Occupant psychological wellbeing and environmental satisfaction after an open-plan office redesign

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ABSTRACT

Open-plan office layouts are commonly used due to perceived economic benefits; however, studies have shown negative occupant wellbeing outcomes associated with this office type. A recent trend in open-plan office design is activity-based, or agile working, which has been associated with positive occupant outcomes. Open-plan offices can vary in features and design, and the present study explored how improving occupants' environment may affect their psychological wellbeing. This case study investigated changes in office workers' environmental satisfaction and psychological wellbeing outcomes after their agile working, open-plan office was redesigned. Environmental satisfaction of occupants increased significantly after the office redesign by 31%, and nine out of 11 environmental satisfaction items were rated significantly higher. After the redesign, occupants reported significantly less control over their job and support from colleagues, and significantly more often feeling anxious or depressed because of work. There were no significant changes in other aspects of psychological wellbeing measured (job demands, stress at work, job satisfaction, fatigue, job performance, life / work balance, and happiness at work). At the time of the post office design measures, there were some changes occurring in the office due to company expansion, which may have affected the results. This study suggests that increased environmental satisfaction alone, may be insufficient to improve employees' psychological wellbeing, and other factors, such as work demands and stressors, need to be considered.

KEYWORDS

wellbeing, environmental satisfaction, open-plan office, activity-based working, agile working

Introduction

Open-plan workplaces are a commonly used office layout, and are considered to have benefits, in terms of more flexibility for remodelling, and reduced occupancy costs (De Croon, Sluiter, Kuijer, & Frings-Dresen, 2005; Hedge, 1982; Vischer, 2008). Literature reviews of open-plan offices and occupant wellbeing have shown negative outcomes, such as reduced privacy and job satisfaction (De Croon et al., 2005), and a consistent adverse impact on employee health, wellbeing, and productivity (Richardson, 2017). Some office relocation studies examining individual change have found poor outcomes after employees have moved from private offices to open-plan offices, which persist over time (Bergström, Miller, & Horneij, 2015; Brennan, Chugh, & Kline, 2002).

Much of the office design and wellbeing literature is based on cross-sectional data, and fewer studies examine occupants' wellbeing outcomes pre and post office relocation or redesign. A limitation of this cross-sectional research is that differences other than office layout may affect

wellbeing outcomes. Another difficulty in comparing employee outcomes in studies, is that there is much variation in office environments (Hongisto, Haapakangas, Varjo, Helenius, & Koskela, 2016). In an open-plan office refurbishment study, Hongisto et al. (2016) found that increased environmental satisfaction could be linked to changes made, and supported by the physical measurements of the office. Occupants' satisfaction, perceived productivity, wellbeing and enjoyment at work increased in an office relocation study, after occupants moved from an older open-plan office, to one which was refurbished (Agha-Hossein, El-Jouzi, Elmualim, Ellis, & Williams, 2013). The latter studies suggest that it is possible to provide a more satisfactory experience for open-plan office workers.

A trend in modern office design is activity-based flexible offices, or agile working, where workers can choose different areas to work depending on their task, and are not given allocated desks (Wohlers & Hertel, 2017). A recent systematic review concluded that activity-based working may be beneficial for interaction, communication, environmental satisfaction, and personal control; however, it may be disadvantageous for concentration and privacy (Engelen et al., 2018). There is limited evidence at present for the effects of activity-based working on physical and mental health, and more research is required to evaluate the effects on occupants (Engelen et al., 2018). Previous research has found that control is important for environmental satisfaction (Lee & Brand, 2005), and giving occupants more choice and control by using agile working practices may remedy some of the reported negative effects of open-plan offices.

The present study investigated the impact of a high-quality office redesign on the environmental satisfaction and psychological wellbeing of employees in an agile working, open-plan office at a manufacturing company in the United Kingdom. The company wanted to redesign their office to improve employees' wellbeing and teamwork, and increase the aesthetic appeal for visiting clients. Employees in this office need to collaborate on projects frequently, and also do individual focused work. Their jobs are creative and technical, mainly consisting of computer work (e.g. Computer Assisted Design), with some 'hands-on' work (e.g. building prototypes). This company uses a 'hybrid' version of activity-based working, which involves the use of allocated workstations, and additional spaces that support different activities (Engelen et al., 2018), such as areas for focused work and informal meetings.

Method

Procedure

This study was conducted over a one year period. Measurement periods were: baseline (immediately prior to the office redesign), T1 (one month after office redesign), and T2 (nine months after office redesign). Ethical approval was granted by the School Research Ethics Committee (SREC) of the School of Psychology, Cardiff University.

The researcher visited the company and gave information sheets and consent forms to the participants. Signed consent forms were stored securely at Cardiff University. At each measurement, participants were sent a link to the online questionnaire, which they were allowed to complete during work time, or at home. An electronic debrief was included at the end of the online questionnaire.

Interviews were also conducted with a random sample of employees. This analysis will be published separately.

Participants

The participants were a relatively young, predominately male group of professional office workers (see Table 1).

Table 1. Participants at each measurement period.

Participants	N	Response Rate %	Female / Male %	Median Age
Questionnaire baseline	23	85	17 / 83	30 - 39
Questionnaire T1	25	85	21 / 79	30 - 39
Questionnaire T2	23	68	17 / 83	30 - 39
Pre-post group (baseline and T1)	19	-	21 / 79	30 - 39
Longitudinal group (baseline, T1 and T2)	12	-	17 / 83	30 - 39 / 40 - 49

Office redesign

The main office design changes were: new sit-stand desks, addition of plants, creation of some new work areas, and a change from a linear layout to a circular 'hub' layout (refer to Table 2). The hub layout was composed of desks arranged in circles, with occupants facing out of the circles, and a project table in the middle of each circle.

Table 2. Description of office design changes.

| Original Design (Baseline)	Redesign
Layout - linear desk arrangement	Layout - circular 'hubs' desk arrangement
Proximity - some people working on the same projects *not* seated next to each other	Proximity - people working on the same projects seated next to each other
Desks - large desks, no partitioning, some desks adjustable height (sit-stand)	Desks - smaller desks, partial partition surrounds, all desks adjustable height (sit-stand)
Storage – personal storage at workstation	Storage – personal periphery storage and shared storage in hubs
Areas for focused work - none	Area for focused work - library area added
No visual information about colleagues	Area to share information about colleagues, company and projects
Meeting areas - two	No change
Workshop area - one	Workshop areas - two
Entrances - one with doors, one open	Entrances - open doorway partially obscured to reduce noise and increase privacy
Plants - none	Plants - 13 large plants, 42 small plants
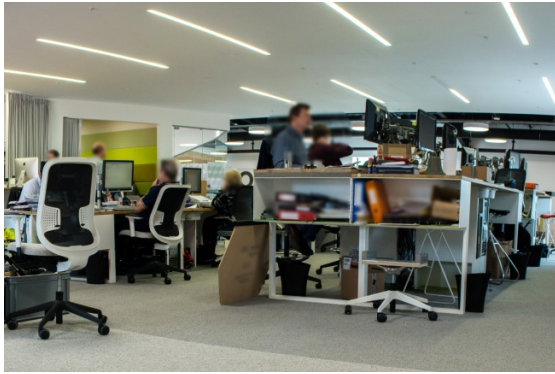
Figure 1a. Image of the office at baseline (pre redesign).

Figure 1b. Image of the office after the redesign.

Questionnaire

An online questionnaire included an 11 item environmental satisfaction scale, and a nine item wellbeing scale. Some of the environmental satisfaction items were from a previous questionnaire (Veitch, Charles, Farley, & Newsham, 2007), and the others were designed for this study through review of the literature. To measure wellbeing, nine questions were included from the Smith Wellbeing Questionnaire (SWELL; Smith & Smith, 2017). The SWELL uses a prompt 'Thinking about the last six months', which was excluded in this questionnaire, due to the timeframe of the measures.

Results

Pre-post sample

Nineteen participants completed both a baseline and a T1 (one month post office design) questionnaire. As illustrated in Figure 2, there was a 31% increase in environmental satisfaction mean ratings from baseline (M = 54.14, SD = 12.21) to T1 (M = 71.09, SD = 12.53). A Wilcoxon Signed Ranks Test indicated that environmental satisfaction was significantly higher at T1 (Mdn = 72.73) than at baseline (Mdn = 58.44), Z = -2.853, N - Ties = 18, p = .004. A dependent t-test showed a significant decrease in wellbeing from baseline (M = 62.22, SD = 10.73) to T1 (M = 56.73, SD = 10.50); t (18) = 2.676, p = .015.

All of the environmental satisfaction item mean ratings increased at T1, with nine items rated significantly higher (see Figure 3).

All of the wellbeing item mean ratings decreased at T1, apart from fatigue at work (refer to Figure 4). At T1, participants reported significantly less control over their job and support from colleagues, and significantly more often feeling anxious or depressed because of work. The other wellbeing item changes were not significant.
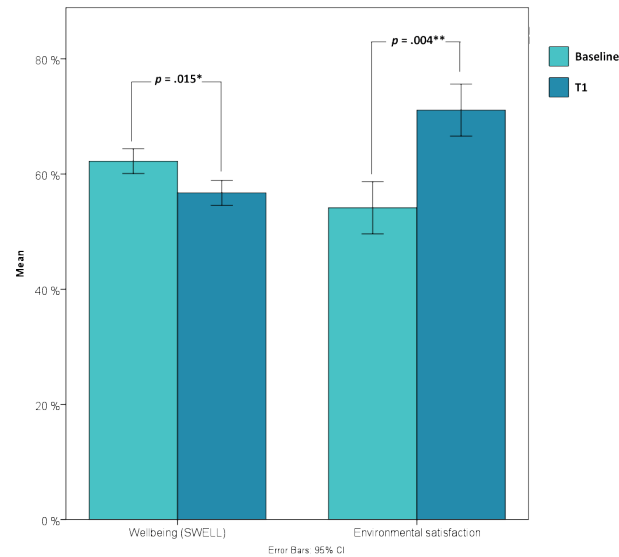
Figure 2. Mean wellbeing (SWELL) and environmental satisfaction percentages at baseline and T1 (one month post office design). * Significant difference (p < .05) ** Significant difference (p < .01)

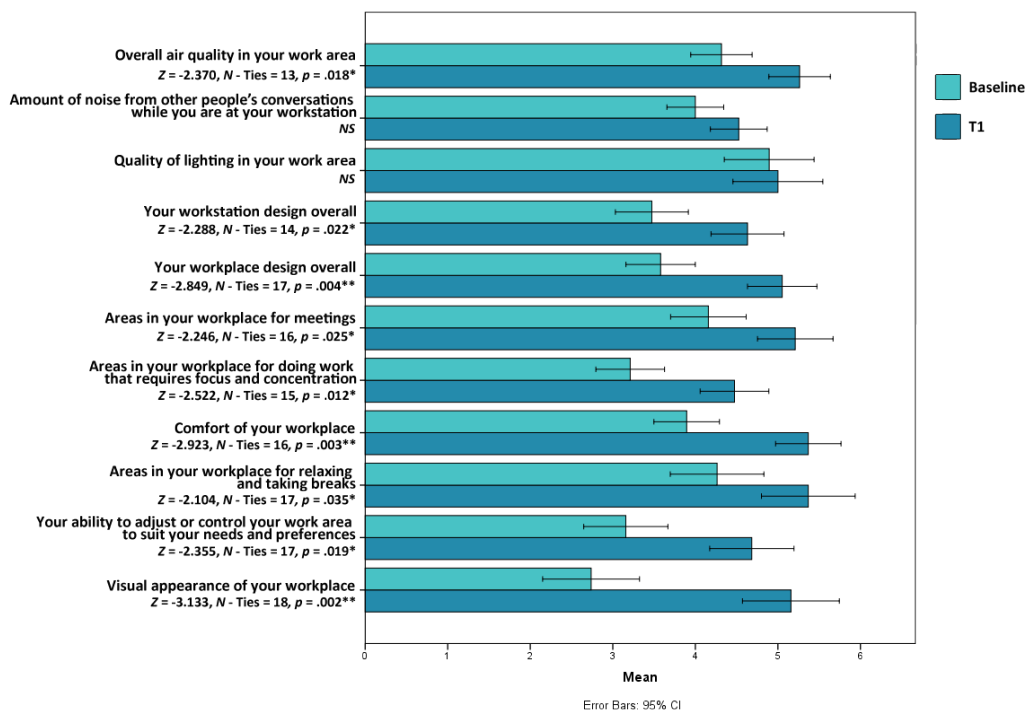Figure 3. Mean environmental satisfaction item scores at baseline and T1 in the pre-post sample (N = 19) on a 7 point Likert scale 1 - Very Unsatisfactory to 7 - Very Satisfactory. *Significant difference (p < .05) **Significant difference (p < .01)
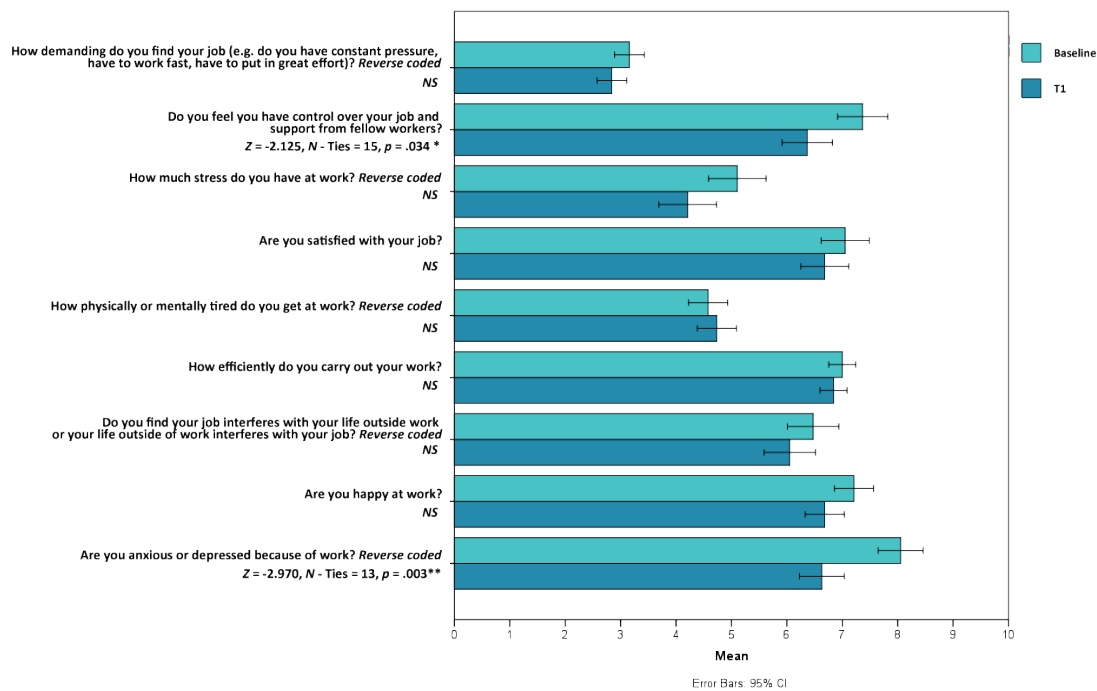
Figure 4. Mean Smith Wellbeing Questionnaire (SWELL) item scores at baseline and T1 in the pre-post sample ($N = 19$). [a] * Significant difference ($p < .05$) ** Significant difference ($p < .01$)

[a]On a scale from 0 to 10. In the SWELL questionnaire, high scores on some items indicated positive wellbeing, whereas others indicated negative wellbeing. The items which indicated negative wellbeing at higher scores were reverse coded in reporting the results.

Longitudinal sample

Twelve participants completed all three questionnaires. Table 3 shows the results for the longitudinal sample at baseline, T1 (one month post office design), and T2 (nine months post office design). A one-way repeated measures ANOVA was conducted with environmental satisfaction over the three time periods in the longitudinal sample. Environmental satisfaction showed a significant effect for time, $F = 9.30 (2, 22)$, $p = .001$, partial eta squared $= .46$. Post hoc tests using the Bonferroni correction revealed that the increase in environmental satisfaction from baseline to T1 was significantly different ($p = .008$), and the decrease from T2 to T3 was not statistically significant. T3 was significantly higher than baseline ($p = .036$). Wellbeing declined over the three time periods, but a Friedman test showed there was no significant effect for time, $\chi^2 = 2.478 (2)$, $p = .290$.

Table 3. Mean environmental satisfaction and wellbeing percentage scores in the longitudinal sample ($N = 12$).

Measure	Baseline	T1 (1 Month Post Office Design)	T2 (9 Months Post Office Design)		
	Mean	Mean	Mean	statistic	p
Environmental satisfaction	53.03 ($SD =$ 13.51)	71.43($SD =$ 9.56)	65.37 ($SD =$ 12.94)	$F = 9.30$ (2, 22)	.001**
Smith Wellbeing Questionnaire (SWELL)	62.31 ($SD =$ 13.12)	57.69 ($SD =$ 9.85)	53.89 ($SD =$ 15.13)	$\chi^2 = 2.478$ (2)	.290

** Significant difference ($p < .01$)

Discussion

It was anticipated that improving occupant satisfaction in an open-plan office environment would result in a parallel increase in self-rated psychological wellbeing. After a high-quality office redesign, employees were significantly more satisfied with their environment. In contrast to this result, some aspects of psychological wellbeing declined. Open-plan offices are generally linked with poorer wellbeing outcomes (De Croon et al., 2005; Richardson, 2017). Much of the wellbeing and office design literature uses comparisons between individuals, whereas this study compared changes within individuals. Measuring change in individuals results in a stronger design, as differences such as personality and job type are controlled. Previous studies have found that increased environmental satisfaction is associated with greater wellbeing outcomes, such as higher job satisfaction (Hongisto et al., 2016; Veitch et al., 2007), wellbeing and perceived productivity (Agha-Hossein et al., 2013). In an open-plan office refurbishment study examining individual changes, Hongisto et al. (2016) found that while environmental satisfaction and job satisfaction significantly increased within individuals, other psychosocial factor ratings, such as stress and social support, did not change significantly. Hongisto et al. (2016) attributed their participants' increased job satisfaction with the refurbishment change management. In the present study, there were no formal change management procedures in place, although occupants' opinions of the original office had been sought prior to the redesign, and some participants were involved in the redesign.

One explanation for the results, is that the difference in office design may not have been great enough to positively impact wellbeing. The original office design was of a high standard, and modern. The change in office design from baseline to T1 (one month post office design) may not have been as dramatic as a redesign in an older, low-quality office design; however, environmental satisfaction did increase in the pre-post comparison group by 31%. In a small longitudinal sample, higher environmental satisfaction was sustained over a period of eight months, indicating that the increase in environmental satisfaction was not a temporary effect. In one study investigating health and productivity in workers after extensive changes to an open-plan office (conversion to a paperless, activity-based office), it was found that there were limited or no changes to work-related fatigue, health changes and productivity, but some improvements in general health and upper extremity complaints in the long-term (Meijer, Frings-Dresen, & Sluiter, 2009). In view of the

limited changes in psychological wellbeing found in the present study and some previous studies (Hongisto et al., 2016; Meijer et al., 2009), one could speculate that office redesign and refurbishment may have a subtle impact on wellbeing.

An alternative explanation for the decline of some aspects of psychological wellbeing in this study, is that wellbeing may have been impacted by other factors, unrelated to the physical environment changes. Qualitative data from questionnaires and interviews (to be published separately) revealed that the decline in wellbeing could have been caused by some changes occurring in the company at T1. At T1, some new staff had joined the office, which may have increased work demands, as more senior employees had to spend time mentoring new employees, in addition to their existing workload. There were also some changes in management, which occurred from T1 to T2 (nine months post office design). These changes occurred due to rapid company expansion, which resulted in the need for additional employees, including management level staff. An unsettled period may have affected the employees' responses to the wellbeing items. At T1, employees' reported significantly less control over the job and support from fellow workers, and significantly more often feeling anxious or depressed because of work. The comments from the participants, paired with their responses to the Smith Wellbeing Questionnaire (SWELL) items, support the view that these changes may have counteracted a potential positive effect from a more satisfactory environment. Office redesigns may occur during periods of expansion and transition in companies, and care should be taken to identify, and minimise, any potential negative impacts on employees from office and company changes. In this study, a formal change management procedure, including more open communication during the period of transition, may have resulted in awareness of issues affecting employees' wellbeing that could have been resolved.

The office studied incorporates elements of activity-based working, and the occupants are encouraged to move around the office and choose where to work. Activity-based offices have been associated with increased environmental satisfaction (Engelen et al., 2018). The qualitative data indicated that occupants felt that physical activity in the office (sit-stand desks, working in different areas) was beneficial for physical and mental health, although some were not able to work away from their desk due to reliance on workstation Computer Assisted Design (CAD). Considering that employees reported that physical activity was beneficial for their wellbeing, office redesigns aimed at promoting wellbeing should ensure that the information technology (IT) supports working away from the desk practices.

There are some limitations of the study. The participants were a small group of office workers, with creative and technical jobs, that require collaboration and individual focused work. Office workers with other job types and needs may have different reactions to a redesign of this kind. Some of the participants were involved in the design of the office, so environmental satisfaction ratings could have been biased, although user involvement is considered good practice (Hongisto et al., 2016; Vischer, 2005). Management and personnel changes occurred during the study period, affecting the ability to draw conclusions about the effect of office design on wellbeing outcomes. The T1 measure took place one month after the redesign was complete, and employees may have been adjusting to the redesigned office, and also the introduction of new employees. To address this limitation, a further measurement at T2 was conducted, and the results were similar to T1. Both the pre-post group and the longitudinal group were small samples, and this may have affected the significance of the results that were obtained. Further research should be conducted using pre-post designs with larger samples.

This case study does not support the conclusion that an increase in office satisfaction after a redesign will result in individual improvements in psychological wellbeing. As this research was conducted in a field environment, rather than a lab environment, other influences likely had an effect on employees over the one year study period. Qualitative data collected suggested that employees' wellbeing may have been affected by company expansion and increased work demands. In order to have a positive impact on occupant psychological wellbeing, it is important to consider more than just the physical environment. Office design interventions aimed at improving employee wellbeing outcomes should seek to make changes in a holistic way, and address work demands and stressors concurrently.

Acknowledgements

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