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Ian DONALD

*The University of Liverpool*

Oi Ling SIU

*Lingnan University, Hong Kong*

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# **MODERATING THE STRESS IMPACT OF ENVIRONMENTAL CONDITIONS: THE EFFECT OF ORGANIZATIONAL COMMITMENT IN HONG KONG AND CHINA**

IAN DONALD

*The University of Liverpool*

OI-LING SIU

*Lingnan University, Hong Kong*

## **Abstract**

*The purpose of the study is to investigate the relationship between environmental conditions and employee health in Chinese white and blue-collar samples, and to examine the role of organizational commitment as a stress moderator. Data are collected using a self-administered questionnaire. The participants are 158 white and 138 blue-collar workers in Hong Kong and 372 blue-collar workers in China. The results show that environmental conditions (including ventilation, workable space, illumination, temperature, noise, air pollution, and freedom to move around at work) are positively related to job satisfaction, and physical and mental well-being. These relationships are particularly true in the Hong Kong white-collar and China blue-collar groups. Further, organizational commitment moderated some of the relationships between environmental conditions and health. Inconclusive results of the buffering role of organizational commitment are obtained.*

## **Introduction**

It has been observed that within Environmental Psychology there has been little empirical research examining multiple stressors (Evans et al., 1996). While some research has been directed towards overcoming this problem, it remains the case that few studies are conducted that look at other contextual factors. For instance, while Evans et al. (1996) consider multiple stressors in an attempt to increase the ecological validity of environmental stress research, conditions that may mitigate, or buffer, the effects of stress are not researched. One reason for this may be that it is difficult to examine such variables within a laboratory context. On the other hand, there are difficulties in carrying out well-controlled experimental studies, incorporating objective physiological and environmental measures, within naturally occurring contexts. Nonetheless, it is important that contextual variables are considered.

Increasingly, work stress and the health of workers has become a source of concern to employers and government agencies. There has been a proliferate amount of research demonstrating links between stress and various negative outcomes, which directly or indirectly affect employee health

and well-being (e.g. Cooper & Marshall, 1976; Beehr & Newman, 1978; Cooper et al., 1988; Cooper & Cartwright, 1996). Studies conducted in the workplace demonstrate that the sources of stress are many and varied. They can, however, be broadly divided into the physical and psychosocial sources. The present paper examines the role of physical stressors in the form of perceived environmental conditions, on employee health. The paper also considers the role of organizational commitment in buffering the relationship between perceived physical conditions and well-being.

### **Physical environment and occupational stress**

There are potentially a great number of attributes within the environment that can impact upon workers (Evans et al., 1996; Evans & Cohen, 1987). Several authors have classified them into broad groupings. For example, Evans et al. (1994) referred to physical characteristics as the inanimate components of the work setting. The components they included were ambient conditions (e.g. air quality, noise, temperature), layout and arrangement of space (e.g. proximity to others, boundaries, proxemics), architectural design (e.g. lighting, colour, furniture), and ergonomic factors (e.g. equipment design, machine pacing, automation). In relation to office evaluation, Donald (1994), drawing on Canter's (1983) more general model of place evaluation, provided a broader tripartite classification that comprises service (e.g. heating lighting, ventilation) social (e.g. privacy, interaction) and spatial (e.g. amount of space) elements of workers' environments.

Research on the role of physical stressors at the professional and managerial level has revealed that the most common physical stressors include noise (Smith, 1991; Sundstrom et al., 1994), vibrations (Quick & Quick, 1984), temperature (Cohen, 1980), air movement and air pollution (Evans et al., 1982; Jokl, 1984), and lighting (Knez, 1995). Whilst white-collar office workers have received much attention, there has been a relative lack of research in relation to stress amongst blue-collar workers. Nevertheless, Cooper and Smith (1985) have argued that blue-collar and unskilled workers are at greater risk of stress than white-collar and professional workers. Based on mortality data from the United States and other developed countries, they concluded that, 'blue collar workers seem to be a vulnerable group to occupational stressors and their manifestations' (p. 1). Arnold et al., (1998) further argued that many blue-collar workers show a greater number of restricted activity days and consultations with general practitioners than do white-collar workers,

As with other contexts, it has been suggested that a variety of working conditions act as sources of blue-collar stress, including repetitive work and shift work (Cox, 1985; Monk & Tepas, 1985; Poulton, 1978; Smith, 1985; Vaernes et al., 1988; Wright et al., 1994). There is also evidence that, among the many sources of stress for blue-collar workers, the physical environment plays a significant, though not necessarily simple role. Sharit and Salvendy (1982), for example, found that some physical stressors interact with other characteristics in the working situation. Wallace et al.

(1988) categorized sources of stress in blue-collar work into three types: (1) heavy work and other physical conditions such as heat, noise, dust, presence of toxic substances; (2) paced, and/or repetitive work, demand for speed; work which is monotonous, requires no skill or over which there is no control; (3) tasks characterized primarily by various types of information processing activities and decisional complexity, often performed under time constraints. Again, this research points to the importance of the broader context of work in accounting for the relationship between the physical environment and stress.

Although it has been argued that discussions of occupational stress often tend to omit physical stimuli in the working environment (Levi, 1994), there has been some research in the area. Many of the physical characteristics of the work environment have been considered in relation to the general health of workers (e.g. Wineman, 1982, 1986; Sundstrom, 1986; Hedge, 1989; Klitzman & Stellman, 1989; Ornstein, 1990; Hughes, 1990), job satisfaction (Ne'eman et al., 1984; Duvall-Early & Benedict, 1992), as well as occupational stress in particular (Sutton & Rafaeli, 1989; Burke, 1990; Leather et al., 1998). For instance, Sutton and Rafaeli's study of 109 clerical workers concluded that physical work characteristics are potential occupational stressors. They identified two categories of physical stressors: intrusions from atmospheric conditions (hotness, coldness, poor quality lighting) and intrusions from other employees (noise and distractions, lack of control over privacy, high population density). Many of these characteristics are associated with open plan offices. In sum, there is evidence to suggest that poor working conditions affect both workers' experience of stress and their psychological and physical health (Warr, 1992; Cox, 1993; Baron, 1995).

### **Stress moderators**

The evidence pointing to the importance of physical stressors is clear. However, there is also a need to examine factors that might interact with these stressors in influencing workers' experience of them. Wineman (1982), for instance, argued that whether a stressor leads to occupational ill health is dependent upon a number of intervening/mediating variables (e.g. expectation levels, aspiration levels, needs, and values). These factors may alter the perception of stress or reduce the negative impacts of a stressor. Other studies have found moderating effects of variables, such as job satisfaction, that interact with the stressor to reduce its impact (e.g. Frankenhauser, 1978).

Whilst the terms moderator and mediator are often used interchangeably within environmental and social psychology, Baron and Kenny (1986) and Evans and Lepore (1997) point to a clear distinction between the two roles played by each type of variable. Moderator variables, they argue, interact with another independent variable to influence an outcome (Evans & Lepore, 1997). Baron and Kenny, consider that a moderator hypothesis is supported if the product or interaction between the two predictor variables is statistically significant, but go on to note that there may also be significant main effects.

In the case of mediators, Barron and Kenny (1986) argue that the outcome variable is directly impacted upon by the main independent variable, but also the mediating variable. In turn the mediating variable is causally dependant on the main independent variable. Further when the causal path from the independent variable through the mediator to the outcome is controlled for, the direct independent variable-outcome path becomes non-significant.

Work attitudes have been identified as significant moderators of work stress. One important aspect of work attitudes is organizational commitment, which may be defined as “the relative strength of an individual’s identification with and involvement in an organization” (Mowday et al., 1982, p. 26). The importance of organizational commitment has been discussed widely in recent years (Mowday et al., 1982; Aryee & Heng, 1990; Mathieu & Zajac, 1990; Cohen, 1992, 1993; Somers, 1995). Aryee and Heng (1990), for instance, claimed that commitment has become more important than job satisfaction in understanding employee work-related behaviour, because it is more stable and less subject to the daily fluctuations of job satisfaction (Mowday et al., 1979).

Recently, researchers have begun to look into the role of organizational commitment as a moderator of the relationship between job stress and well-being (Kobasa et al., 1982; Mowday et al., 1982; Mathieu et al., 1991; Begley & Czajka, 1993; Leong et al., 1996; Siu & Cooper, 1998). What the research has not shown, however, is the impact that organizational commitment can have on, or its interaction with people’s responses to environmental stressors. An aim of the present study is to examine the relationship between environmental stressors, job commitment and health outcomes for both blue and white-collar occupations.

### **Stress and non-western populations**

Bond (1996) has pointed out that most contemporary psychology is based on data from North America and other Western cultures. In order to understand human behaviour more fully, as well as to contribute to the generalizability of theories in psychology, it is important to conduct research in other cultures. As around 20 per cent of the world’s population is Chinese, it is important in developing a broad understanding of human behaviour that research using such populations is carried out.

As with psychology in general, the majority of work looking at workers’ stress has used Western populations. In particular, there have been relatively few studies within Far Eastern cultures. Amongst these, research carried out with Chinese workers in Hong Kong (e.g. Siu & Donald, 1996) has shown that physical environmental conditions are significant sources of stress, affecting workers’ mental and physical ill-health, and job satisfaction. In this study, environmental conditions were measured by seven items assessing employees’ satisfaction towards work space,

lighting, temperature, noise, ventilation, air quality, and freedom to move around at work. A further investigation by Siu and Cooper (1998) examined the role of organizational commitment on the relationship between sources of stress and job satisfaction, psychological distress and quitting intention, and found significant direct and moderating effects of organizational commitment in the stressor-strain relationships. However, the occupations examined in these studies have mainly been those of white-collar workers.

Chinese populations are particularly interesting when considering organizational commitment. For instance, it has been argued that a high level of organizational commitment is one of the characteristics of the Chinese work force. The Confucian philosophy of China could be suggested to lead employees to being more committed and loyal to their employers. Empirically, there is some support for this, with studies finding that the level of organizational commitment reported for Chinese managers is higher than for their counterparts of other nationalities (Chow, 1990; Perrewe et al., 1995). Given this characteristic of Chinese workers, it would be expected that organizational commitment has the potential to be a significant moderator of environmental stressors.

A further characteristic of Chinese societies that makes them of particular interest is their levels of economic growth and the likely associated levels of stress experienced by the workforce. The largest Chinese societies can be found in People's Republic of China (PRC), Hong Kong, Taiwan and Singapore. Since 1979, China has made great progress in economic reforms, in which Hong Kong and Taiwan have contributed so much that the three economies have been termed 'Greater China'. In China, the average annual real economic growth in 1979-93 was 9.3 per cent. The average annual real growth in Taiwan in 1970-93 was 8.6 per cent; in the same period Hong Kong achieved 74 per cent growth. The GDP annual growth rates of China, Hong Kong, and Taiwan were estimated in 1997 to be 8.8 per cent, 5.3 per cent, and 6.5 per cent respectively. Given this rapid growth it is not surprising that studies have revealed high levels of stress in Hong Kong, China, and Taiwan.

In sum, the present study examines three areas that have been neglected in the person-environment and behaviour literature: moderating effects of organizational commitment on environmental stressors, blue and white-collar workers and a non-Western, Chinese sample.

### **Physical conditions of factories in Hong Kong and China**

The physical conditions found in factories in China and Hong Kong differs markedly. The shortage of land in Hong Kong has led to factories being smaller and more cramped than those in Mainland China. The ventilation and air quality is poor, and few, if any, facilities are provided for the workforce. In comparison, the factories in China, especially in the areas considered in the

current study, tend to be newer, more spacious and with much better facilities. For instance, there are recreation areas, lawns for staff to use at lunch times, hostels, administration blocks, as well as the factory rooms themselves. The sizes of the factories in China, with their abundant land, tend to be very large and the air quality good.

## **Hypotheses**

The preceding discussion leads to a number of hypotheses. It is expected that there will be differences in the perception and experience of environmental conditions among different occupational and national groups. First, blue-collar workers are likely to have less positive perceptions of their work environments than are white-collar workers (Wallace et al., 1988; Wright et al., 1994). Within the blue-collar workers sample, those from China are more likely to have positive evaluations than the Hong Kong sample. This should merely reflect the difference in gross environmental quality for the two sets of workers. Thus the first, relatively basic, hypothesis is that the white-collar workers will have the most positive evaluations of their environment, followed by the China blue-collar sample, with the blue-collar workers from Hong Kong having the most negative evaluations.

The second hypothesis relates to the impact of the perceived physical characteristics of work environments on the psychological experience and health among blue and white-collar workers (Poulton, 1978; Sutton & Rafaeli, 1987; Cox, 1993; Evans et al., 1994; Leather et al., 1998). It is expected that workers who report higher satisfaction towards their environmental conditions will report higher job satisfaction and better mental and physical wellbeing. Given the first hypothesis, white-collar workers should show the least evidence of stress, followed by the China and Hong Kong blue-collar workers respectively. While it could be argued that such a result would simply reflect differences in job type, blue versus white-collar work, it needs to be born in mind that, as noted above, many blue-collar jobs are particularly stressful. In addition, the study allows comparison between two groups of blue-collar workers.

The final hypothesis relates to the role of organizational commitment as a moderator of the relationship between job stress and outcomes. While the moderating effect of organizational commitment has previously been demonstrated (e.g. Begley & Cazjka, 1993; Siu & Cooper, 1998), it has not been considered in relation to the evaluation of environmental conditions. It is further hypothesized that organizational commitment will interact with environmental conditions to determine job satisfaction, mental and physical well-being. A schematic representation of the moderator model, based on Baron and Berry (1986) is shown in Figure 1.

## Method

### Measures

In order to test these hypotheses a number of existing, validated instruments were used to measure environmental conditions, organizational commitment and the various health outcomes.

### Independent variables

*Environmental conditions.* Seven items were constructed to measure respondents' satisfaction with the physical conditions including ventilation, workable space, illumination, temperature, noise, air pollution, and freedom to move around at work. They were measured on a 6-point scale ranging from very satisfied (6) to very dissatisfied (1) giving a possible range of 6-42. These measures are in keeping with those used by Siu and Cooper (1998). While it may be desirable to have more objective environmental measures, in addition to subjective ones, the context of the research, factories in Hong Kong and especially China, precluded the use of such measures. Moreover, the central interest of the research was not concerned with the impact of specific, objective environmental conditions per se, but the relationship between perceptions of the environment and health outcomes.

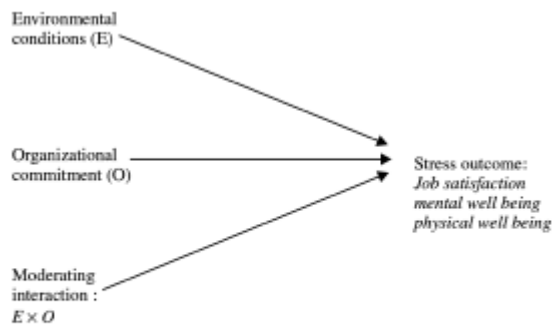


FIGURE 1. Basic model of the moderating effect of organizational commitment on stress outcomes.

### Moderator variables

*Organizational commitment.* Organizational commitment refers to the relative strength of an individual's identification with the organization. The nine-item Organizational Commitment Questionnaire (OCQ) (excluding the negative items) developed by Mowday et al. (1979) was used. This consists of a seven-point scale ranging from strongly agree (7) to strongly disagree (1) (high score = high commitment). The possible range of scores is therefore from 9 to 63. The nine-item OCQ was used to reduce the length of the questionnaire, and because the negatively worded items lack stability (Tetrick & Farkas, 1988). Example items are: 'I am proud to tell others that I am part of this organization', 'I really care about the fate of this organization'.



## Dependent variables

Three parts of the Occupational Stress Indicator-2 (OSI-2) (Cooper & Williams, 1996) were used to measure job satisfaction and mental and physical wellbeing. The Occupational Stress Indicator (OSI) (Cooper et al., 1988) has been found to be both reliable and valid in previous studies in Western (Bogg & Cooper, 1995; Cooper & Williams, 1991; Robertson, et al., 1990) and Chinese societies (Siu et al., 1997; Lu et al., 1997; Situ & Cooper, 1998)

*Job satisfaction.* Job satisfaction refers to a pleasurable emotional state resulting from an employee's appraisal of their job or organization. This was measured using the 12-item Job Satisfaction Scale of the OSI-2. Only the first 11 items were used because item 12 was very similar to item 9 after being translated into Chinese. Item 12 was therefore deleted. The reliability of the eleven items has been demonstrated by Siu and Cooper (1998). Each item is rated on a 6-point scale ranging from very satisfied (6) to very dissatisfied (1). The potential range of scores was 11 to 66.

*Mental well-being.* Mental well-being refers to psychological health, including contentment, resilience, and peace of mind. Part A (How you feel or behave) of Section 2 (How you assess your current state of health) of the OSI-2 was used to measure mental health. This consists of 12 items scored from 6 to 1. (a range of 12 to 72) in which numbers 3, 5, 8, and 11 are negative items. An example of a positive item is: 'Would you say that you tended to be a rather over conscientious person who worries about mistakes or actions that you may have taken in the past, such as decisions?' (from very true to very untrue) (High score = better mental well-being). An example of a negative item is: 'When the pressure starts to mount at work, can you find a sufficient store or reserve of energy which you can call upon at times when you need it that spurs you into action?' (from lots of energy to not much energy).

*Physical well-being.* Physical well-being refers to physical state of health, including calmness and energy. 'Part B' Your physical health) of Section 2 of the OSI-2 was used to measure physical health. There are 6 items in this scale. (A high score indicates better physical well-being, with the possible range being from 6 to 36.) Example items are: 'Feeling unaccountably tired or exhausted', 'Shortness of breath or feeling dizzy'.

As with all stress and health studies, it would be desirable to use physiological measures of stress and health related outcomes. However, the context of the study again precluded the use of such measures. While this limits to some extent the scope of the study, self-report measures are considered both reliable and acceptable within the stress and health literature.

## Sample

The sample for the study included white and blue-collar workers in Hong Kong, and a group of

blue-collar workers in China. The white-collar sample for the study was drawn from employees from computing professions, the property management field, and a commercial bank in Hong Kong. These occupational groups are relatively typical of the type of white-collar workers in Hong Kong. Ideally, a sample from white-collar workers in China would also have been included in the sample. However, most white-collar workers in China are employed by the state. The sensitivity of surveying and questioning employees of state-owned organizations prevented the inclusion of a white-collar sample from China.

## Procedures

Data were collected using a self-administered questionnaire.

*White-collar group.* One hundred and twenty questionnaires were delivered to designated managers of four large property management companies in Hong Kong. They were asked to distribute the questionnaires to staff working at all levels in their companies. A total of 72 questionnaires were collected by the researcher three weeks later (a 60% response rate). Of those, 65 valid completed questionnaires were used for analysis.

In the sample of computer professionals, 74 questionnaires were delivered to a designated person, and in turn distributed to the computer sections of two large retail banks in Hong Kong and the Hong Kong Hospital Authority. A total of 51 completed questionnaires were collected by the researcher three weeks later, yielding a 69 per cent response rate.

Fifty questionnaires were distributed to one commercial bank in Hong Kong through a designated manager. A total of 44 questionnaires were collected two weeks later (a 88% response rate), but two incomplete ones were discarded. These three subgroups provide a total sample of 158 white-collar employees.

*Blue-collar group.* The data were collected from four sites in China. Data were collected in a garment factory in Xiaolan by delivering the questionnaires to a designated supervisor of the chosen factory by the researcher. A briefing on questionnaire administration was given by the second author. The completed questionnaires were collected one week later. Data collection in a textile factory in Hangzhou, a textile factory in Zhanjiang and a garment factory in Panyu, in China, was conducted in the same way by a colleague of the authors. The response rates in the China sample were: Hangzhou (10 out of 10=100%), Xiaolan (281 out of 300=93.7%), Zhanjiang (71 out of 80 = 88.8%), Panyu (10 out of 20 = 50%)

Data were collected from eight factories in Hong Kong through a designated person in each chosen factory. The factories were chosen by a convenience sampling method, from different

industrial areas in Hong Kong. For some small factories in Hong Kong, all of the workers in the factories were invited to participate in the study. The type of factory and response rates were: a battery production factory in Kwun Tong (41 out of 50 = 82%), a garment factory in Sun Po Kong (22 out of 30 = 73.3%), a garment factory in Kwun Tong (15 out of 20 = 75%), a food production factory in Tsuen Wan (4 out of 10 = 40%), a garment factory in Tai Kok Tsui (22 out of 30 = 73.3%), another garment factory in Kwun Tong (14 out of 20 = 70%), a knitting factory in Tai Kok Tsui (10 out of 15 = 66.7%), a food production factory in Kwai Chung (10 out of 10 = 100%). A total sample of 372 blue-collar workers in China and 138 blue-collar workers in Hong Kong was achieved.

## Analysis and Results

### Reliability of measures

As the measures employed in the study are not routinely used with people in Hong Kong and China, the reliabilities for all measures by all samples were estimated (Tables 1 to 3). The alpha coefficients tend to be either quite high or high. With the exception of the mental well-being measure for the China blue-collar group all alphas are above .6, which is acceptable for exploratory research of this sort. The alpha for mental well-being (China) is 0.57, which is close to being acceptable, and so is used in the following analysis. Nonetheless, some care needs to be taken in the interpretation and acceptance of results using this measure.

It can also be seen from the means presented in these tables that the level of organizational commitment varies between the groups. Blue-collar Chinese workers are the most committed (44.7), followed by the blue-collar sample in Hong Kong (37.7), and the white-collar group with the least organizational commitment (36.8). It should be noted that the difference in levels of organizational commitment between the two samples in Hong Kong is negligible.

TABLE 1  
*Means, standard deviations, and reliabilities for all measures  
in Hong Kong white-collar workers (n = 158)*

	Mean	s.d.	Alpha	Range
Environmental Conditions	24.63	6.73	0.89	7–40
Mental well-being	47.11	9.32	0.77	23–72
Physical well-being	22.91	5.97	0.85	11–35
Job Satisfaction	38.77	10.71	0.95	18–60
Organizational Commitment	36.85	10.69	0.93	13–63

TABLE 2  
*Means, standard deviations, and reliabilities for all measures  
in Hong Kong blue collar workers (n = 138)*

	Mean	s.d.	Alpha	Range
Environmental Conditions	25.64	6.28	0.85	7–38
Mental well-being	43.79	6.55	0.62	28–67
Physical well-being	23.00	4.95	0.71	8–34
Job Satisfaction	38.05	9.10	0.90	11–61
Organizational Commitment	37.74	9.39	0.87	9–61

TABLE 3  
*Means, standard deviations, and reliabilities for all measures  
 in China blue collar workers (n = 372)*

	Mean	s.d.	Alpha	Range
Environmental Conditions	28.84	5.20	0.72	14–42
Mental well-being	46.78	8.69	0.57	22–71
Physical well-being	24.54	4.49	0.61	10–36
Job Satisfaction	44.63	8.94	0.86	16–66
Organizational Commitment	44.77	8.09	0.76	21–62

The response ranges are given for each group in relation to each of the scales (Tables 1-3). It can be seen that there does not seem to be any ceiling effect, with the possible exception of the Chinese sample's rating of organizational commitment. Given the pattern of responses to the other scales, it is likely that the lack of very low ratings is due to greater commitment or loyalty rather than concerns over being critical of the organizations. However, without direct test, such a conclusion remains speculation.

### Comparisons of satisfaction with environmental conditions

To test the second hypothesis a series of one-way analyses of variance (ANOVA), with post hoc-Scheffe test, were conducted to examine differences in perceived environmental conditions between Hong Kong white-collar workers, Hong Kong blue-collar workers, and China blue-collar workers.

The results showed that China blue-collar workers are the most satisfied with their environments, having the highest mean for the summed items ( $M = 28.84$ ). Hong Kong blue-collar workers were the next most satisfied ( $M = 25.64$ ), with the Hong Kong white-collar workers scored the least satisfied ( $M = 24.63$ ). These differences were statistically significant at  $p < 0.05$  level ( $F$ -ratio = 33.52). While these results support the contention that the blue-collar workers in Hong Kong would be less satisfied than those in China, it was not expected that the least satisfied would be the white-collar sample.

### Relationship between environmental conditions and employee health

Table 4 shows the correlation coefficients between the total score for environmental conditions and the measures of employee health (job satisfaction, physical well-being, and mental well-being).

It can be seen that for all groups, the environmental conditions scale was positively and statistically significantly related to job satisfaction. For the white-collar and blue-collar China groups, environmental conditions are also related to physical and mental well-being, although for the latter group the correlation with physical well-being is quite low. For the Hong Kong blue-collar sample, the environmental conditions scale was not related at a statistically significant level to either physical or mental wellbeing. Generally, the results support the hypothesis that there would be a relationship between evaluations of workers' environmental conditions and stress

outcomes. However, this is only true for the white-collar and China blue-collar samples. That the greatest similarities are between the Hong Kong white-collar and China blue-collar groups suggests that the results cannot be simply explained by reference to job type or location.

### **Moderating effects of organizational commitment**

To examine the potential moderating effects of organizational commitment on the environmental conditions-health relationships, a series of hierarchical regression analysis were conducted to predict stress outcomes (Cohen & Cohen, 1983; Stone & Hollenbeck, 1989). To overcome problems of multicollinearity, mean-centered scores were used in calculating the interaction terms. Prior to performing the hierarchical regression analysis, demographic variables were examined to test for any confounding effects. None of the demographic variables were found to be statistically significant in predicting the outcome variables.

TABLE 4  
Zero-order Pearson product-moment correlations between environmental conditions and employee health

	Job Satisfaction	Physical Well-being	Mental Well-being
Hong Kong White-collar Group: Environmental Conditions	0.63***	0.50***	0.45***
Hong Kong Blue Collar Group: Environmental Conditions	0.70***	0.11	0.15
China Blue Collar Group: Environmental Conditions	0.55***	0.12*	0.20***

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

In each regression analysis environmental conditions were entered into the equation, followed by environmental conditions and organizational commitment, then environmental conditions  $\times$  organizational commitment. Analyses were carried out predicting job satisfaction (Table 5), physical wellbeing (Table 6) and mental well-being (Table 7) respectively.

*Job satisfaction.* The results of the regression analyses (Table 5) indicated that job satisfaction could be predicted quite accurately from organizational commitment and perceptions of environmental conditions ( $R^2 = 0.611$ ,  $F(2,252) = 119.36$ ,  $p < 0.001$ ). In each case, organizational commitment increased the explained variance in job satisfaction. The regressions also indicate clear differences between the white and blue-collar workers. An examination of the beta weights revealed that while perceived environmental conditions were the more important predictor of job satisfaction for blue-collar workers, organizational commitment was the more important predictor in the white-collar group. After controlling for the additive effects of organizational commitment and environmental conditions, the mean-centred interaction term was only statistically significant for the white-collar workers ( $F_{\text{change}}(1,151) = 6.91$ ,  $p < 0.01$ ). Therefore, evidence for the moderating effect of organizational commitment on job satisfaction only clearly exists in relation to the white-collar sample.

*Physical well-being.* Physical well-being (Table 6) was predicted less accurately across all of the groups. Environmental conditions and organizational commitment both explain a statistically significant amount of variance, and together explained 35.9 per cent of the variance in physical well-being in the white-collar group ( $F(2,152)=42.49$ ,  $p<0.001$ ). Although the addition of the interaction term increased the explained variance in physical well-being by 1.3 per cent, the term narrowly failed to reach statistical significance ( $F_{\text{change}}(1,151)=3.25$ ,  $p=0.07$ ). While this result does not support organizational commitment as a moderator of the effect of environmental conditions on physical well-being, there is some suggestion that it may play a small role.

The results also show that environmental conditions and organizational commitment are poor predictors of physical well-being among blue-collar workers. In the Hong Kong sample, neither term contributed statistically to the prediction of physical well-being ( $F(2,129) = 1.17$ ,  $p=0.32$ ). The results are fairly consistent in the Chinese sample. Although environmental conditions initially emerged as a statistically significant predictor of physical well-being ( $b = 0.116$ ,  $p=0.05$ ), the introduction of organizational commitment reduced the beta weight to non-significance ( $b = 0.056$ ,  $p=0.32$ ), indicating that environmental conditions are not an important predictor of physical well-being after controlling for organizational commitment. Organizational commitment remained the sole predictor of physical well-being in the final equation ( $b=0.178$ ,  $p=0.01$ ). Consequently there is no evidence for organizational commitment as a moderator. However, the removal by organizational commitment of the effect of environmental conditions as a predictor of physical well-being suggests that there may be a mediating rather than a moderating effect.

*Mental well-being.* The results of the regressions predicting mental well-being were relatively consistent with the previous analyses for the Hong Kong white-collar group. Mental well-being could be predicted from both environmental conditions and organizational commitment. Further, the additive, but not interactive combination of environmental conditions and organizational commitment predicted mental well-being ( $R^2 = 0.237$ ,  $F(3,151) = 15.60$ ,  $p<0.001$ ). Although Barron and Kenny (1986) seem to suggest that an additive effect can be taken to show moderation, applying the stricter conceptualization of interaction, the results do not support the hypothesis that organizational commitment is a moderator of environmental conditions.

TABLE 5  
 Predicting job satisfaction

	$R^2$	$R^2_{ch}$	$F$	$\beta$
<i>Hong Kong White Collar</i>				
Step 1: Environmental Conditions (E)	0.395***	0.395***	100.05	0.629***
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.611***	0.216***	119.36	0.387*** 0.523***
Step 3: Environmental Conditions (E) Organizational Commitment (O) E × O	0.628***	0.017**	84.97	0.300*** 0.494*** -0.167**
<i>Hong Kong Blue Collar</i>				
Step 1: Environmental Conditions (E)	0.485***	0.485***	122.47	0.696***
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.587***	0.102***	91.54	0.531*** 0.359***
Step 3: Environmental Conditions (E) Organizational Commitment (O) E × O	0.587***	0.000	60.75	0.521*** 0.355*** -0.031
<i>China Blue Collar</i>				
Step 1: Environmental Conditions (E)	0.311***	0.311***	154.22	0.557***
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.407***	0.097***	117.21	0.438*** 0.333***
Step 3: Environmental Conditions (E) Organizational Commitment (O) E × O	0.408***	0.001	78.08	0.454*** 0.339*** -0.030

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

In contrast, while the simple effects of the two independent variables could not predict mental wellbeing among the Hong Kong blue-collar workers ( $F(2,118) = 1.63$ ,  $p > 0.05$ ), the inclusion of the interaction term increased the explained variance in mental well-being by 3.3 per cent ( $F_{change}(1,117) = 4.08$ ,  $p > 0.05$ ). Such a result suggests some form of moderating effect of organizational commitment, although the condition of each of the independent variables predicting the outcome variable is not met. Indeed, there could be some suggestion that organizational commitment is playing a mediating role.

It can be seen from Table 7 that environmental conditions, organizational commitment, and their multiplicative composite each contributed statistically significantly to the prediction of mental wellbeing among blue-collar workers ( $R^2 = 0.125$ ,  $F(3,324) = 15.37$ ,  $p < 0.001$ ). In contrast to the white-collar workers, organizational commitment emerged as the more important predictor of mental wellbeing in the Chinese blue-collar workers. The results again support the notion of a moderator effect.

The regressions indicate the importance of considering the interactive effects of the environment and organizational commitment; when considering their additive effects only organizational

commitment emerged as a statistically significant predictor of mental well-being ( $b = 0.279$ ,  $p < 0.001$ ). However, the beta weight attached to environmental conditions reached statistical significance after the inclusion of the interaction term into the regression equation ( $b = 0.196$ ,  $p < 0.01$ ).

TABLE 6  
Predicting physical well being

	$R^2$	$R^2$ ch	$F$	$\beta$
<i>Hong Kong White Collar</i>				
Step 1: Environmental Conditions (E)	0.256***	0.256***	52.53	0.506***
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.359***	0.103***	42.49	0.339*** 0.362***
Step 3: Environmental Conditions (E) Organizational Commitment (O) $E \times O$	0.372***	0.013	29.83	0.261** 0.336*** -0.148
<i>Hong Kong Blue Collar</i>				
Step 1: Environmental Conditions (E)	0.013	0.013	1.67	0.112
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.018	0.005	1.17	0.149 -0.080
Step 3: Environmental Conditions (E) Organizational Commitment (O) $E \times O$	0.018	0.000	0.80	0.139 -0.084 -0.029
<i>China Blue Collar</i>				
Step 1: Environmental Conditions (E)	0.013*	0.013*	4.64	0.116*
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.038***	0.024**	6.68	0.056 0.167***
Step 3: Environmental Conditions (E) Organizational Commitment (O) $E \times O$	0.040**	0.002	4.69	0.089 0.178** -0.059

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

## Discussion

### The Reliability of measures

The reliabilities of the scales for environmental conditions and organizational commitment were acceptably high in all three samples with the possible exception of mental well-being in the Chinese sample. Compared to previous studies using the OSI, the reliability of job satisfaction was high (a ranges from 0.86 to 0.95 in the present study;  $a = 0.91$  for Bogg and Cooper (1995) using 1,051 senior civil servants;  $a = 0.88$  for Cooper and Williams (1991) using 31 blue-collar workers;  $a = 0.88$  for the study by Robertson et al. (1990) using 105 management consultants).

However, the reliability of the mental health scale is lower compared to previous studies (a ranges from 0.57 to 0.77 in the present study;  $a = 0.89$  for Bogg and Cooper's (1995) study;  $a = 0.87$  for Cooper and Williams' (1991) study;  $a = 0.88$  for Robertson et al. (1990) study). The reliability of



physical health is also low, yet can be considered comparable with those obtained from previous research (a ranges from 0.61 to 0.85 in the present study;  $a = 0.82$  for Bogg and Cooper's (1995) study.  $a = 0.79$  for Cooper and Williams' (1991) study;  $a = 0.78$  for Robertson's et al. study). Generally, then, the measures used in the present study are reliable.

TABLE 7  
Predicting mental well being

	$R^2$	$R^2$ ch	$F$	$\beta$
<i>Hong Kong White Collar</i>				
Step 1: Environmental Conditions (E)	0.198***	0.198***	37.78	0.445***
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.231***	0.033*	22.80	0.351*** 0.204*
Step 3: Environmental Conditions (E) Organizational Commitment (O) $E \times O$	0.237***	0.006	15.60	0.300** 0.187* -0.098
<i>Hong Kong Blue Collar</i>				
Step 1: Environmental Conditions (E)	0.023	0.023	2.79	0.151
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.027	0.004	1.63	0.120 0.070
Step 3: Environmental Conditions (E) Organizational Commitment (O) $E \times O$	0.060*	0.033*	2.48	0.184 0.072 0.192*
<i>China Blue Collar</i>				
Step 1: Environmental Conditions (E)	0.039***	0.039***	13.39	0.199***
Step 2: Environmental Conditions (E) Organizational Commitment (O)	0.107***	0.067***	19.40	0.096 0.279***
Step 3: Environmental Conditions (E) Organizational Commitment (O) $E \times O$	0.125***	0.018**	15.37	0.196** 0.314*** -0.178**

\* $p < 0.05$ ; \*\* $p \leq 0.01$ ; \*\*\* $p < 0.001$ .

### Environmental conditions as stressors

The Chinese blue-collar workers were more satisfied with their environmental conditions than the Hong Kong blue-collar workers. The obvious explanation for this is that the factories in China simply provide better environmental conditions than those in Hong Kong. However, it is not possible to rule out the possibility that other factors contribute to the higher levels of satisfaction amongst the China sample. For instance, Bond (1991) has argued that the Chinese tend to conform and accept the conditions provided by those in authority. It is also possible that there are lower expectations amongst the sample in China compared to those in Hong Kong, where the population has historically enjoyed better conditions. Despite these possibilities, the most parsimonious explanation is that the higher satisfaction is a result of better environments.

What is striking about the results is that the white-collar sample in Hong Kong are marginally less satisfied with their environmental conditions than the blue-collar sample in that region. Given that

the environments of white-collar workers are of a better quality than those of the blue-collar group, the results are unlikely to simply reflect environmental quality. The most probable explanation for this result is that as a major international business center, it is likely that the expectations of the white-collar workers are significantly higher than those of the blue-collar sample. The gap between expectation and provision will therefore be greater, and result in lower levels of satisfaction, despite the environment per se being of a higher quality. However, this hypothesis was not tested directly here. Effort in clarifying this issue would be helpful.

In the white-collar sample, environmental conditions were also statistically significantly related to health outcomes (Table 4). The results therefore support previous findings in Western societies (e.g. Cox, 1993; Hedge, 1989; Hughes, 1990; Sunstrom, 1986; Warr, 1992). In these studies, physical characteristics of work were related to health among office workers. The results of the present study also corroborate previous research in Hong Kong (Siu & Donald, 1996) in which perceived environmental conditions were found to be strongly related to job satisfaction, physical and mental health.

What is interesting here is that as objectively the office workers' environments were better than those of the factory workers, there is unlikely to be a simple stimulus-response relationship between environmental conditions and health outcomes. Other factors that influence this relationship are likely to include potentially greater role ambiguity, type of work and the need for concentration, and attitudes towards the organization, the latter being considered below. One factor that has been shown to be important to stress outcome has been control of the stress stimulus. For those working in offices it may be the case that control may be more important due to the nature of the tasks being performed, and the higher levels of concentration required.

The complexity of environment-stress relations is further indicated by a slight difference in the patterns of the relationship between environmental conditions and health effects in the blue-collar samples in Hong Kong and China (Table 4). For the Hong Kong blue-collar group, environmental conditions were only statistically significant and positively related to job satisfaction; whereas in the China blue-collar group, it was significantly and positively related to all three outcome measures; physical wellbeing, job satisfaction, and mental well-being

It is not clear from the present data why this should be the case, particularly given the argument that workers in China are thought to be less likely to complain and the finding that they are the most satisfied with their environment. One possible explanation is that workers in China are more likely to work away from their homes and their extended families than are workers in Hong Kong. It may well be possible that the lack of a wider social support network, which is particularly important in Eastern cultures (Draguns, 1990), exacerbates the stress related health outcomes. This

suggests that variables other than those considered here, social support, may be operating as moderator or mediator variables for this particular population.

Nevertheless, the results provide evidence of environmental conditions being a potential stressor in blue-collar workers. As argued earlier, evidence of the effects of physical working conditions on physical and psychological health in blue-collar workers is lacking. This research adds to the argument that significant relationships exist between environmental conditions and psychological outcomes of work stress is true for both white-collar and blue-collar workers, and further contributes to generalizability of research on stress, extending the findings to Eastern samples. The results suggest that it is worthwhile undertaking detailed measures of workers' physical environments to establish more clearly and precisely the environment-stress relationship at work.

Finally, with one exception, the strength of relationships between environmental conditions and stress outcomes follow a similar pattern within each group, with job satisfaction being most highly related, followed by mental well-being and finally physical well-being. Where this is not the case, the difference in the correlation between environmental conditions and physical and mental well-being is not significant. This would be expected in terms of the outcomes that are most readily affected by stress conditions. Job satisfaction is relatively open to change, whereas mental and physical well-being requires more chronic exposure to stressful environments.

#### **Organizational commitment as stress moderator**

The present results showed organizational commitment to be a significant predictor of health outcomes, as well as a significant moderator in some of the perceived environmental conditions-health relationships. The results are, however, inconsistent and complex. For instance, there is some indication that commitment may play a mediating rather than moderating role in some relationships, or that it plays little role at all in others. These differences are difficult to explain in any consistent way, and point to the need to examine the various factors in more detail in future work.

In keeping with the correlations previously discussed, the results of the regressions show that job satisfaction can be predicted reasonably well from employees' physical conditions, they also show that organizational commitment is a predictor of this outcome. Further, job satisfaction can be predicted more accurately than either of the other two outcome measures. There are however differences between the three groups, in terms of the importance of these two factors in predicting job satisfaction. For the blue-collar workers, perceived physical conditions are most important, whereas organizational commitment is a more important predictor for the white-collar workers.

More interesting is the interaction between perceived environmental conditions and

organizational commitment for the white-collar group. There is research evidence from organizational psychology that would lead to the expectation that there would be an interaction between employees' conditions, physical or organizational, and outcomes such as job satisfaction. For instance, Cole (1979) found that the higher the commitment of Japanese workers, the greater their expectations, and the lower their job satisfaction. This would partially fit with the results for the Hong Kong white-collar workers.

While job satisfaction appeared to be open to the influence of environmental conditions and organizational commitment, the results suggest this is less the case for physical well-being. Again, however, there are clear differences between the groups. For the white-collar group environmental conditions was the best predictor of physical well-being with organizational commitment accounting for another 10.3% of the variance. However, the results show that, as for the other groups, there is no interaction effect.

Neither environmental conditions nor organizational commitment were predictive of physical wellbeing for the blue-collar workers in Hong Kong. The results for the China blue-collar sample show that there is a slight statistically significant relationship between environmental conditions and physical well-being, however, this is no longer the case when organizational commitment is added. Therefore the best predictor of physical well-being amongst this group is organizational commitment. Given that this group was most satisfied with their environment, it is perhaps to be expected that there appears to be little impact on stress outcomes. Further, the results tend to suggest that organizational issues account more for those health outcomes that are present. The pattern of results indicates that drawing any conclusion regarding environmental impact may be spurious if organizational factors are not also considered. Given that such variables are not usually included in environmental assessments, the present research has wide implications.

The final outcome variable, mental well-being, shows a variety of relationships with environmental conditions and organizational commitment. For the white-collar group both environmental conditions and organizational commitment predict mental well-being. However, there is no interaction effect of the two independent variables. For the Hong Kong blue-collar workers neither environmental conditions nor organizational commitment alone are predictive of mental well-being. Nonetheless, the interaction between the two does increase the amount of variance accounted for in mental wellbeing, though only by a small, but statistically significant, amount. A slightly different picture emerges for the China blue-collar group. In this case, both environmental conditions and organizational commitment, as well as their composite, are predictive of mental well-being. Moreover, the interaction between the two independent variables also improved prediction. Organizational commitment does therefore appear to be moderating health outcome.

It would be expected that there would be some differences in the patterns of results between the three groups. The importance of the interaction between environmental conditions and organizational commitment is evident. In some cases the results suggest that organizational commitment may be playing a mediating, rather than moderating, role in the impact of environmental conditions on stress outcomes. Clearly, establishing and explaining the mechanisms that operate in relation to each group needs to be established.

The existing organizational psychology literature may shed some light on why there are a variety of impacts and roles played by the physical environment and organizational commitment in predicting stress outcomes. For instance, it has been demonstrated that increased commitment may lead to people being more likely to experience stress. Mathieu and Zajac (1990) found that highly committed people feel the effect of stress more than those less committed. Further, Lazarus and Folkman (1984) argued that commitment supposedly increases vulnerability to psychological threats. In contrast to this, opposite arguments have been made. From the work of Kobasa et al. (1982), for example, it could be argued that commitment protects workers from the negative effects of stressors, such as environmental conditions, enabling them to attach direction and meaning to their work.

Unfortunately, these issues cannot be tested with the current data. What the data do point to, however, is the need to examine contextual variables, such as job attitudes, when assessing the impact of environmental factors on stress outcomes. They further indicate that the relationship between environmental conditions and stress are complex and less clear and simple as, for instance, suggested by Begley and Czajka (1993). The differences in the results for each group also warn against generalizing findings from one population to another, even when those populations appear to be very similar on major dimensions such as job type. One of the strongest messages to emerge from the study is that this is an area that requires considerable empirical and theoretical effort if the nature of the impact of environmental factors on workers stress is to be understood.

#### **Note**

Correspondence and reprint requests should be addressed to Ian Donald at: Department of Psychology, The University of Liverpool, Eleanor Rathbone Building, Bedford Street South, Liverpool L69 7ZA, UK. Tel.: 0151-794-3913; Fax: 0151-794-3938; E-mail: [don@liverpool.ac.uk](mailto:don@liverpool.ac.uk)

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