment-behavior studies. The theoretical model proposed in this study illustrates the interaction of physical conditions, in which leads to either stressful event or no stressful event link directly to the physiological changes as the results of the interaction of the physical conditions, eventually leads to the behavioral disturbance; specifically refers to the decrease in job performance. However, the effects of physical working environment being discussed in this research need a thorough study, in order to understand the maximum dimension and effects on work behavior (job performance).
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