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Workspace satisfaction: The privacy-communication trade-off in open-plan offices

Jungsoo Kim*, Richard de Dear

Faculty of Architecture, Design and Planning, Wilkinson Building G04, The University of Sydney, NSW 2006, Australia

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ABSTRACT

Open-plan office layout is commonly assumed to facilitate communication and interaction between co-workers, promoting workplace satisfaction and team-work effectiveness. On the other hand, open-plan layouts are widely acknowledged to be more disruptive due to uncontrollable noise and loss of privacy. Based on the occupant survey database from Center for the Built Environment (CBE), empirical analyses indicated that occupants assessed Indoor Environmental Quality (IEQ) issues in different ways depending on the spatial configuration (classified by the degree of enclosure) of their workspace. Enclosed private offices clearly outperformed open-plan layouts in most aspects of IEQ, particularly in acoustics, privacy and the proxemics issues. Benefits of enhanced 'ease of interaction' were smaller than the penalties of increased noise level and decreased privacy resulting from open-plan office configuration.

1. Introduction

There exists a large body of literature looking at how physical environment influence occupants' perception and behaviour in office buildings. As office layout has transitioned in recent decades from conventional private (or cellular) spatial configuration to modern open-plan, the impacts on occupants and organisations have been extensively studied from a variety of perspectives in disciplines as diverse as architecture, engineering, health and psychology.

In addition to tangible economic benefits of open-plan offices such as increased net usable area, higher occupant density and ease of re-configuration (Duffy, 1992; Hedge, 1982), the open-plan office layout is believed by many to facilitate communication and interaction between co-workers by removing internal walls, which should improve individual work performance and organisational productivity (Brand & Smith, 2005; Kupritz, 2003). However there is not much empirical evidence to support these widespread beliefs (Kaarlela-Tuomaala, Helenius, Keskinen, & Hongisto, 2009; Smith-Jackson & Klein, 2009). On the contrary, a plethora of research papers identify negative impacts of open-plan office layout on occupants' perception of their office environment. For example, some longitudinal survey results have demonstrated a significant decline in workspace satisfaction (Sundstrom, Herbert, & Brown, 1982), increased distraction and loss of privacy (Kaarlela-Tuomaala et al., 2009), and perceived performance decrement (Brennan, Chugh, & Kline, 2002) after relocation of employees from enclosed workplace to open-plan or less-enclosed workplace. Moreover, the occupants in these studies didn't adapt or habituate to the change in spatial layout (Brand & Smith, 2005; Brennan et al., 2002; Virjonen, Keränen, Helenius, Hakala, & Hongisto, 2007), and many researcher draw the causal link between declining environmental satisfaction and deteriorating job satisfaction and productivity (Sundstrom, Town, Rice, Osborn, & Brill, 1994; Veitch, Charles, Farley, & Newsham, 2007; Wineman, 1982). Still other research studies attribute escalating Sick Building Syndrome (SBS) symptoms such as distress, irritation, fatigue, headache and concentration difficulties (Klitzman & Stellman, 1989; Pejtersen, Allermann, Kristensen, & Poulsen, 2006; Witterseh, Wyon, & Clausen, 2004) to open-plan office layout.

An extensive research literature consistently identifies noise and lack of privacy as the key sources of dissatisfaction in open-plan office layouts (Danielsson & Bodin, 2009; de Croon, Sluiter, Kuijer, & Frings-Dresen, 2005; Hedge, 1982). Firstly, studies based on either occupant surveys and laboratory experiment report that noise, in particular irrelevant but audible and intelligible speech from co-workers, disturbs and negatively affects individual performance on tasks requiring cognitive processing (Banbury & Berry, 2005; Haka et al., 2009; Smith-Jackson & Klein, 2009; Virjonen et al., 2007). The loss of productivity due to noise distraction estimated by self-rated waste of working time was doubled in open-plan offices compared to private offices, and the tasks requiring complex verbal process were more likely to be disturbed than relatively simple or routine tasks (Haapakangas, Helenius, Keekinen,

* Corresponding author. Tel.: +61 2 9351 5927.
E-mail address: jungsoo.kim@sydney.edu.au (J. Kim).

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& Hongisto, 2008). Also, Evans and Johnson (2000) argue that exposure to uncontrollable noise can be associated with fall in task motivation. Secondly, with a reduced degree of personal enclosure, open-plan layout often fails to isolate the occupants from unwanted sound (i.e. sound privacy) and unwanted observation (i.e. visual privacy), resulting in the overall feeling of loss of privacy and personal control over their workspace (Brand & Smith, 2005; Brill, Margulis, Konar, & BOSTI, 1985; Danielsson & Bodin, 2009; O'Neill & Carayon, 1993). Consequently, occupants experience excessive uncontrolled social contact and interruptions due to close proximity to others and perceived loss of privacy, known as overstimulation, which leads to occupants' overall negative reactions toward their office environment (Maher & von Hippel, 2005; Oldham, 1988).

Although that the absence of interior walls in open-plan office layout purportedly improves communication within teams and, in turn, enhances employee satisfaction, the presumption of improved workplace satisfaction is yet to be verified. Indeed, the disadvantages of open-plan offices dominate previous research outcomes. To date there has been no attempt at quantifying pros and cons of the open-plan office layout. Hedge (1982) opined that the improved social climate within open-planed offices was insufficient to offset the occupants' negative reactions to this spatial workplace configuration, but attached no empirical evidence to support this argument. Thus the primary objective of this paper is to weigh up the positive impact of the purported advantages of open-plan office (i.e. interaction between colleagues) against the negative impact of the disadvantages (i.e. noise and privacy) in relation to occupants' overall satisfaction with their workspace. This study also explores how occupants' attitude toward indoor environment changes between different office layouts categorized depending on the degree of personal enclosure. For example, an occupant located in a spacious private office would have different expectations or priority for Indoor Environmental Quality (IEQ) compared to an occupant located in a dense, open-plan office. To summarise, the research questions addressed in this paper are:

(1) Does occupant satisfaction with various IEQ factors change depending on different office layouts?
(2) Does the priority of various IEQ factors (i.e. relative importance for shaping occupants' overall workspace satisfaction) differ between occupant groups in different office layouts?
(3) Do the benefits such as easiness of interaction between co-workers offset the disadvantages such as distraction by noise and loss of privacy in the open-plan office layout?

2. Methods

2.1. Occupant survey database

Although the influence of the office environment on occupants has attracted inter-disciplinary research attention over recent decades, the literature remains incoherent and ambiguous. This is possibly the result of a failure on the part of researchers to agree on common or standardised instruments to measure occupant ratings of their work environment (Veitch et al., 2007). Therefore the empirical analysis in the present paper is based on an "industry standard" Post-Occupancy Evaluation (POE) database from CBE (Center for the Built Environment) at the University of California, Berkeley. CBE's occupant survey questionnaire is one of the most widely used POE tool at present and is also prescribed within the IEQ section of building rating systems such as LEED (USGBC, 2009) and in Australia, NABERS (2009).

CBE has conducted the occupant survey since 2000 and accumulated data from buildings with various occupancy types. It was developed as a web-based survey tool assessing the building occupants' satisfaction ratings for various IEQ aspects including thermal comfort, air quality, lighting, acoustics, office layout, office furnishings, cleanliness & maintenance, and overall workspace satisfaction (Brager & Baker, 2009; Zagreus, Huizenga, Arens, & Lehrer, 2004). The survey respondents express their satisfaction level with each questionnaire item on the seven-point scale ranging from '*very dissatisfied*'(coded as −3) through '*neutral*' (coded as 0) to '*very satisfied*' (coded as +3). Table 1 summarises the questionnaire items used in the analysis for this study. The database also contains information about survey participants' demographics and the building's characteristics such as design features, service systems, materials and other technical aspects. CBE's database contains POE responses from various types of buildings including offices, hospitals, schools, commercial, residential, industrial, etc. (Frontczak et al., 2012). Since this study focuses on the influence of different office layouts on occupant responses, our analysis is based on the office building subset (a total of 42,764 samples collected in 303 office buildings) of the entire CBE database. Survey respondents' personal characteristics such as gender, age (30 or under, 31-50, and over 50), and type of work (administrative support, technical, professional, and managerial) are described in Table 2.

CBE's questionnaire classifies the office layouts into five categories, depending on the level of personal enclosure: (1) Enclosed private office; (2) Enclosed shared office; (3) Cubicles with high partitions (about five or more feet high); (4) Cubicles with low partitions (lower than five feet high); and (5) Open office with no partitions or limited partitions. The number of survey samples within each office layout category is listed in Table 3. The CBE's POE database does not contain a specific description of architectural or functional characteristics, nor the number of people sharing. Danielsson and Bodins' (2008) definitions and descriptions of

Table 1
List of questionnaire items used for the analysis (from CBE occupant survey database).

IEQ dimensions	Survey questions
Thermal comfort	How satisfied are you with the ***temperature*** in your workspace?
Air quality	How satisfied are you with the ***air quality*** in your workspace (i.e. stuffy/stale air, cleanliness, odours)?
Lighting	How satisfied are you with the ***amount of light*** in your workspace? How satisfied are you with the ***visual comfort*** of the lighting (e.g., glare, reflections, contrast)?
Acoustic quality	How satisfied are you with the ***noise level*** in your workspace? How satisfied are you with the ***sound privacy*** in your workspace (ability to have conversations without your neighbours overhearing and vice versa)?
Office layout	How satisfied are you with the ***amount of space*** available for individual work and storage? How satisfied are you with the level of ***visual privacy***? How satisfied are you with ***ease of interaction*** with co-workers?
Office furnishings	How satisfied are you with the ***comfort of your office furnishings*** (chair, desk, computer, equipment, etc.)? How satisfied are you with your ***ability to adjust your furniture*** to meet your needs? How satisfied are you with the ***colours and textures*** of flooring, furniture and surface finishes?
Cleanliness & maintenance	How satisfied are you with ***general cleanliness*** of the overall building? How satisfied are you with ***cleaning service*** provided for your workspace? How satisfied are you with ***general maintenance*** of the building?
Overall satisfaction	All things considered, how satisfied are you with your ***personal workspace***?