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Do green offices affect employee engagement and environmental attitudes?

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Employees working in 15 public- and private-sector office buildings in a mid-sized Canadian city reported their level of work engagement (as measured by job satisfaction, perceived productivity and affective organizational commitment), environmental orientation, pro-environmental behaviour and opinions about the physical aspects of their buildings. The buildings' green attributes were assessed on an objective 36-item scale. Neither engagement nor environmental attitudes were correlated with green design attributes. However, employees' office impressions were significantly *negatively* correlated with the number of green design attributes. Surprisingly, the results suggest that green design in office buildings does not have a positive effect on employee engagement or on environmental attitudes and behaviours.

Keywords: Employee engagement; green building design; satisfaction

Employee engagement is a strong indicator of an innovative and stimulating workplace. Engagement has been defined as 'a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption' (Schaufeli *et al.* 2002, p. 74). It is often measured by means of the Utrecht Work Engagement Scale (UWES) (Montgomery *et al.* 2003, Durán *et al.* 2004, Schaufeli and Bakker 2004). However, the physical environment of the work setting is not mentioned in any of the 17 items that make up the UWES.

The government of British Columbia developed the Workplace Environment Survey (WES) in 2006. Its results provide insight into how the performance and satisfaction of the public service might be improved. However, the WES contains only a small number of questions about the physical environment of ministry office buildings. Despite this, in a recent survey, 28% of public sector employees reported that changes to the physical environment of their workplace would boost future productivity (British Columbia Public Service 2007).

Several agencies are working to ascertain how attributes of green buildings, such as enhanced ventilation, acoustics and thermal controllability, affect occupants. In the United States, the Center for the Built Environment (CBE) seeks to improve the design, operation and environmental quality of building systems. Research at the CBE often links physical aspects of occupied space with human behaviours such as energy consumption and productivity. In Canada, the National Research Council's Institute for Research in Construction examines sustainable technology and design concepts to learn how to make buildings less resource intensive. Similarly, in the United Kingdom, an independent consultancy called Building Use Studies investigates how building characteristics affect occupant health, perceived comfort and control, and productivity.

Academic architectural literature also contains several studies that focus on one or more occupant outcomes in relation to building structure, operation or technology (e.g. Vischer 2008, Baird and Ooosterhoff 2010, Drake *et al.* 2010). In particular, one study asked whether green buildings were perceived as better by users (Leaman and Bordass 2007). Users tended to accept insufficiencies more in green buildings than in conventional buildings. Another study explored the relations between the amount of personal control occupants had over heating, cooling, ventilation, lighting and noise, and whether such control was considered to be important (Baird and Lechat 2009). Occupants perceived the amount of personal control they had over lighting as reasonable. However, perceived control over heating and cooling, ventilation and noise was relatively low. In addition, a post-occupancy evaluation of the Council House 2 building in Melbourne showed that indoor environment quality positively affected perceived satisfaction, healthiness and productivity of its occupants (Paevere and Brown 2008).

Despite these efforts, researchers do not seem to have considered how sustainable built settings affect the array of attitudes and behaviours that make up employee commitment, engagement and pro-environmental conduct. Therefore, an appropriate next step for this body of research is to explore employee engagement in workplaces with different physical characteristics, such as varying degrees

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of 'greenness'. This initial study examines whether green design attributes in office buildings are associated with employees' engagement attitudes and reported environmental behaviours.

The green workplace

Sustainable buildings maximize the use of natural and renewable resources in order to lower consumption of non-renewable energy and materials, and to decrease project and maintenance costs (Williams 2007). Leadership in Energy and Environmental Design (LEED) considers a building sustainable if it reduces waste and water use, increases reuse, recycling and energy-use monitoring through efficient appliances, fixtures and fittings (Canada Green Building Council 2009). Generally, LEED accredits commercial buildings based on performance in seven key areas: indoor environmental quality, regional priority, innovation in design, sustainable sites, water efficiency, energy and atmosphere and materials and resources (Canada Green Building Council 2009). The latter four of these areas are compatible with Williams' definition of sustainable design.

Healthy buildings are designed for occupant comfort and health. Although environmentally friendly materials and technologies may be integrated into a healthy building, non-renewable energy sources, such as fossil fuels, are typically used. Williams (2007) notes that if energy utilized in healthy designs is not sustainable, the building itself cannot be considered sustainable. In the present study, healthy buildings were defined as having contemporary daylighting and indoor air quality strategies, controllable thermal settings, non-toxic paint, low volatile organic compound carpeting and finishing materials, and employing strategies to reduce off-gassing and the growth of bacteria. Among LEED's seven areas of performance, the one that most closely represents healthy design is indoor environmental quality section. To receive credits in this area, a building must incorporate enhanced ventilation strategies and implement an indoor air quality management plan. Low-emitting materials, controllability of systems, thermal comfort and access to daylight and views are also requirements in this section (Canada Green Building Council 2009).

Despite the differences between the terms 'sustainable' and 'healthy', the word 'green' is often used to refer to both types of design attributes. LEED, the Canadian Mortgage and Housing Corporation (CMHC) and BOMA do not formally distinguish between these terms.

Why green design may influence employees' attitudes and behaviours

Work environments ought to reflect an organization's sense of identity to promote positive employee attitudes and performance through teamwork and collaboration (McCoy 2002). Decoration, allocation of space, signs, artwork and colour are a few design features that help communicate this

to employees (McCoy 2002). Design features that facilitate task accomplishment also bolster employee satisfaction, productivity and commitment (e.g. the size and quality of workspaces, meeting spaces and designated areas for joint activities). Attributes such as these are commonly built into green buildings. Other green design attributes, such as environmental controllability, recycling options and showers can communicate an organization's environmental orientation.

The literature on biophilic architecture in relation to occupants' cognitive and emotional functioning suggests that contact with natural forms can be healthy and restorative (Joye 2007). Studies on the aesthetic appeal of natural content show that, in particular, calm water features and vegetative attributes contribute to positively valenced reactions towards settings (Joye 2007). Given that green buildings often incorporate features intended to positively affect attention restoration and stress reduction in occupants (e.g. outdoor views, indoor vegetation, landscape artwork, architectural imitations of natural forms), and because organizations that operate in green buildings would seem to be communicating their regard for the environment to employees and others, we hypothesize that employees working in offices with more green design attributes will report greater work engagement (i.e. higher job satisfaction, perceived productivity and affective organizational commitment) than those working in offices with fewer green design attributes. We also hypothesized that mere exposure to a green workplace is associated with employee concern for the environment and pro-environmental behaviour.

However, whether working in a green building is associated with pro-environmental behaviour in its occupants is unknown. We are unaware of any empirical studies of this question. In the closest study we could locate, mere exposure to sustainable products increased altruistic behaviour in consumers (Mazar and Zhong 2010). Perhaps exposure to green design attributes in the workplace influences employees' engagement and behaviours in a similar manner.

Method

Participants

Seventy-seven adults (52 women and 25 men, $M = 40$ years) with varying education and job levels volunteered to participate. They were recruited by obtaining permission to circulate a questionnaire to employees by email in 15 urban office buildings. They had spent an average of 4 years working in their office building.

Materials

A questionnaire was provided to employees electronically. Job satisfaction was measured with an 18-item subscale from the Job Descriptive Index (JDI; Smith *et al.* 1969).

Participants were asked to choose one of three options ('yes,' 'no' or 'I don't know') to indicate whether a specific word described their job (e.g. 'routine', 'frustrating' or 'useful').

Perceived productivity was measured by asking whether employees considered their hours spent at work as productive (e.g. McGuire and Liro 1986) using a 5-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5). Other measurements of perceived productivity included asking participants to estimate how many productive hours they experienced in a typical work week, whether they felt their office environment allowed them to be as productive as they would like using a 5-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5) and whether any concerns had been voiced about the impact of the office environment on productivity ('yes' or 'no'). Space for open-ended elaboration on this question was provided.

Organizational commitment is the degree of psychological identification with, or attachment to, an organization and is related to job satisfaction and motivation (Schultz and Schultz 1998), and three types of organizational commitment have been proposed: affective, continuance and normative (Allen and Meyer 1987). Essentially, employees with strong affective organizational commitment remain working for an organization because they *want* to, whereas those with strong continuance organizational commitment remain because they feel they *need* to and employees with strong normative organizational commitment stay because they feel they *ought* to (Allen and Meyer 1990). Only the affective form of organizational commitment correlates positively with job satisfaction and pro-social behaviour (Porter *et al.* 1974). Thus, the Affective Commitment Scale (ACS; Allen and Meyer 1990) was used to assess employees' emotional attachment to, identification with and involvement in, an organization (Solinger *et al.* 2008). Responses were made on a 7-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (7).

The New Ecological Paradigm scale (NEP; Dunlap *et al.* 2000) was included to measure pro-environmental orientation. The NEP uses a 5-point scale ranging from 'strongly agree' (1) to 'strongly disagree' (5). In addition, participants were asked about their pro-environmental behaviour using the General Measure of Ecological Behaviour scale (GEB; Kaiser 1998), recently adapted by Gifford *et al.* (2009) for use in North America.

The authors created the General Office Opinion Scale (GOOS). Nine yes- or no-type questions were created to measure employees' opinions about the amount of general and personal space in their office, noise concealment from inside and outside the building, lighting conditions and whether they considered their office building as green.

Finally, participants reported their age, gender and highest level of education (e.g. 'bachelor's degree'; 'some post-bachelor degree', etc.). They also indicated the closest description of their job classification from a list of 4 (e.g.

executive (4), manager (3), supervisor (2) or staff (1), and the number of years spent working in the building.

The green attributes of the office buildings were assessed using a list of 18 sustainable and 18 healthy features gathered from LEED, Building Owner's and Manager's Association (BOMA) publications and literature on green design principles (e.g. Williams 2007). See Table 2.

Procedure

Seventeen office buildings were chosen for inclusion in an attempt to gather data from a wide range of green structures (i.e. newly constructed, marketed as a LEED building, no obvious green features, etc.); 15 agreed to participate. A facilities management staff member working in each building was contacted to enquire about the number of green design attributes in the building. Features were then counted by the contacted staff member (i.e. one point given for each attribute present). The nature of work carried out in participating buildings was largely administrative, occurring in the public and private sectors, as well as in an office-oriented portion of a hospital, and in several buildings on a university campus.

A non-probability sampling method was used in obtaining permission from a managerial representative in each building to circulate 20 electronic questionnaires per building to employees. Completion of the questionnaire was voluntary and implied informed consent; participants returned questionnaires by email or post. On average, five employees responded per building; the overall response rate was 26%.

Results

Descriptive statistics for all scales and demographic variables are displayed in Table 1. Each variable was tested for normality based on recommendations by Kline (1997). All variables met the criteria for skewness (values between $+3$ and -3) and kurtosis (values between $+8$ and -8). Reliability coefficients (Cronbach's α) were calculated for each scale. The 18-item subscale of the JDI had strong internal consistency, $\alpha = 0.82$. Similarly, the ACS and NEP scales were both quite reliable, $\alpha = 0.86$ and 0.80, respectively.

The seven-item GEB scale's reliability improved when two items were removed. If deleted, questions concerning the degree to which participants agreed with purchasing local produce, and the degree they agreed with keeping their home cool and putting on a sweater in the winter increased the scale's alpha level from 0.68 to 0.74. Thus, the GEB was treated as a five-item scale in all analyses.

The Perceived Productivity Scale (PPS) had low internal consistency, $\alpha = 0.50$. This was not entirely unexpected because it contained only five items; the PPS as a whole was not used in further analyses (two items were retained; see below).

Table 1. Instrument, instrument type, means and standard deviations of all variables.

Instrument	Type of instrument	M	SD
Number of sustainable attributes ranges from 0 to 18	Expert-rated scale	5.82	4.65
Number of healthy attributes ranges from 0 to 18	Expert-rated scale	11.77	4.35
GDAS (combined number of sustainable and healthy attributes, number ranges from 0 to 36)	Expert-rated scale	8.80	4.40
Job Description Index (JDI); Smith *et al.* (1969), ranges from 'no' (1), 'yes' (2) and 'I don't know' (0)	Self-report scale; 18 items (one subscale)	4.61	1.46
PPS (one item open-ended; one item based on McGuire and Liro (1986), where number of productive hours are reported; two items range from 'strongly agree' (1) to 'strongly disagree' (5), one item ranges from 1 = 'no', 2 = 'yes')	Self-report scale; 5 items	2.52	1.47
Affective Organizational Commitment Scale (ACS); Allen and Meyer (1987), ranges from 'strongly disagree' (0) to 'strongly agree' (7)	Self-report scale; 8 items	3.86	1.47
EES (combined using JDI, two items from the PPS and ACS)	Self-report scale; 28 items	3.66	0.86
New Environmental Paradigm (NEP; Dunlap *et al.* (2000), ranges from 'strongly disagree' (1) to 'strongly agree (5))	Self-report scale; 15 items	2.03	0.57
GEB scale (Kaiser 1998, adapted by Gifford *et al.* 2009, ranges from 'strongly disagree' (1) to 'strongly agree' (5))	Self-report scale; 7 items used (of 21 original)	2.46	0.97
GOOS (created for present study, range from 'no' (1), 'yes' (2) and 'I don't know' (0))	Self-report scale; 10 items	1.62	0.32
Year born		1969	12.58
Gender		1.68 (female)	0.47
Highest education level range from 'some secondary school' (1) to 'PhD or postdoctoral degree' (7)		4.53 (some post-bachelor degree)	1.28
Months worked in office		45.51	64.48
Job description (e.g. 'executive', 'manager', 'supervisor', 'staff')		3.29 (supervisor)	0.84

The nine questions on the GOOS somewhat reliably represented participants' overall impressions of their office building, $\alpha = 0.68$.

Affective organizational commitment in employees has been shown to positively relate to job performance (Meyer *et al.* 1989) and job satisfaction (Porter *et al.* 1974). Thus, we created an Employee Engagement Scale (EES) by combining the JDI subscale, the ACS and the two continuous items from the PPS. The reliability of this scale was excellent, $\alpha = 0.84$.

Given that the terms 'sustainable' and 'healthy' are often used synonymously, and the strong positive correlation found between these variables ($r(75) = 0.88$, $p < 0.01$), the two 18-item scales were merged to form a 36-item Green Design Attributes Scale (GDAS; $\alpha = 0.94$) (Table 2).

Hypothesis testing

When the number of green design attributes and scores on the EES were correlated, no significant positive correlation was found ($r = -0.07$, $p > 0.05$). In fact, no significant positive correlations were found between the GDAS and the EES's component scales, nor the NEP or GEB (r's ranged from 0.06 to -0.14, all p's>0.05). A *post-hoc* power

analysis revealed that 77 participants provides a power of 0.76 to detect a medium effect size ($r = 0.30$) (Cohen 1988). Thus, the study's design had an excellent chance to detect a medium effect size, if one exists.

However, a significant *negative* correlation occurred between the number of green design attributes and scores on the GOOS, $r(75) - 0.30$, $p < 0.01$, which is the reverse of the hypothesis. Thus, all relations between green design and work engagement and pro-environmental behaviour, across 15 buildings, were either null or negative.

What might be related to engagement?

Because the GOOS's reliability was not very strong ($\alpha = 0.68$), some of its items were likely more responsible for the negative association than others. Thus, correlations between each of its items and the number of green design features were computed. Only two significant correlations were found: One pertained to opinions about having enough access to a window, $r(75) = -0.31$, $p < 0.01$. The other concerned employee opinion about enough decoration and aesthetic appeal inside the office, $r(75) = -0.34$, $p < 0.01$. Thus, employee opinion about these aspects seemed largely responsible for the significant negative correlation between

Table 2. Green design attributes for building categorization.

Building type	Attribute
Sustainable	Emphasize energy efficiency and resource management
	Rely only on renewable energy and renewable materials, or materials that can be fully recycled or reused
	Have been certified under the sustainable sites, water efficiency, energy and atmosphere, or materials and resources sections within the LEED commercial interiors rating system
	Have a net zero energy flow (balanced imports and excesses)
	Deal with heat loss using ventilation and air tightness strategies
	Use solar photovoltaic (PV) electricity
	Reduce erosion, light pollution and construction-related pollution
	Achieve water reduction through efficient appliances, fixtures and fittings
	Monitor energy use
	Use sustainably grown, harvested, produced and transported products and materials
	Use low-flow showerheads and toilets
	Discourage development on previously undeveloped land
	Minimize impact on ecosystems and waterways
	Encourage regionally appropriate landscaping
	Control storm water runoff
	Use composite roofing
	Include solar shading where appropriate
	Use rainwater harvesting systems
Healthy	Emphasize occupant comfort
	Emphasize occupant health
	Provide access to views
	Provide access to natural daylight
	Improves acoustics
	Improves indoor air quality
	Have been certified under the indoor environmental quality section within the LEED commercial interiors rating system
	Continues to rely on some non-renewable resources
	Continues to produce some pollution
	Use non-reactive finishing materials
	Use low-emission finishing materials
	Operable windows
	High personal control within the space
	Showers for commuters
	Incorporate vegetation or water features into interior and/or exterior
	Effort to reduce off-gassing and growth of bacteria improve health of occupants
	Have recycling options for employees
	Effort to reduce growth of bacteria to improve health of occupants

their overall office opinions and the number of green design attributes in the office buildings.

Other results

Among the attitudinal and behavioural scales, several significant correlations were found. Responses on the ACS significantly correlated with the job satisfaction subscale of the JDI, $r(75) = 52$, $p < 0.01$. This supports Mathieu and Zajac's (1990) finding that job satisfaction and affective organizational commitment are positively associated. Also, responses on the NEP significantly correlated with responses on the EES, $r(75) = 0.24$, $p < 0.05$ and, not surprisingly, the GEB, $r(75) = 0.38$, $p < 0.01$.

Age positively correlated with responses on the GEB, $r(75) = 7$, $p < 0.05$. Also, a significant negative correlation occurred between job classification and responses on the NEP, $r(75) = -0.30$, $p < 0.01$. Finally, the number of

years employees spent working in their office negatively correlated with the number of green design attributes, $r(75) = -0.28$, $p < 0.05$.

Discussion

This study did not find the expected positive relations between green design attributes in office buildings and employee work engagement (i.e. job satisfaction, perceived productivity, affective organizational commitment), or attitudes and reported behaviours concerning the environment. In fact, across 15 buildings with varying numbers of green design attributes, employees tended to have significantly more *negative* impressions of their offices as the number of green attributes increased.

Particular complaints, such as not having enough access to a window and not being allowed to decorate or personalize work areas may have contributed to the negative

correlation. These are common complaints in workplace settings. For example, in their evaluation of the Ann Arbor Federal Building, Marans and Spreckelmeyer (1981) found similar associations between adequate window views, space for personalization and employee satisfaction. In a later study, Marans and Spreckelmeyer (1982) found that the architecture of a building influences employees' reactions with their immediate workspaces, as well as their feelings about the 'ambience of the agency within which they work' (p. 333).

Decision makers should take employees' feelings about view access and decoration space into account throughout the design process, even when green design attributes are being integrated. If employee concerns about their work environment are addressed before green design attributes are in place, such attributes may have a measurable effect on employee attitudes and behaviours at work.

The lack of positive associations may have occurred in the present study because the number of years employees had worked in their office building ($M = 4$ years) was negatively related to the number of green design attributes of a building. Time and novelty may have influenced whether employee attitudes and behaviours were affected by green design. Perhaps more than 4 years are necessary for employees to be positively affected by green design; perhaps the opposite was true and an average of 4 years was long enough for positive impressions to form, but then fade. This would be consistent with Fischer's (1997) statement that familiarity with an environment, along with values attributed to its features, help to define an individual's evaluation of a place.

Several other correlations of interest emerged. Employees with strong pro-environmental orientations on the NEP tended to perceive themselves as more engaged at work than those with weaker environmental orientations, and they reported higher job classifications. The former also reported engaging in more pro-environmental behaviour, and age positively correlated with more reported pro-environmental behaviour. These findings may be useful for understanding the behaviours and attitudes of those who strongly value the environment. We also confirmed Mathieu and Zajac's (1990) finding that affective organizational commitment significantly correlates with job satisfaction.

Some authors assert that factors such as autonomy, job enrichment and opportunities to use one's skills are associated with strong feelings of organizational commitment (Schultz and Schultz 1998). Had affective organizational commitment positively correlated with the number of green design attributes, the physical environment could be advanced as an additional factor to further develop models of organizational commitment. However, because this is an initial study with a small sample of respondents per building, further testing of an engagement scale that includes the construction of organizational commitment is necessary.

This study's results have implications for the manner in which the terms 'green', 'sustainable' and 'healthy' are used in the design literature. Agencies such as the Canada Mortgage and Housing Corporation, Building Owners and Managers Association and LEED use these terms interchangeably. Future work probably should not distinguish between these terms, and the marketing of buildings that contain both sustainable and healthy features ought to use the term 'green' to best convey the design's environmental goals and attributes. In addition, some green design attributes may be more important than others. The GDAS treats all 36 attributes equally, which may not be the best way to measure how green buildings are perceived. Future research is needed to determine whether its green design attributes vary in importance.

Although further reliability testing of the methodologies used is essential, this initial study has augmented knowledge of social design in terms of how green office buildings affect occupants' attitudes and behaviours. More comprehensive research is needed to investigate the generalizability of these findings in other work settings.

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