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Differences in perception of noise and privacy in different office types

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Abstract

Differences between office types with regard to their architectural and functional features may have an impact on the employees' disturbance by noise and perception of privacy. These aspects may in its turn have an impact on employees' satisfaction and psychological responses to the office environment. In a study 469 employees in 26 different companies have rated their satisfaction with the office environment in the seven office types used in office design today. This paper discusses the results concerning the employees' perception of noise and privacy and put the results in relation to the two different aspects of privacy, visual and acoustic privacy, and the role of personal control. In the statistical analysis adjustments for potential confounders as age, gender, job rank and line of business were done, which are known confounders. Substantial differences between employees in different office-types were found. The fact that there were such differences between different types of offices that mean sharing of workspace and work facilities was a surprise. Architectural and functional features of the offices are discussed as the main exploratory factors for these results

Introduction

It is known that the physical environment has an influence on employees' general satisfaction with the physical work environment, which has an impact on health status and job satisfaction (e.g., Bodin Danielsson & Bodin, In press-b; BOSTI, 1981; Sundstrom, 1986b). The physical work environment interacts with the employee and acts as a physical stimulus by influencing the individual's awareness and behaviour (Davis, 1984). When a physical stimulus is perceived as a threat it is called "environmental stressor". Examples of environmental stressors in the office environment are: disorientation, environmental deprivation, crowding and noise et al. The two latter is of specific interest in the context of open plan office, due to its physical feature. Both noise and crowding are recognised as very important factors for environmental satisfaction (e.g., Bell, Greene, Fischer, & Baum, 2001et al.; Carlio & Gardner, 1992; Hedge, 1982) as well as job satisfaction among office employees (Evans & Johnson, 2000; Sundstrom, Town, Rice, Osborn, & Brill, 1994et al.). Crowding, is a perception and personally defined subjective feeling of having too many other people around (Gifford, 2002), compared to density which is an objective measure of spatial density (Hayduk, 1983). Crowding is known to have negative influence on different aspects of environmental satisfaction (see review by: Duval, Charles, & Veitch, 2002) and cooperativeness among colleagues (Freedman, Klevansky, & Ehrlich, 1971). Noise, on the other hand, is considered the major environmental stressor in shared work spaces (e.g., Evans & Johnson, 2000; Helenius, Keskinen, Haakangas, & Hongisto, 2007; Sundstrom et al., 1994), and very hard to control in open environments.

Open plan office (Bell et al., 2001), has become very popular in office design the last decades. There are several reasons for open plan office's grown popularity: 1) reduction of office space and cost decline, 2) more flexibility for organizational changes, 3) more efficient work flow and communication, 4) possibly enhancement of social facilitation and 5) supervision (Duval et al., 2002). Appr. 70% of office employees work in some sort of open plan offices (Brill, Weidemann, Alard, Olson, & Keable, 2001).

When environmental stressors are recognized they are handled by copying strategies (e.g., Cohen, Evans, Stokols, & Krantz, 1986; Lazarus, 1966). These may in turn give rise to physiological as well as psychological stress reactions. Example on stress reactions among office employees, according to Sundstrom (1986b) are: Arousal, Stress, Distraction and overload, and Fatigue.

Personal control is a fundamental component in all psychological coping strategies. There are however different means to achieve personal control. Control refers to autonomy and it can be achieved by different means psychological as well as physically in an office environment (Lee & Brand, 2005; O'Neill & Carayon, 1993; Rodin, Solomon, & Metcalf, 1978; Veitch, 1996). Intrusion in privacy means lost control at an individual level. Privacy theories mean that the main function of privacy is to maintain the individual's self-identity (Altman, 1976; Westin, 1967).

Crowding as well as noise are highly connected to the concept of *privacy* (Altman, 1975, 1976; Brown, 1987 et al.), and both factions are intrusions in privacy in different ways. Privacy can be defined as the regulation of interaction between the self and others and/or environmental stimuli (Kupritz, 1998) and due this it is of specific interest in open plan office design. There are two aspects to privacy: visual privacy and acoustic privacy (O'Neill & Carayon, 1993). *Visual privacy* at work refers to desired degree of visual isolation and the ability to not be disturbed by unwanted observation at the workstation (Sundstrom, 1986b). *Acoustic privacy* includes speech privacy as well as isolation from different types of noise such as office equipment, people walking by etc (Sundstrom, 1986a).

The purpose is to investigate the office type's influence on employees' perception of noise and privacy, with a special focus on different types of open plan office. The office type's influence on employees' perception of noise and privacy has not been investigated thoroughly in my opinion. Studies on occupants' satisfaction with different aspects of the physical environment have compared employees' experiences in traditional cell-office to those in open plan offices (e.g., Bell et al., 2001; Hedge, 1982; Oldham & Brass, 1979; O'Neill & Carayon, 1993), without any distinction between different open plan offices that exist in office design today. The term open plan office is very broad way, and ought to be used in a more distinctive manner in order to detect possible differences between employees' experiences and be able to design better open plan offices in

the future. This article also investigates which the part the concept of personal control as well as the two aspects of privacy, acoustic and visual privacy, may play in employees' experience of noise and privacy.

Method and procedure

This study of perception of noise and privacy between employees in different office types is part of a larger study with 491 office employees that deals with environmental satisfaction among office employees. For details on (For details see Bodin Danielsson & Bodin, In press-a).

Each participating office had either one or several of the seven office types that have been identified in office design today (Ahlin & Westlander, 1991; Duffy, 1999) was combined to achieve a more accurate definition of existing office types. The traditional open plan office has been divided into three sub-divisions based on group size of sharing workspace, due to its possible impact on employees.

The office types are defined by their *architectural features*, and *functional features*. The office types are:

1. The *cell-office*, a single person room office.
2. The *shared room office*[1], a room shared by 2-3 people.

Open plan offices: The open plan office is mainly defined by employees sharing a common workspace. The following definitions of the open plan office are used:

3. *Small open plan office* with 4-9 pers./room.
4. *Medium-sized open plan office* with 10-24 pers./room.
5. Large open plan office with more than 24 pers./room.

Office types with a more flexible design:

6. *The flex-office*, defined by the employees not having any personal workstations. It is the most flexible office type. Good access to back-up spaces for concentrated work, meetings etc. It is dimensioned for <70% of the workforce to be in office at the same time. The employees are able to work from home in the flex-office.[2]
7. The *combi-office*[3] has no strict spatial definition; instead it is the teamwork and the sharing of common facilities that defines it. Good access to back-up spaces for teamwork, meetings etc. Work within the office takes place >25% of the time at other places than the personal workstation on an "as-needed basis".

To measure the perception of the physical environment and architectural design of the office a combination of two questionnaires was used: 1) BIU (Building-In-Use) Assessment (Vischer, 1996) and 2) The interplay between group organization and interior design (Söderberg, 1993). Here only items concerning noise and privacy will be presented.

Noise as well as Privacy was measured by three items each. The scales that had four or five categories were dichotomized before the analyses. Office type was treated as main exploratory factor with seven categories. Cell-office was chosen as reference category against which the other office types were compared. Other factors included in the multivariate analysis were: age, gender, job rank, and line of business, for which the outcomes were adjusted. The main explanatory variable for the analysis was office type, for details see (Danielsson, 2005). The outcome parameter in the logistic regression is the odds ratio (OR). The processing of statistical data and the estimation of the regression models were done with STATA (Vers. 9) and Statistix (Vers. 8).

Results

There were substantial differences between employees' perception of noise and privacy in different office types. In terms of *noise* cell-office employees were most satisfied; there was a significant difference compared with the other office types. There was however also a great internal difference between the different office types that means sharing of workspace and work facilities in different ways. Most satisfied within this group were those in flex-offices and least satisfied were those in large open plan offices, see Table 1.[4] After adjustment for the confounders there were significant risks for dissatisfaction, see Table 3.[5] When it comes to *privacy* a somewhat different picture appeared. Cell-office employees and those in flex-office were almost equally not disturbed by being observed (visual privacy), see Table 1. When it came to trouble by being overheard (acoustic privacy) it was once again those in cell-office that reported least dissatisfaction followed by those in flex-office, see Table 1. Most dissatisfaction on both items was reported in traditional open plan offices. The reported disturbance with acoustic and visual privacy is interesting with regard to its relation to the item "No possibility for seclusion within workspace." Despite the fact a great majority of those in flex-office report no possibility for seclusion, employees in this office type report little problem with being overheard or being observed.

[1] Ahlin's and Westlander's (1991) definition for a room shared by more than one person. Original definition is Swedish is "delat flerpersonsrum" (room shared by several people).
[2] In this study the employees had to be at the "home office" at least 75% of their working hours, since it was this office environment that was evaluated in the study.
[3] The traditonal combi-office was introduced as a combination of cell-office and open plan office where the individual rooms had windows giving into the common "multi space". Most of the office facilities were found in this multi space. Today, there is not a strict special definition of combi-office; in some combi-offices the employees have individual rooms in others they have an individual workstation in an open plan office layout.

[4] The numbering of the tables is based on their original numbering in the source.
[5] Ibid.

Table 1. Proportions of self-reported complaints and dissatisfaction with Ambient factors, Noise and Privacy and Design-related factors for 469 employees. The smallest proportion for each outcome is underlined and the highest proportion is in bold. A univariate test of the effect of office-type is shown with all p <0.05 in bold.

Outcome (Complaints about or less satisfied with)	Cell-office (n=131)	Shared-room (n=26)	Small open plan office (n=43)	Medium-sized plan office (n=56)	Large open plan office (n=75)	Flex-office (n=81)	Combi-office (n=57)	**All Office types** (n=469)	***p*-value for office-type** (univariate)
Noise and Privacy									
Noise									
Disturbed by background noise	16%	35%	30%	29%	**47%**	27%	40%	30%	**<0.001**
Disturbed by voices, office equipment etc.	12%	42%	40%	45%	**50%**	37%	39%	34%	**<0.001**
Lack of acoustic privacy for conversation	8%	77%	77%	86%	**86%**	79%	84%	62%	**<0.001**
Privacy									
No possibility for seclusion within Workspace	19%	88%	98%	96%	**99%**	91%	86%	73%	**<0.001**
Troubled by being overheard	5%	42%	44%	43%	**50%**	22%	32%	29%	**<0.001**
Troubled by being observed	8%	23%	30%	**32%**	20%	10%	23%	18%	**0.001**

Source: Bodin Danielsson & Bodin (In press-a)

Table 3. Odds Ratios (OR) from multivariate analysis of complaints and dissatisfaction for Ambient factors, Noise and Privacy and Design related factors for 469 employees. Logistic regression models with office-type as the explanatory variable and age, gender, job rank, market division and job satisfaction as additional covariates. Reference category is cell-office. 95 % confidence intervals for the OR are shown in brackets. p-value for the hypothesis of no effect of office type is given in the rightmost column. Low and high OR statistically significant different from 1.0 and tests showing statistical significance (5% level) are in bold.

Outcome (Complaints about or less satisfied with)	Cell-office (n=131)	Shared-room (n=26)	Small open plan office (n=43)	Medium-sized plan office (n=56)	Large open plan office (n=75)	Flex-office (n=81)	Combi-office (n=57)	Multivariate test of the effect of office-type
Noise and Privacy								
Noise								
Disturbed by background noise	1.0 (ref.)	3.0 (1.0-9.1)	**3.1 (1.3-7.2)**	**2.7 (1.4-5.3)**	**7.8 (3.0-20.1)**	**2.3 (1.2-4.5)**	**4.9 (2.2-10.8)**	**<0.001**
Disturbed by voices, office equipment etc.	1.0 (ref.)	**5.7 (2.6-12.3)**	**6.2 (2.6-14.6)**	**7.5 (3.9-14.2)**	**10.9 (5.7-20.6)**	**4.7 (2.8-8.1)**	**5.7 (3.1-10.7)**	**<0.001**
Lack of acoustic privacy for conversation	1.0 (ref.)	**40.9 (7.5-222.8)**	**47.3 (14.3-156.2)**	**79.2 (31.7-198.1)**	**100.6 (31.5-321.0)**	**46.0 (20.6-102.7)**	**74.2 (26.8-205.0)**	**<0.001**
Privacy								
No possibility for seclusion within Workspace	1.0 (ref.)	**28.2 (3.0-263.0)**	**220.1 (40.9-1185)**	**113.7 (21.8-593.0)**	**333.2 (36.6-3031)**	**59.9 (15.4-232.7)**	**24.6 (5.2-116.4)**	**<0.001**
Troubled by being overheard	1.0 (ref.)	**15.2 (3.9-58.3)**	**15.2 (6.6-35.1)**	**14.0 (7.2-27.2)**	**19.8 (9.5-41.3)**	**5.1 (2.1-12.2)**	**9.2 (4.1-20.9)**	**<0.001**
Troubled by being observed	1.0 (ref.)	**2.9 (1.0-8.0)**	**4.1 (1.3-12.9)**	**4.5 (2.4-8.3)**	**2.7 (1.2-6.3)**	1.0 (0.4-2.2)	**3.1 (1.3-7.4)**	**0.006**

Source: Table 3 in Danielsson (2005, Study III p. 25)

Conclusion and discussion

The fact that cell-office employees would report most satisfaction with the noise and privacy aspect of the physical office environment was not surprising. Cell-office is the office type that offers the best acoustic and visual privacy of all office types due to its architectural and functional features. Thus environmental stressors like noise and lack of privacy will occur more often in offices where workspace and facilities are shared. The great internal differences between employees' perception of noise and privacy in different office types with an open plan layout were a surprise. This is most likely explained by the differences in architectural and functional features between these office types that at a first glance might appear to be the same.

The office type that stood out by its good results within this group was flex-office, especially in terms of privacy. The good results in terms of privacy is probably explained by the fact that this office type offers the employees almost as good opportunity to excess personal control as cell-office does,

however by different means. In a cell-office having a personal room offers great personal control, in the flex-office you excess personal control by its extreme flexibility in architectural and functional features. It is possible to work from home when it when it is suitable. At the office you can choose whom to sit next to for the day, to work in a room for concentrated work/phone calls when necessary or in a project room with colleagues. The traditional open plan offices don't offer this ability to excess personal control by choice like flex-office does and it is probably the explanation for their less good results.

Noise is harder to control for in an open plan layout than privacy with the physical features and there were also greater reports on disturbance on noise in these offices types. The fact that flex-office employees better results in terms of is in line with Duval and colleagues' theory (2002) that the perception of crowding and privacy has a mediating effect on negative stimuli such as noise. The results show that it is the same office types that report most problems and privacy. The fact that most problem with noise was reported in large open plan office (>24 person/room), followed by those in medium-sized open plan offices (10-24 people/room) was not surprising, since a) the more people there is in a room the more noise it will be and b) none of these office types offer the employees good ability to excess personal control by their functional or architectural features. The other office types hold either smaller groups of people, offer back-up rooms or more flexible work ways, which gives the employee different options of how to deal with privacy and noise issues.

To conclude, the results show that it is not useful to discuss open plan office the way it is done today since there are different architectural and functional features that differentiate these office types, which leads to different working conditions. When discussing the results of this study it is interesting to compare them with a study that investigated health status and job satisfaction among employees in different office types. In that study it was the same office types that stood out as good as well as bad (Bodin Danielsson & Bodin, In press-b). This fact reinforces the hypothesis that the architectural and functional differences between the different types are of great importance.

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