



# Evaluating user experience in green buildings in relation to workplace culture and context

Evaluating user  
experience

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Zosia Brown

*Institute for Resources, Environment and Sustainability,  
University of British Columbia, Vancouver, Canada*

Raymond J. Cole

*School of Architecture and Landscape Architecture,  
University of British Columbia, Vancouver, Canada, and*

John Robinson and Hadi Dowlatabadi

*Institute for Resources, Environment and Sustainability,  
University of British Columbia, Vancouver, Canada*

## Abstract

**Purpose** – This paper aims to explore the relationship between green building design and workplace design practice, and to examine the role of organizational culture in shaping design and operation decisions with consequence for user experience.

**Design/methodology/approach** – A literature review and introduction of key concepts establish the foundation for the research and provide a context for interpreting results. Empirical findings are presented from a pre- and post-occupancy evaluation of a company's move to a new headquarters building designed both to shift organizational culture and to meet environmental objectives.

**Findings** – The paper demonstrates that, while there are potentially significant gains to be made from integrating green building with workplace design strategies from the outset, there are many other factors beyond the quality of the space, which may play a role in shaping user experience. Links are drawn between improved occupant comfort, health and productivity in the new headquarters building, and organizational culture and contextual factors accompanying the move. The findings raise a number of important questions and considerations for organizational and workplace research, and post-occupancy evaluation of buildings.

**Research limitations/implications** – The research and findings focus on the experience and context of one company's move to a new headquarters building and cannot be extrapolated. Given the mainstreaming and merging of green building design with workplace design practice, more research and studies are needed to advance this important line of inquiry.

**Originality/value** – The paper brings together the two agendas of workplace design and green building design, which have until very recently progressed along separate paths.

**Keywords** Environmental management, Organizational culture, Customer satisfaction, Office layout

**Paper type** Research paper

## Introduction

The benefits of green building[1] to the organizations and individuals who inhabit them are the subject of increasing attention and research. Green building strategies



Funding for this work was provided by the Social Sciences and Humanities Research Council and the Pacific Institute for Climate Solutions.

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have been linked to gains in occupant comfort, health and productivity, as well as to organizational success through improved quality of work life, enhanced relationships with stakeholders, enhanced community livability, and the ability to market to pro-environmental consumers (Heerwagen, 2000). Green buildings also have the potential to shape and reinforce organizational culture, through imbuing values and beliefs around the human connection to nature and sustainable patterns of living, offering greater personal control and responsibility to occupants to shape their immediate environment, and fostering a collective sense of responsibility and pride for the organization and building (Cole *et al.*, 2008).

Much of the evidence on the performance of green building in-use stems from early adopter projects where the notion of “green” was considered to be front-and-centre in the design and operation priorities. With green building moving into mainstream, office buildings are now incorporating “green” into the workplace in much more subtle and integrated ways. The contemporary workplace is expected to provide a whole host of benefits including a reassuring atmosphere, compensation for the abstraction of work, protection of workers from stress, unification of the organization, expression of organizational values, motivation and mobilization of staff, promotion of sociability and cooperation, and reflection of a company’s desired image (Collard and DeHerde, 2001). Changes in the twenty-first century including new business processes, new philosophies of spatial organization, and advances in computing and telecommunication, have led to a shift in viewing the workspace as a backdrop for work to an active support for getting work done (Vischer, 2008).

Current trends in workplace design include: a greater emphasis on flexibility, both in work schedules and organization of space, as the assumption of permanent individual ownership of workstations is replaced by increasingly mobile workers (Worthington, 2006); success measured more commonly in terms of the attraction and retention of staff rather than absolute efficiency (Tanis and Duffy, 1999); and building design and internal arrangement of workspace reflecting an increasing effort to take into account a firm’s operation and corporate culture (Goodrich, 1986; Haworth, 2000). Each of these factors can fundamentally shape how individuals, groups and the organization operate, and the resulting potential gains in workplace satisfaction and productivity can be difficult to disentangle from those due to green building factors.

The two agendas of workplace design and green building design have for the most part progressed along separate paths. As Heerwagen *et al.* (1998) suggest “emerging interests in workplace productivity, the workplace of the future and energy efficiency are all proceeding with little connection or common goals”. And yet, organizational and green building factors are highly interrelated, some would even argue dependant on one another for success, in the sense that the benefits of both are more likely to occur when the building and organization are treated as an integrated system from the outset (Heerwagen, 2000). By encompassing both environmental and social considerations, such integration may be thought of as a form of “sustainable” (as opposed to “green”) building design process.

This paper explores this important new area of research, linking workplace design, organizational culture and green building in evaluating user experience in buildings. It centers around a Canadian company’s move to a new headquarter building explicitly designed to both shift organizational culture and to meet environmental objectives. Post-occupancy evaluations (POEs) conducted pre and post-move allowed for the

unique opportunity to assess physical, organizational and cultural changes that occurred as a result of the move, and how they relate to gains observed in comfort and productivity of staff. The findings have relevance for building designers, owners, operators and end users striving to realize the combined benefits of green and workplace design.

### Study description

The two headquarter office buildings, both located in Toronto, Ontario, are designated in the paper as HQ1 (old building) and HQ2 (new building). HQ1 is a conventionally designed building leased from a property management company and characterized by closed offices and cubicles, while HQ2 is a “green” designed, custom-built facility characterized by an extensive open plan office layout. Table I compares key building attributes and properties for HQ1 and HQ2.

The company is family-owned and staff feel strong levels of personal attachment to the brand, the organization and to other members of the staff[2]. It moved from HQ1 to HQ2 in the Fall of 2008, and the research reported below was conducted six months prior to and five months after the move.

#### *Old facility: HQ1*

HQ1 is a 16 300m<sup>2</sup>, six-storey traditional office building, located along a busy road in a suburb north of Toronto (Figure 1). Built in 1974, the building is concrete construction with sealed, reflective-glazed windows, and conditioned through a central forced air ventilation and cooling system, and radiant perimeter heating. The building has been regularly upgraded by the property management company to incorporate energy efficient fixtures and system upgrades. The property management company is also responsible for building operation and maintenance, complaints resolution, renovations, and exterior landscaping.

Home to 382 employees, HQ1 served as the central location for company operations, information technology, real estate, marketing, human resources, finance, and accounting. Organizational culture in HQ1 centered on the value and responsibility of the individual staff member in helping the company achieve success, exemplified through the company slogan “The difference is you”. The interior workplace design consisted of a combination of cubicle desks in the building core (8ft-high partitions, three to four sides closure), and closed offices along the perimeter typically occupied by higher level managers. Staff members’ workstations were organized by department in terms of floor number and seating arrangement. Board rooms were centrally located and closed off to the rest of the staff to maximize privacy. Overall, the workplace

Building properties	HQ1	HQ2
Size	16,300 m <sup>2</sup>	9,300 m <sup>2</sup>
No. of floors	6	2
Year of completion	1974	2008
Tenancy	Leased facility	Custom-built facility
No. of occupants	382	216
Green design	n/a	LEED-Silver standard
Workplace design	Closed offices and cubicles	Open plan layout

**Table I.**  
Comparison of building  
attributes and properties  
for HQ1 and HQ2

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**Figure 1.**  
Old headquarters building  
prior to the move

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design and culture embodied by HQ1 could be characterized as private, hierarchical, low-interaction and individually focused.

*New facility: HQ2*

HQ2 is a 9,300m<sup>2</sup>, two-storey green office building, located along a major highway approximately the same distance from the downtown core as HQ1 (Figure 2). Although accessible by public transit, most employees at HQ2 drive to work, as with the previous



**Figure 2.**  
New headquarters  
building after the move

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building. Completed in 2008, the building was designed to LEED-NC Silver standard, with key sustainability features including: extensive natural lighting, views to the outdoors for 90 percent of spaces, daylight and occupancy sensors, high efficiency lighting fixtures, CO<sub>2</sub> monitoring, low-emission materials and finishes, water efficient fixtures, and native vegetation landscaping. While custom designed and built, the building remains leased from the development company who are also responsible for facilities management.

The building was designed to accommodate the same staff and departmental groups as in HQ1, with the exception of the IT department which was re-located to an off-site facility at the time of the move. However, significant cuts to the company operating budget meant that roughly 40 percent of the headquarters staff was made redundant shortly after the move to HQ2, leaving a remainder of 216 employees in the building.

With the move to HQ2, the company used the opportunity to promote a new organizational culture centered on the collective rather than the individual, along with the introduction of new company slogan “everyone is special”. The building front entrance expresses a warm and welcoming feeling, with sliding doors opening onto a large closet for visitors’ coats, and bright colours contrasting with subdued beiges and greys in the interior design. A waterfall located in the atrium provides visual and acoustic benefits, and a self-serve coffee bar offers free beverages to employees throughout the day. The building also houses a 24-hour gym and fitness facility, offering a variety of exercise classes to staff and providing day-lockers and showers.

The most striking difference between HQ2 and HQ1 is the workplace design, now characterized as one large open plan office. The majority of staff members (80 percent) sit at workstations on the ground floor, arranged in inter-connected desks (five to 12 people per hub) with below eye-level partitions. There is no differentiation in workstation size or location based on hierarchy; the executive team sit with the rest of the staff. Meeting rooms located along the south perimeter have glass walls to maximize transparency. There are a number of collaborative workstations interspersed among the desk hubs, as well as quiet spaces for concentrated work. Sound masking is provided by white noise generators combined with background radio playing throughout the building. Overall the workplace design and organizational culture embodied by HQ2 may be characterized as transparent, egalitarian, high interaction, and collective focussed, a significant shift from the culture of HQ1.

## Methods

Building users were surveyed in the spring of 2008 (HQ1) and 2009 (HQ2) using the Building Use Studies (BUS) occupant questionnaire (UBT, 2008 version). The BUS survey gives respondents an opportunity to rate and comment on building design, work requirements, comfort (temperature, air quality, noise and lighting), health and productivity. Widely used in post-occupancy evaluations around the world, the BUS survey has led to the development of national and international building performance benchmarks, which can be used to situate the building performance within a broader context. The survey was modified to include questions regarding occupants’ knowledge of the building, engagement with personal control, and perceptions of organizational culture[3].

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The survey was conducted via a web-based version and ran for approximately one week in each building. Response rates for the survey were 37 percent for the HQ1 (145 responses, confidence interval 0.06) and 48 percent for HQ2 (104 responses, confidence interval = 0.07). In both buildings, the majority of respondents were aged 30 or over (76 percent in HQ1, 87 percent in HQ2) and female (60 percent in HQ1, 56 percent in HQ2). In HQ1, 58 percent of respondents had worked in the building for one year or more while 42 percent had worked there for under a year, while in HQ2 all respondents had worked in the building for less than a year. Since the survey was completed anonymously, it was unknown how many and which respondents of the HQ2 survey had also completed the HQ1 survey.

Owing to limited resources, it was not possible to conduct a full assessment of corporate culture (e.g. as per Goodrich, 1986) however, the human resources manager, who had held this post in both HQ1 and HQ2, was interviewed to gain insight into strategic aspects of the organizational culture and workplace environment. In addition, company publications (e.g. brochures, and tour scripts for the new building) were reviewed for identification of recurring themes and important values and beliefs, and the workplace environment was observed directly through a guided building walk-through and two days spent working in each building.

### Results

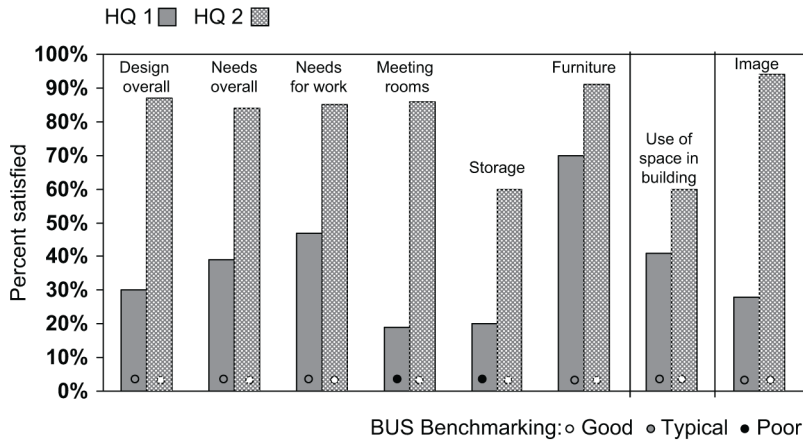
Results from post-occupancy evaluations conducted both pre (HQ1) and post move (HQ2) buildings allowed for the assessment of human and environmental performance in terms of occupant satisfaction with workplace design, comfort, productivity, health and wellbeing, and overall performance compared with benchmark[4]. In addition, occupants' perceptions of how organizational culture influence their behaviour and expectations of the workplace were examined.

#### *Overall satisfaction with building*

Occupants in HQ2 were highly satisfied with the building in terms of its overall design, ability to meet needs, image, facilities and furnishings (Figure 3). Satisfaction ratings for these variables were significantly higher than had been reported in HQ1, and exceeded the BUS benchmark. Open-ended comments suggested occupants appreciated the aesthetic quality of the architecture and interior design of the new building, the brightness, openness and views to outside and the availability of meeting rooms. Some respondents complained about the lack of printers, and not having enough storage at their desk for files and personal items. (The latter may have related to the introduction of a "Clean Desk" policy in HQ2, designating a central storage area for staff to keep personal items such as coats, boots, umbrellas, while requiring they maintain their desk areas clear of clutter). Overall, satisfaction with the building design of HQ2 ranked in the 83rd percentile of benchmarked buildings, and related to both workplace design (workstation layout, meeting rooms, storage) as well as green aspects (daylighting, views to outside).

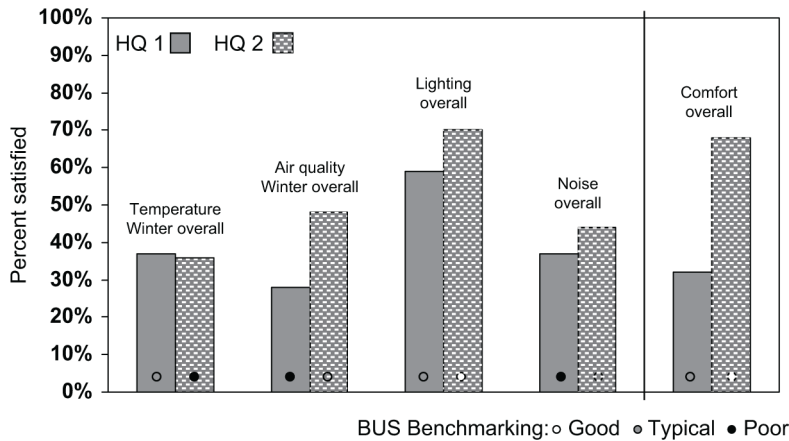
#### *Comfort*

Overall, comfort was on average 36 percent higher in HQ2 compared with HQ1 (Figure 4). The greatest gains in comfort were with respect to lighting (70 percent satisfied) and air quality (48 percent satisfied) with numerous comments referring to



**Figure 3.** Occupant satisfaction with workplace design in HQ1 and HQ2

**Note:** “Good” signifies that the study building is significantly better than BUS benchmark, “typical” is neither better nor worse than benchmark, and “poor” is significantly worse than benchmark



**Figure 4.** Occupant comfort in HQ1 and HQ2 compared with BUS benchmark

**Note:** “Good” signifies that the study building is significantly better than BUS benchmark, “typical” is neither better nor worse than benchmark, and “poor” is significantly worse than benchmark

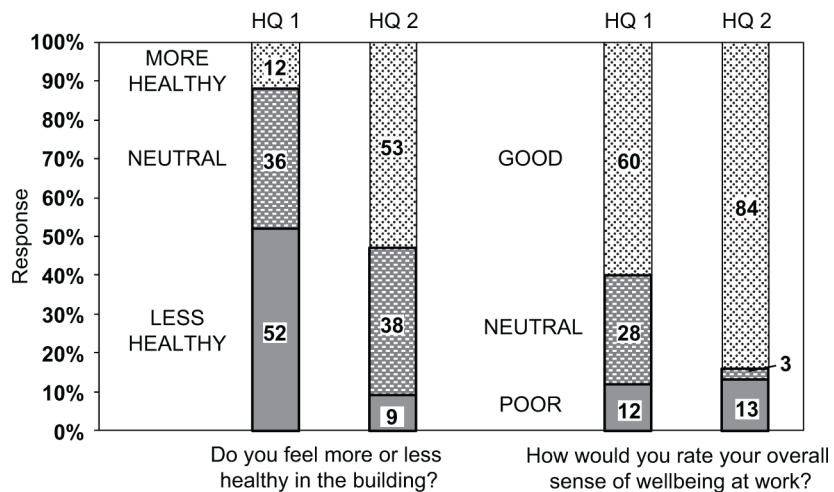
the clean, fresh air and exceptional lighting conditions. A total of 44 percent were satisfied with noise in HQ2 (slight improvement over HQ1) and only 36 percent satisfied with thermal comfort (slight decline in satisfaction from HQ1). Comments suggested that some found the background music and occasional loud conversations to be distracting in HQ2, with 46 percent reporting too much indoor noise generally, and 42 percent reporting too much noise from other colleagues specifically. With respect to thermal comfort, the majority of respondents in HQ2 found the temperatures to be too

cold in the winter (69 percent). Since winter temperatures in Toronto did not differ significantly between 2008 and 2009 (Environment Canada, 2009), this may have been due to HVAC set-points in the building set too low, to accommodate a higher density of occupants than actually materialized (as a result of layoffs). Summer thermal comfort data was unable to be collected, since respondents in HQ2 had not spent a full year in the building at the time of survey.

Satisfaction with overall comfort in HQ2 ranked in the 68th percentile of benchmarked buildings, and related to aspects of both workplace design (open plan concept, acoustics) and green design (fresh air, daylighting). Gains in overall comfort from HQ1 to HQ2 were greater than gains in satisfaction with individual comfort variables. This finding may be expressed as a higher level of “forgiveness” of occupants in HQ2 compared to HQ1 (1.21 and 1.08 respectively). Forgiveness is a measure of the amount of tolerance for chronic faults, derived by comparing mean values for overall comfort with mean values for specific comfort variables (UBT, 2008). The value for forgiveness resulting from occupant responses in HQ2 ranked the building in the 95th percentile of benchmarked buildings, and suggests that occupants were willing to tolerate more discrepancies in comfort in HQ2 than in HQ1 for the benefits they perceived in the building overall.

*Health and wellbeing*

Respondents were asked whether they felt more or less healthy when in the building compared to their experience of using buildings in general. Overall, respondents felt more healthy (41 percent healthier on average) and rated their overall sense of wellbeing higher (24 percent improved on average) in HQ2 than in HQ1 (Figure 5). Reasons given included better air quality, improved physical health from use of the gym, improved moods from access to sunlight and the waterfall, and a general “feeling” that health and wellness are more of a priority in the new building. Occupants’ perceived health in HQ2 ranked the building in the 80th percentile of all benchmark dataset buildings. It is unclear whether, at the time of the HQ1 survey, staff anticipated that there would be substantial lay-offs occurring within the year. If so, this



**Figure 5.** Occupants’ perceived health and wellbeing in HQ1 and HQ2



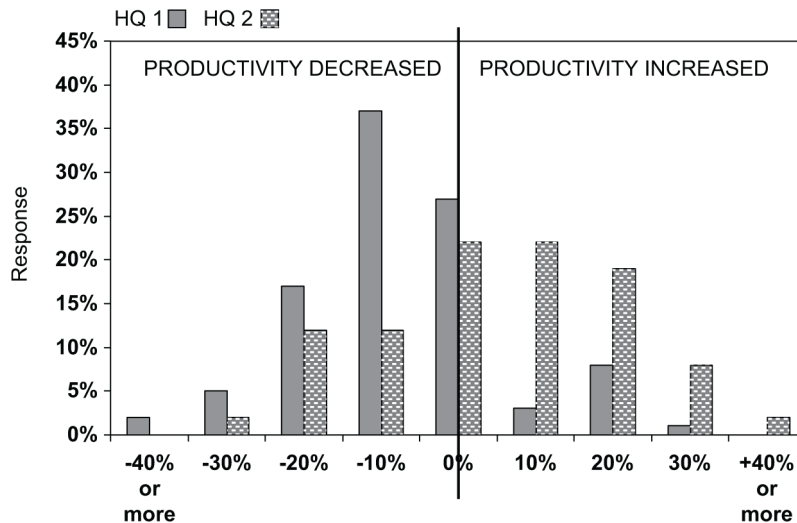
may also have contributed to the difference in sense of wellbeing between buildings. Thus, while reported improvements to health and wellbeing in HQ2 were in part a reaction to green design features and improved indoor environmental quality, confounding factors resulting from the move, including psychological impacts of staff layoffs, may also have influenced the post-occupancy findings.

#### *Perceived productivity*

Respondents were asked to estimate how their productivity at work was increased or decreased by the environmental conditions in the building, compared to their experience of using buildings in general[5]. Three quarters (73 percent) of respondents in HQ2 rated the building as having a neutral or positive effect on their productivity compared to 39 percent in HQ1 (Figure 6). On average, respondents felt their productivity increased by 5 percent due to environmental conditions in HQ2, representing a 12 percent gain in productivity from HQ1, where the average perceived affect on productivity was  $-7$  percent. Respondents attributed gains in productivity to indoor environmental conditions (natural light, clean air), tidiness of the workspace (in part due to the “Clean desk policy”), ease of access to colleagues, and improved ability to communicate and collaborate from the open plan concept. It is possible that the major loss of perhaps the less effective colleagues also had an impact on reported productivity.

#### *Workgroup size and personal control*

Results for perceived productivity gains in the open plan office of HQ2 are in contrast to Leaman and Bordass (1999) and others who argue that workplace productivity improves when workgroups are smaller and more integrated and individuals have personal control over their immediate environment as typically provided by cellular offices. Occupants in HQ2 reported sharing their office or workstation on average with “4 to 5 others”, which was significantly higher compared to HQ1 ( $p < 0.05$ ), and yet surprising given the open plan concept devoid of any noticeable subdivisions. This



**Figure 6.** Occupants' perceived productivity decrease and increase in HQ1 and HQ2

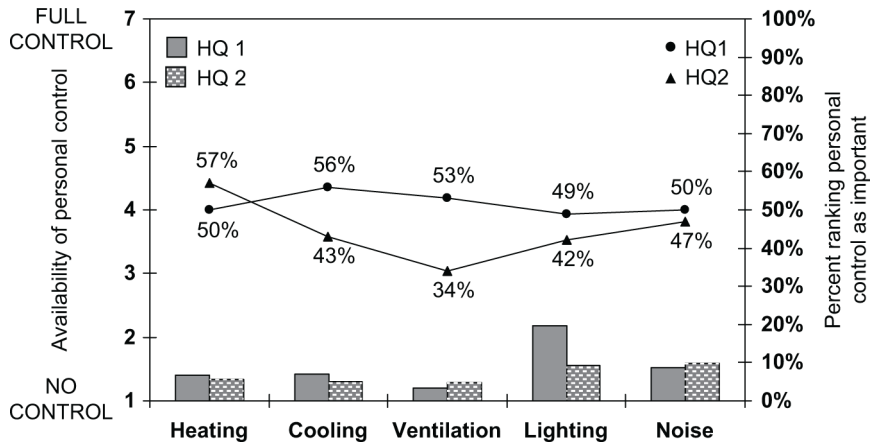
suggests that the company structure and organization, in terms of working group size (by department, brand etc.) and reporting hierarchy, shaped occupant perception of the extent of their workspace more so than the open plan office itself.

In contrast, the availability of personal control over indoor environmental variables was rated low in both HQ1 and HQ2 (average response “no control” to “low control”), ranking in the bottom 2-8 percent by variable of benchmarked buildings. The frequency with which occupants took an action to influence their immediate environment was also reportedly low in both buildings (average response “never” to “once/month”). This is not surprising given that in HQ1, lighting switches were one of the few forms of available personal control, while in HQ2 control over heating, cooling, lighting, ventilation and acoustics were all designed to be automated and programmed with no manual override except during non-peak hours.

Environmental control – and users’ perception of control – is thought to affect workers both in the physical/mechanical sense as well as the psychological sense through empowerment (Vischer, 2005). While half of the respondents in HQ1 rated personal control over indoor environmental quality as being important to them, this fraction declined in HQ2, particularly for those variables with which occupants’ satisfaction had improved, i.e. lighting, cooling and air quality (Figure 7). Leaman (2003) compares personal control to other design strategies for managing indoor environmental quality including “fit and forget” (systems operating in the background normally without intervention) and “make habitual” (policy, ethics and value systems that implement and internalize control). Findings suggest that the automation of control had, to a great extent, become habitual to occupants of HQ1 allowing for a relatively easy transition into the open plan office of HQ2 when coupled with policy and culture validating this approach. However, when indoor conditions caused discomfort (e.g. winter thermal comfort in HQ2), occupants would like to have been able to do something about it.

*Organizational culture*

Respondents were asked their opinions regarding how the organization’s implicit and explicit workplace “rules” guided their behaviour. There was no significant difference



**Figure 7.**  
Availability and importance of personal controls in HQ1 and HQ2

between the number of days and hours worked in HQ1 and HQ2 (average 4.7 days/week, 9 hours/day for both buildings), nor in the flexibility of arrival time at work (average response “somewhat to very flexible” for both buildings). Flexibility of dress code was rated significantly higher in HQ1 compared to HQ2 ( $p < 0.05$ ), possibly related to the open plan concept and sharing of workstation with more people in HQ2, including senior management. Overall levels of stress at work were the same across both buildings (average response “somewhat stressful”), and there was no significant difference between occupants’ level of attachment to the organization (average response “somewhat to very attached”). It is possible that offsetting effects relating to the staff layoffs and shift in organizational culture contributed to occupants’ responses. For example: the stress from moving to a new building and accommodating to the pressures of a reduced staff may have been offset by relief and validation of worth from personal retention in the company; and decline in attachment to the organization due to the constant shifting of culture and slogans may have been compensated for by the appreciation of features and amenities in the new building.

### **Attribution of performance improvements**

Performance improvements in HQ2 over HQ1 were documented in the areas of comfort, health, wellbeing and productivity. Results from the post-occupancy evaluation suggest that these were in part related to workplace design and organizational culture aspects (e.g. open plan concept, high interaction, transparent, egalitarian values, and a greater emphasis on health and wellbeing) and in part related to green building aspects (e.g. daylighting, views to outdoors, improved ventilation, biophillic features). However, a number of other influential factors may also have played a role, complicating the attribution of performance improvements. These included:

- (1) A high level of engagement of company managers in the building design, fit-out and handover, exemplified by:
  - an open plan concept trial set up on the 4th floor of HQ1 pre-move, intended to acclimatize staff to the anticipated workplace design of HQ2; and
  - a staged move in to the new building, requiring all staff to engage in learning sessions focussing on the workplace design and new office protocols.
- (2) A concerted effort by the company to convey the new organizational culture, in terms of values, beliefs and identity, through:
  - a tour guide script used to transition occupants into from HQ1 to HQ2 emphasized features such as the calming effect of the waterfall, wellness aspects of the fitness centre, a quiet room intended for moments of personal reflection, as well as considerations for wellbeing and safety embedded in design strategies throughout the building;
  - the building design expressing organizational culture through explicit means (e.g. signage incorporating the new slogan and words such as “comfort”, “green building”) and implicit means (e.g. high transparency, high interaction, people oriented); and
  - implementation and enforcement of new in-house policies such as the Clean Desk Policy, uniform background music and combined with white noise, and greater automation of control of indoor environmental quality.

- (3) Significant layoffs of up to 40 percent of the workforce shortly after moving to HQ2, impacting:
- perceived wellbeing and levels of stress, relating to the possible anticipation of layoffs pre-move and relief/validation of worth from retention in the organization post-move;
  - perceived productivity, relating to pressures associated with working with a reduced staff in HQ2 but potentially offset by the loss of perhaps less effective colleagues; and
  - perceived workplace cultural aspects, including level of attachment to the organization amidst layoffs and willingness to adopt new company values and slogans.

As Leaman and Bordass (1999, p. 5) suggest:

[...] buildings are complex systems made up of physical and human elements and their many associations, interactions, interfaces and feedbacks. Because of interdependencies, it is often fruitless to try and separate out different variables and treat them as 'independent'".

The realization of organizational benefits in HQ2, in terms of gains in occupant comfort, health, wellbeing and productivity, were related to the combined implementation of workplace design and green building design strategies. These strategies were deployed against the backdrop of a company highly committed to the successful transition into a new headquarter building and way of working, while at the same time faced with having to cut the workforce. The outcome was overwhelmingly positive for HQ2, but the lessons learned are difficult to extrapolate beyond the case study. More research is needed combining pre and post-occupancy evaluation with contextual and cultural analysis to better understand the relative contribution of influential factors.

### **Discussion**

This paper provides a demonstration of the complex nature of user experience in buildings, shaped in part by the characteristics and quality of the space, but also influenced by a host of other factors. Gains in occupant comfort, productivity, health and wellbeing documented in a company's move to a new headquarter building coincided with a shift in workplace design and culture and an emphasis on green building, suggesting that when these aspects work together in synergistic ways the benefits can be considerable. However, workplace design and green building strategies can also interact in antagonistic ways, compromising the potential building performance. Indoor environmental quality in green buildings has been known to cause occupant discomfort in key workplace attributes such as acoustics, lighting conditions and glare, leading to modifications to be made that clash with initial design intentions. Conversely, workplace design can compromise green building performance by failing to take into account the operation of environmental systems and access to control points when programming the use of space and arranging partitions, carpet and furniture. In addition, there are many other factors relating to organizational culture and context which may play a role, some of which have been addressed here, some of which need to be taken into consideration in future studies.

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The findings reported raise a number of important considerations for organizational and workspace research, and post-occupancy evaluation of green building:

- (1) How much of the performance improvements attributed to green building are actually green building related, versus those due to organizational culture/workplace design?
- (2) Are certain organizational culture/workplace models more suited to green building design than others?
- (3) What are the potential performance gains to be made from better integrating green building design with workplace design and organizational culture at the outset of design?
- (4) What kinds of demands will this integration place on owners, designers, facilities managers and users in future office buildings?
- (5) What changes are necessary in post-occupancy evaluation to explicitly take into consideration cultural and contextual factors?

This paper begins to articulate some of the key issues arising from the mainstreaming and merging of green building design with workplace design practice. It explores the role of organizational culture in shaping and design and operation decisions, and highlights the need for further research into realizing the combined opportunities from integrating green and workplace goals in the context of building design.

### Notes

1. The term “green building” is defined and interpreted in many different ways, primarily related to the range of performance issues addressed, but all green buildings typically strive for a reduction in resource use, reduction in emissions and waste, and the improvement of occupant comfort and health. The definition of green building used in this paper relates to the scope, emphasis and performance targets currently incorporated in voluntary green building rating systems such as Leadership in Energy and Environmental Design (LEED®).
2. For the purposes privacy, the company’s identity and several aspects of its organizational structure, culture and operations have been omitted in this paper.
3. Sample questions from the BUS occupant questionnaire (modified) are as follows:
  - (1) All things considered, how would you rate the building design overall?
  - (2) All things considered, how to you rate the overall comfort of the built environment?
  - (3) In the building as a whole, do the facilities meet your needs?
  - (4) Specifically, for the work that you carry out, how well do the facilities meet your needs? Please give examples of things which can hinder effective working?... and examples of things which usually work well?
  - (5) Please estimate how you think your productivity at work is decreased or increased by the environmental conditions in the building?(6) Do you feel more or less healthy when you are in the building?
  - (7) How would you describe your overall sense of wellbeing at work?... stress while at work?... level of personal attachment to this organization?
4. Throughout the results section, “benchmark dataset” and “benchmark buildings” refer to the 2008 BUS International Benchmark comprising 66 buildings from 16 different countries, the majority of which are new buildings and “green” designed.
5. Perceived productivity, asking occupants to self-assess their productivity at work, is one of many approaches used to evaluate the impact of the indoor environment on work output.

Perceived productivity, as defined in the BUS questionnaire, relies on the ability of respondents to compare their own building with “buildings in general”, which introduces a degree of bias into the results. Other more accurate measures of productivity include the use of performance metrics such as speed, accuracy and quality of work (where applicable), and the evaluation of absenteeism and churn.

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### Corresponding author

Zosia Brown can be contacted at: [zbrown@ires.ubc.ca](mailto:zbrown@ires.ubc.ca)