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All papers submitted to COBRA were assessed by expert panel, drawn from the construction and building research community, The conference organisers wish to extend their appreciation to the members of the panel for their work, which is invaluable to the success of COBRA.

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Health and wellbeing in a deep plan office space

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1. Introduction

This research tracks public sector employees as they move from a 1960s office building into a purpose-built, environmentally sound, office accommodation. It hypothesises that in this instance the attempts to change the image and effectiveness of an organisation by changing workspace layouts has been ineffective and considers the consequent implications for individuals working in that organisation. It looks at the likely relationship between health and wellbeing of individuals and productivity. The case study is founded in the public sector but the findings are equally applicable to private sector workplaces.

2. Background

The Commission for Architecture and the Built Environment (CABE) in the UK reports (CABE BCO, 2005) that differences in productivity can be as high as 25 per cent between comfortable and uncomfortable staff. Individuals react uniquely to environmental conditions, but the most important factors in achieving health and comfort are air quality, temperature, overall comfort, noise and lighting. Most of these environmental factors can be readily and easily measured in any office, particularly in an era with the widespread use of Building Management Systems (BMS) to control mechanical and electrical building services plant.

Clements-Croome and Baizhan (2000) however draw a distinction between ‘comfort’ and ‘wellbeing’, inferring that although comfort is an important factor in productivity, wellbeing is a ‘prime requisite’. They suggest that productivity depends on:

“Good concentration, technical competence, effective organisation and management, a responsive environment and a good sense of well-being.”

Putting personal environmental control into occupants’ hands can also be important for both comfort and productivity (CABE BCO, 2005). CABE suggests that variances in individual preference and the growing importance of staff autonomy both point to the value of personal control to the greatest degree consistent with efficient operation, of the air conditioning, lighting and related building systems. Wyon (1998) has indicated that a good indoor environment may only satisfy eighty per cent of an occupants’ perceived level of comfort, with individual control satisfying the remaining twenty per cent. It has also been suggested in a number of studies that in order to improve productivity, firstly comfortable conditions have to be provided (and conditions should be improved periodically) and, secondly, occupants’ requirements have to be met rapidly.

3. Workspace Development

Historically in the UK, public sector workspace has gone through a number of phases which could be said to reflect the fluctuation in the prestige of the organisation and employee. The magnificent edifices of Whitehall and the impressive Town Halls of Manchester and Glasgow were designed to reflect status and support top-down government structures. As a result of the wide scale expansion in the public sector workforce between 1945 and 1950, purpose-built structures were designed to create a dynamic image in a post war drive to modernity; Harlow Town Hall may be a good example. In the 1970s and 80s as public sector expenditure was cut the accommodation provided reflected the reduction of prestige and rewards in public service employment, during this stage accommodation was provided in an *ad hoc* and reactive basis, often speculative offices rented from the private sector. Internally, these were typically organised into central corridor with offices to each side and continued to reflect status according to grade, and the horizontal and vertical boundaries of the hierarchical structure. In the 21st century there is a new focus on modernising public sector management and working conditions to attract and retain staff and improve productivity. There are a range of workplace configurations and cultural changes affecting the way the public services operate; the geography of an organisation; and redesign of workspace has been introduced to reinforce a culture of internal communication and break down traditional hierarchy. The aim of creating a flexible working environment where staff would feel valued and well motivated, whilst improving the efficiency of space usage was a key aspect of the reform and modernisation agenda (DEGW, 2004). At the same time office design has evolved to a deep plan format to easily accommodate first trading floors and latterly call centre operations. This configuration requires air conditioning to operate effectively.

Duffy (1993) identifies deep plan spaces as the least flexible in accommodating work styles and in a period where energy costs and energy efficiency are of increasing importance the deep plan space has limitations in its ability to reduce environmental impacts.

One aspect of modernisation is the use of the workplace to drive business change, which may be achieved through: *efficiency* - making economic use of real estate and driving down occupancy costs; *effectiveness* - using space to support the way that people work, improving output and quality; and *expression* - communicating messages both to the inhabitants of the building and to those who visit it, to influence the way they think about the organisation (BCO, 2005).

Sir Anthony Turnbull speaking of the refurbishment of the UK government's Treasury Building summarised these aims as:

'It has prompted communication, both formal and informal and has encouraged flexible ways of working. Above all it has fostered a feeling of self-confidence and presented an attractive image to the talent we need to recruit.' (CABE BCO, 2005)

4. The Study

This study examines the employees of two office developments within a city centre in the North East of England. In 2005 the participants moved from a 1960s office building to newly completed office accommodation on an adjacent site.

The 14 storey 1960s building (now demolished) had a shallow floorplate and was constructed with a concrete frame and precast concrete cladding. The majority of floors within the building were open plan in nature, although a small number of departments retained cellular offices. Floors within the building each housed approximately fifty staff. Social facilities in the form of 'tea points' were provided on each floor.

As was typical of the time, the working areas were naturally ventilated with single glazed, steel framed, windows. A central gas fired boiler heated the building with perimeter radiators and the radiators were fitted with thermostatic valves, allowing some level of occupant temperature control. Lighting to all work areas was provided by luminaires recessed into suspended ceilings, with desk lamps to provide task lighting. No specific noise control measures were used within any of the buildings working areas, although meeting and interview rooms had a high level of acoustic performance.

In contrast, the new building is a deep plan floorplate building constructed with a steel frame and insulated cladding panels with double glazed steel framed windows. It is divided into an eight storey high north wing and five storey central and south wings. The majority of floors are open plan with minimal cellular offices constructed for senior staff. Heating is by gas fired central boiler and radiators, cooling by passive chilled beams. Mechanical ventilation is provided through floor diffusers. A BMS automatically controls the internal environment. The new building was assessed to be 'excellent' under the Building Research Establishment's Environmental Assessment Method (BREEAM) scheme - this was an essential part of the building procurement to support the Governments' carbon reduction targets.

5. Research methods

This research carried out evaluations of comfort and wellbeing (as perceived by occupants) to determine a relationship between these factors and productivity.

Historical methods of productivity research are seen as largely scientific, and conducted in controlled, limited environments (van der Vordt, 2003). There have been a number of more recent studies considering the interactive and subjective nature of a 'real world' workplace (such as Leaman and Bordass (2005)) that utilise occupants' self-assessment of workplace quality and personal productivity levels.

Building performance, and the effect this has on occupant satisfaction and productivity is often measured through the use of post-occupancy evaluation surveys (POE). This form of evaluation came to prominence during the 1980s, with the rise of the facilities management (FM) discipline demanding more information on the buildings they manage, and the development of the Office Environment Survey, conducted to address increasing reports of incidences of sick building syndrome within the UK.

POEs were used in this study and were carried out in 2002 and 2006, before and after the move. The POEs were identical apart from identifying those employees who had moved from the 1960s building. The research has the benefit therefore of drawing upon two identical surveys of the same staff in two offices. In contrast to many research projects trying to relate staff productivity and satisfaction over a number of case studies (van der Vordt, 2003) this has the benefit of having the staff as a 'constant', notwithstanding some turnover between the two surveys.

The research questionnaire design allowed respondent staff to indicate their views on a wide variety of issues using 'tick box' responses and the opportunity to provide a written commentary, this data was subsequently analysed to provide quantitative data to compare with the previous office. More interesting in many respects was the qualitative data which was gathered by allowing staff the opportunity to comment on the issues being measured.

Response data from the second survey are reported below with the comparable results from the first survey in brackets.

The second survey was administered to 400 (143) with a response rate of 41% (47). Of the respondents 61% (70) worked in open plan offices occupied by 8 or more persons. 53% (48) of the respondents described themselves as professional or managerial staff, which clearly implies that individual offices are a rare commodity in both buildings. Some 84% of the respondents in the second survey had worked in both offices.

6. Results

6.1 Health and Wellbeing

It is possible to have an environmentally sound building, as defined by a recognised scheme such as BREEAM, but fail to address any health or wellbeing issues for occupants (as BREEAM is not prescriptive, the points may be obtained in other sections, such as Transport or Energy). BREEAM attaches considerable weight to health and wellbeing and includes a variety of indicators such as openable windows, proximity to windows to allow a view out and the provision of occupant controlled blinds to control glare. In this instance the building scored very well in the 'Health and Wellbeing' section generally but lost points on the 'view out' of a window as it was a deep plan building. Credits were awarded under the BREEAM schemes for installing openable windows but in practice these are locked shut.

The previous offices did not have air conditioning and staff described the building as '*smelly and stuffy*', however they did have an element of control over their environment to the extent that they had access to opening windows and could open them at will. In contrast, the staff in the new, open-plan, building have little or no control over their working conditions. An uncomfortable environment might only be improved by phoning the FM team, requesting more heating or cooling, then waiting for a sensory indication that their request had been dealt with. The situation may be exacerbated by a

perception of longer response times that are common due to the practical difficulty in matching the different preferences of groups or individuals.

6.2 *Layout*

People tend to prefer working at low densities rather than at high densities due to them being given more freedom in the workplace. Open-plan layouts typically involve problems of raised noise, visual distraction and reduced privacy as well as an inability to control an individuals' environment referred to above.

There were complaints from staff that they could not concentrate on their work due to noise and distractions from colleagues. For example *'the noise levels make it very difficult to concentrate when people are talking to one another'*. The design of the building has attempted to compensate for this problem by providing 'quiet rooms ' which can be booked for concentrated works, however *'when in quiet rooms you can hear every word from adjoining rooms and the kitchen'*. The 'quiet' rooms have well insulated walls and soundproof doors, however sound is easily transmitted across the suspended ceiling.

Analysis of the questionnaires indicates how important these factors are in practice. The problems do not arise from a switch from cellular to open plan offices as, in the sample 10% fewer staff were working in open plan accommodation. The difficulties arise in the number of people per floor and the configuration of the office. Staff have moved from narrow floor plans with light and ventilation on both sides, to a deep plan building with up to 100 people in a large open space (where it may be 20 metres to the nearest window). In these circumstances staff feel more subjected to control of their environmental conditions via the FM team and the BMS and subject to noise coming from all directions.

There may also be a layout/social aspect to the working conditions revealed by anecdotal evidence from staff. In the previous office each floor had its own social breakout space in the form of a 'tea-point'. This fostered a sense of community amongst the team working on the floor. In the new building the tea-making / lounge area is equal in area, but is accommodated in two large (anonymous) spaces shared by the whole building, thus losing the team ownership or the social space.

6.3 *Personal control and response time*

Individual occupants need systems to provide comfortable environment and also require systems to respond quickly to avoid their discomfort. It is stated that the occupants become healthier, happier and more productive the more rapid the response times become and that an occupants' tolerance threshold can be widened by a rapid response (Leaman & Bordass, 2005).

One of the major findings of the study relates to the control of environment afforded to staff. In the old building the staff were close to windows and although in poor condition were openable to improve ventilation. They had individual control of the ceiling lights and because the standard of lighting was perceived to be poor, had been provided with task lighting on an *ad hoc* basis. In the new building there was a complete absence of individual control exacerbated by inadequate commissioning of the building services during a rushed occupancy programme.

As a result parts of the building were too cold or too hot, the lighting generally was too bright and the windows, although openable, were locked shut to avoid extraneous natural ventilation compromising the BMS. Staff complained constantly to the FM team with requests to adjust temperatures at the local level (the BMS was addressable down to four workstations). Staff perceptions were of a lack of control over their environmental conditions, an unseen intermediary (the FM team) has to be phoned or e-mailed to request changes, and then there was never any certainty that action had been taken. Understandably, this was a considerable impediment to productivity.

6.4 Building commissioning

It is now three years since the building was occupied and the FM team have spent much of that time identifying and correcting defects, for example the location of sensors next to heat sources, which jeopardised the effective running of the BMS. The lighting was found to be well above the design level and has been adjusted to a more comfortable specification. Low humidity and the carpet specification had conspired to create a chronic static electricity problem, to such an extent that at one stage the FM team considered issuing gloves to all the staff! (this has now been 'cured' by increasing the relative humidity levels).

Many of the problems might have been avoided if the building had undergone a comprehensive commissioning of the building services installation during the hand-over phase. In the event, completion was rushed to avoid penalty payments by the developer with the ironic result of transferring the commissioning process from the specialist installers to the building occupants.

7. Discussion

Reviewing the data the most remarkable aspect is the extent to which the new building fails to meet the aspirations of the staff that moved from a building, which by common consent was accepted as providing a poor working environment.

The survey revealed that 35% of respondents felt that their productivity was reduced in the new building whilst only 15% felt that productivity had increased.

Overall, most of the respondents considered that environmental conditions had improved, but in this instance environmental conditions include the 'newness' and appearance of the building as well as matters of temperature and humidity. In a recent study (Walsh, 2008) staff moving to a new office were forgiving of its failures in comfort condition because they were impressed by an awarded winning iconic design that generated a strong 'feel good' factor. It may be interesting to discover how long this 'honeymoon effect' lasts.

The most telling statistic is the response to the question 'In respect to your overall satisfaction with your workspace, given the choice would you prefer to return to your physical conditions at the previous building'. 24% of staff would prefer to return to the conditions of the 'poor' building.

8. Conclusions

Organisations are aware of their responsibility to provide a healthy productive workplace for their staff. In the move to the new building the employers felt they were moving from a building that was of poor quality to a new building with excellent environmental credentials.

In the short term, benefits were lost due to inadequate commissioning of the building services that made the new building very uncomfortable for a significant number of staff for a considerable time.

In the long term it may be questioned whether the move to the new building was a good idea in principle. The old building could have been refurbished with new windows, solar shading and high efficiency boilers. The building would have had a new lease of life as a light, airy and flexible workspace.

The new building, whilst employing relatively efficient heating and cooling plant, has a considerably larger carbon footprint as well as higher energy costs. The shape of the building means that it is

inflexible as regards work styles (Duffy, 1993) and cannot be occupied without the extensive mechanical services.

The record energy prices of 2008 provides strong evidence that future energy costs will increase ahead of the rate of inflation and will become more significant in relation to overall office accommodation costs. An environmentally sensitive refurbishment may have not only retained the embedded energy in the 1960s building but also have provided a healthier working environment with lower overall running costs.

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