OFFICE LAYOUT AND WORKSPACE ENCLOSURE AS MEDIATORS TO WORKERS' PRIVACY AND COMMUNICATION AFFECTING PRODUCTIVITY

生産性に影響する就業者のプライバシーとコミュニケーションに対する媒介としての
オフィスレイアウト及びワークスペースの囲み

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This study is part of a complex research on current Japanese office environments. Based on qualitative and quantitative data from group interviews and questionnaires, 'free-layout' and seating positions in 'isle-type' layout, as well as levels of workspace enclosures were defined and then cross-tabulated by the following psychophysical environmental characteristics: visual- and acoustical privacy (noise issues) and ease of communication. Layout differences did not have strong effects on privacy and noise issues, but affected intersectional communication. Seating positions affected workers' visual and acoustical privacy, as well as communication. Enclosure levels had the strongest mediating effects on privacy and communication. Communication and visual privacy showed significant positive correlations with different facets of productivities. Noise and lack of privacy were pointed out as most serious issues.

Keywords: office layout, seating positions, workspace enclosure, privacy, communication, productivity

キーワード: オフィスレイアウト、座席位置、ワークスペースの囲み、プライバシー、コミュニケーション、生産性

1. Research Objectives

This study is part of a broad scale, complex research on office environments. Figure 1 shows the hypothesized holistic model that was set up to describe the relationship between physical characteristics of the workplace, workers perception, and their job and environmental satisfaction, all possibly affecting productivity.

The main purpose of this study is to investigate workers' visual and acoustical privacy, as well as ease of communication, which are suggested to be mediated by the office layout, seating positions and individual workspace enclosures. It is hypothesized that noise has an avert effect on workers' performance, while privacy and ease of communication enhances productivity. It is also hypothesized that layout and enclosure affect ease of communication; and the latter one also affects workers' visual and acoustical privacy.

This study does not deal with objectively measured physical issues; rather, it approaches from subjective questioning and self-reporting of workers, using generally categorized models. Thus, the results are solely based on users' perception of the physical and psychophysical environment.

2. Background of the Study

2.1. The Physical Characteristics of Offices

Brennan et al. (2002)¹⁾ describe the work environment as a system consisting of physical (workspace, corridors for movement, etc.), social

Figure 1. Research model (Shaded areas indicate limitations of discussions, and solid lines indicate hypothesized relationships in this paper)

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(like team member relations), and psychosocial factors (communication, privacy and environmental control)³⁾. Physical features of the work environment contribute to the overall organizational climate of the workplace (Kupritz, 2000)²⁾. It is also known, that workplace design can enhance or inhibit individual, group and organizational effectiveness (Brill et al., 1984)³⁾.

Brill et al. (2001)⁴⁾ defines 'open office' as "a workspace^{b)} whose perimeter boundaries do *not* go to the ceiling". Open offices can vary according to their layout from the most open and simple "bull pen" in which the desks are arranged in strict rows to "landscape offices"^{c)} that integrate "systems furniture"^{d)} and partitions of different sides and heights.

Research on *open offices* and workers' behavior has showed quite mixed findings: among positive outcomes, Zahn (1991)⁵⁾, Oldham et al. (1979)⁶⁾, Ellis et al. (1980)⁷⁾, and Boyce (1974)⁸⁾ all found increased communication among coworkers, while Brookes et al. (1972)⁹⁾ reported more group sociability. Zeitlin's (1969)¹⁰⁾ research findings indicated overall satisfaction with the landscaped office, even though it was implied that job performance and satisfaction cannot be facilitated by the office layout.

On the other side, negative findings have been more numerous. They include decreased performance and environmental dissatisfaction among workers (Oldham et al., 1979⁶⁾, Hedge, 1982¹¹⁾, and Canter, 1972¹²⁾, lower levels of psychological privacy (Brookes et al., 1972⁹⁾ and Hedge, 1982¹¹⁾, and disturbance (Canter, 1972¹²⁾, Ellis et al., 1980⁷⁾, Brookes et al., 1972⁹⁾ and Hedge, 1982¹¹⁾. Brennan et al. (2002)¹⁾ found that open office design may reduce communication since it prohibits confidential conversations, while Oldham et al. (1979)⁶⁾ and Boyce (1974)⁸⁾ found open-plan offices noisy and distracting. Sundstrom (1978)¹³⁾ found that social contact in open offices can exceed an optimum level, causing the worker to feel crowded. Rader et al. (1981)¹⁴⁾ suggested a non-empirical relationship between factors in the office setting initiated by the open plan, and issues of stress and low productivity.

Brill et al. (1984)³⁾ refers *enclosure* as "the nature and configuration of the physical barriers that separate a workspace from other areas in the office." Enclosure (or the opposite: openness) has been measured as a function of design characteristics, such as number of partitions surrounding the workspace, and height of partitions. Thus, open office has many variations according to the number of partitions, openness, and architectural accessibility (Oldham, 1988¹⁵⁾, and Oldham et al., 1983¹⁶⁾). Brill et al. (1984)³⁾ examined workers' reactions to the height of partitions and defined three levels of enclosure: low panels, high panels and walls. They found a positive relationship between partition height and increased privacy, communication and job performance. It was also found that the number of partitions enclosing the space can mediate the effects of partition heights. Sundstrom et al. (1980)¹⁷⁾ reported that privacy, satisfaction with workspace and performance increase with the number of partitions. O'Neill (1994)¹⁸⁾ also found a positive relationship between the number of partitions and enhanced reactions. Akiyama et al. (1995)¹⁹⁾ reported that work area satisfaction does not merely depend on physical factors, but also determined by workers' interactions in a group.

The Japanese equivalent of the bullpen is the 'isle-type' layout^{e)}, which is mostly used in the offices. It is believed that open layouts generally facilitate greater communication, which in turn, facilitates

greater productivity (Boje, 1971²⁰⁾, Pile, 1978²¹⁾): the isle-type layout with no or low partitions is believed to enhance communication by allowing constant eye contacts.

Free layout^{f)} on the other hand usually encompasses more / higher partitions, thus believed to provide private spaces with more privacy.

2.2. Psychophysical Factors in Offices

Workers in open offices work in physical proximity to others with some, or no physical boundaries (Brennan et al., 2002)¹⁾. These physical characteristics of the office are said to affect workers' privacy and interpersonal communication.

Privacy in the work environment generally refers to the ability to regulate the flow of information and social contact, both incoming and outgoing (Sundstrom, 1986)²²⁾. Privacy, a common characteristic of self-protection, can be real or perceived and can be achieved through physical or social innovation (Kupritz, 1998)²³⁾. There are different types of privacies, such as 'speech or conversational privacy'^{g)}, 'acoustical privacy'^{h)}, and 'visual privacy'ⁱ⁾. The visual and acoustical isolation supplied by the physical design of an environment typically is called 'architectural privacy' (Kupritz, 2003)²⁴⁾. Research shows that employees associate psychological privacy with architectural privacy (Sundstrom et al. 1980)¹⁷⁾. Thus, perceived privacy is correlated with actual physical enclosure (Sundstrom et al., 1982)²⁵⁾. Kupritz (1998)²³⁾ found that visual and acoustical distractions, consequences of lack of privacy can decrease workers' productivity and increase errors. Sundstrom et al. (1980)¹⁷⁾ also found a positive correlation between privacy and performance. In Brennan et al.'s (2002)¹⁾ survey of open offices the primary complaints by workers were lack of privacy and confidentiality, and increased noise. Akiyama et al. (1996)²⁶⁾ found that privacy and communication were not merely determined by the office's physical properties, but also depended on the activities performed there.

Noise, refers to unwanted or irrelevant sound (Landy et al., 1980)²⁷⁾. Office workers hear sounds from many sources, like office machines, phones ringing, people talking, etc. Such sounds become noise to those who prefer not to hear them (Brill et al., 1984)³⁾; thus, people talking may be important source of information to some, but considered noise by others. In the 1978 Steelcase survey (Harris, et al., 1978)²⁸⁾, office workers identified "the ability to concentrate without noise and other distractions", as the most important of 16 features of the office environment. In Brill et al.'s (2001)⁴⁾ survey, the "ability to do distraction-free solo work" was also No.1. among 10 factors. Noise is a potentially serious problem for office workers, because its adverse effects of job related stress (Kahn et al., 1992)²⁹⁾. Boyce (1974)⁸⁾ found that more than half of the workers in open plan offices were disturbed by noise, and 55% of the noise came from people talking. Nemecek et al. (1973)³⁰⁾ also reported that more than a third of workers complained of noise, particularly conversations among co-workers. Miura et al. (2001)³¹⁾ found positive correlations between indoor noise and area of space. However, Sundstrom et al. (1994)³²⁾ did not find any relationship between noise and performance. Despite noise has been shown to affect physiological processes, Takahashi et al. (2001)³³⁾ pointed out that exposure to mild noise in office environments had not been well studied or documented.

While most of the 'noise' comes from people talking, adequate *communication* is a must to accomplish the goals of an organization. It is one of the major factors related to interpersonal relationships

influenced by the furniture and office layout (Ha et al., 2002)³⁴⁾. The transfer of information can occur through many different channels, such as face-to-face, telephone, e-mail, etc. According to Brill et al. (1984)³⁾, many of today's experiments to increase productivity use enhanced communication as their method (Quality Circles) or as they product (electronic mail). In BOSTI's³⁾ newest survey (Brill et al., 2001)⁴⁾, it was reported that 87% of the workers learned the most through informal interactions (as opposed to formal meetings), however, 58% of workers in open offices did not learn anything from unwittingly overhearing others' conversations.

3. Methods of the Study

3.1. Group Interviews

A comprehensive question sheet addressed questions about individual workspaces, communication, privacy, and environmental satisfaction, etc. 19 group interviews of office workers were carried out at 17 different large Japanese companies with 42 workers (33 men and 9 women). Pictures were taken (a total of 1077) and floor plans were collected of almost all the offices³⁾. Part of the findings of the interviews are discussed in this study.

3.2. Questionnaire Survey

Our questionnaire consisted of 74 questions which covered the overall research model in Figure 1. Table 1 shows the overall structure of the questionnaire and the limitations of this paper.

CATEGORIES	SUBCATEGORIES	NO. OF QUESTIONS *
Demographical characteristics	Personal	3(2)
	Job description	4(1)
	Others	5
Quality of life		1
Characteristics of work itself		2
Ambient work characteristics		6
Job satisfaction		1
Characteristics of physical workspace	Layout	2(1)
	Enclosure	5
	Others	5
Psychophysical ambient-environmental characteristics	Privacy	7(5)
	Communication	7(6)
	Noise	5
	Others	4
Satisfaction with work environment		2(1)
Characteristics of secondary spaces		6
Productivity / work performance	Overall productivity	2
	Facets of productivity	6(4)
Free writing		1
Total number of questions:		74(33)

Table 1. Question categories in the questionnaire (Shaded areas indicate discussed issues in this article. *No. of questions analyzed in this paper are shown in ()).

Profile of companies	No. of collected questionnaires	% of total
construction	506	49.3
industrial	195	19.0
governmental	130	12.7
service	82	8.0
product manufact.	22	2.1
trading	23	2.2
gas provider	21	2.0
advertising	14	1.4
software	10	1.0
telecommunication	10	1.0
banking	5	0.5
other	8	0.8
Total:	1026	100.0

Gender of respondents	No.	%
Male	741	72.2
Female	285	27.8
Age of respondents	No.	%
under 25	47	4.6
25-34 yrs old	436	42.5
35-44 yrs old	281	27.4
45-54 yrs old	165	16.1
55-64 yrs old	83	8.1
no answer	14	1.3
Length of time at present workspace	No.	%
<1 year	331	32.3
1-5 years	596	58.1
6-10 years	64	6.2
> 10 years	23	2.2
no answer	12	1.2

Table 2. Demographical characteristics of respondents and profile of their companies in the questionnaire

The pre-tested questionnaires were distributed to several companies with open office layouts (42 offices at various locations in major cities in Japan). With a return rate of 84.3%, 1039 workers answered the questionnaire. 13 questionnaires were discarded because of insufficient information. The remaining 98.8%, 1026 questionnaires served as the main database (Table 2).

4. Discussion

4.1. Qualitative Findings from Group Interviews

The group interviews revealed mixed findings regarding workers' perceptions about their work environment. During the interviews, we noted that usually upper management decided the layout of the office, the isle-type layout being the far most popular. The seating order in each isle was decided by the section chiefs. Below, we summarize the findings of the group interviews, and from its qualitative nature, instead of percentage values we discuss trends and worker opinions based on the majority (generally about 2/3rd) of workers.

Generally, it was believed by many, that in an open office with no partitions, communication was easier. On the other hand, there was a strong need for at least a minimum privacy. Managers said they liked to see their subordinates, however workers' opinion about 'being constantly watched' were usually the opposite: most of them felt it as a strong lack of privacy. Group communication was found to be very important, and workers defined the necessity of having partitions at least between the isles to increase group privacy. Some workers thought that the open layout did not necessarily enhance communication, because a required level of privacy could not be achieved.

Regarding individual partitions, most workers felt their necessity for an optimum level of visual privacy. Low partitions seemed to be able to provide some level of privacy, while keeping the office look more spacious. Those who felt necessary to have enclosure considered medium-height partitions to be the best: here they could achieve a satisfactory level of privacy while sitting, but the space could be overseen when standing. Some workers felt that if they were surrounded by partitions, the space in between would feel more like their territory, however the overall office would feel more crowded.

In most cases, different sections and departments were working in the same open office, which was a source of much noise. Most workers considered their office noisy, and most of the cases the source of noise were unwanted, overheard conversations or people talking on phones. Noise was described by many as stressful. In a seemingly easy-to-communicate open layout, it was interesting to note that some workers considered the *lack* of communication stressful.

Some workers defined the ideal layout where everyone had private workspaces to concentrate, with common places in between the isles for information exchange between team members.

4.2. Quantitative Findings from the Questionnaire Survey

4.2.1. Layout, Seating Positions and Levels of Enclosures

All the questionnaires were taken in open offices (see Section 2.1 for definition). In this study, we discuss 2 kinds of open offices: isle-type layout³⁾ and free layout.¹⁾ While at the 'other' category workers drew or explained their layout (not discussed in this paper), at the 'isle-type' category workers checked their seating positions among 3 'zones' (Table 3): end of the row (END), middle of the row (MID) and head of

Left	Front	Right	Front (F)	Left (L)	Right (R)	Back (B)
	nothing taller than desk	0	0	0	0
can see over when sitting	1	1	1	1
cannot see over when sitting	2	2	2	2
cannot see over when standing	3	3	3	3		

Table 4. Categories of partitions (heights and sides)

	OPEN OFFICE				Other layout (free drawing or explanation)	No answer	Total
	Isle-type layout			Free layout

	END	MID	HEAD				
No.	277	390	132	156	71	0	1026
%	27.0	38.0	12.9	15.2	6.9	0.0	100%
Sub.	77.9% (799)			15.2% (156)	6.9% (71)		
Total:	955						

Table 3. Categories of office layouts and seating positions (Shaded areas indicate analyzed areas in this article)

Level of enclosure	Category of enclosure level		Examples of possible enclosures (refer to Table 4 for abbreviations)	(No. of workers)	%	Total	Change of partitions				
							Good as it is	Want more or higher	Want less or lower	No answer	Total
0	MIN	Minimum enclosure	FLRB FLRB FLRB No 0000 0000 0000 Low 1111 1111 1111 Med 2222 2222 2222 High 3333 3333 3333	331	34.8	60.5% (575)	67.7% (389)	28.0% (161)	2.1% (12)	2.2% (13)	100% (575)
1			LEVEL 0 LEVEL 1 LEVEL 2	115	12.1						
2				129	13.6						
3	MED	Medium enclosure	FLRB FLRB FLRB No 0000 0000 0000 Low 1111 1111 1111 Med 2222 2222 2222 High 3333 3333 3333	95	9.9	35.0% (336)	71.2% (239)	19.6% (66)	7.7% (26)	1.5% (5)	100% (336)
4			LEVEL 3 LEVEL 5 LEVEL 7	115	12.0						
5				25	2.6						
6				92	9.6						
7				9	0.9						
8	MAX	Maximum enclosure	FLRB FLRB FLRB No 0000 0000 0000 Low 1111 1111 1111 Med 2222 2222 2222 High 3333 3333 3333	25	2.6	3.5% (34)	73.6% (25)	14.7% (5)	8.8% (3)	2.9% (1)	100% (34)
9			LEVEL 8 LEVEL 10 LEVEL 12	5	0.5						
10				3	0.3						
11				1	0.1						
12				0	0.0						
no answer:				10	1.0						
Total:				955	100						

Table 5. Categories of enclosure levels and users' wishes to change their partitions (% values show distributions within one enclosure level)

the row (HEAD).

Our sample consisted of 77.9% workers working in the isle-type layout. 15.2% worked in free layout, and the remaining 6.9% ('other') consisted of different minor layout types¹⁾. In this study we analyze and compare data from the first two major layout types, thus leaving 955 workers in the main database (Table 3).

Enclosure was defined by the combination of different heights and numbers of partitions around individual workspaces. Partition heights were subjectively measured based on individual perceptions. Four categories of partition heights were set up (Table 4.) based on workers' perceived visual privacy and were coded from 0 to 3. These were combined with the possible 4 sides, and 13 levels of enclosure were defined (Table 5). Based on the findings from the interviews and BOSTI's survey (Brill, et al. 1984³⁾), 3 categories of enclosure levels were set up for further analyses. Most workers in our sample (60.5%) worked in minimum enclosure workspaces. 34.8% of all workers had no partitions at all and nobody from the sample had Level 12 enclosure. Maximum enclosure was very rare also (3.5%). Since 10 people did not answer here, only the remaining 945 sample were further analyzed.

To the question: 'How would you like your partitions to be?', answers were cross-tabulated by the 3 enclosure categories (see right-side of Table 5). Almost one-third (28.0%) of workers with minimum enclosure workspaces wanted more or higher partitions, and only less than 10% of workers with medium or maximum enclosure wanted less or lower partitions. However, more than two-third of workers in all levels of enclosures answered that they did not need any change.

The 3 seating positions in the isle-layout, together with the free layout and the 3 enclosure levels define 12 main variations of individual workspaces (from END-MIN to FREE-MAX, see upper part of Table 6).

Workers' perceptions of their psychophysical environment (perceived visual and acoustical privacy, and ease of communication) were investigated by cross-tabulations within these 12 categories. Most workers (28.5%) fell into the MID-MIN category; that is, they sat in the middle of the row in the isle-layout, with minimum enclosure around their workspaces. None of the workers had maximum enclosure in the MID position, and due to insufficient number of sample in the HEAD-MAX category, data was not analyzed here. Most workers in the free layout had medium enclosure levels.

Layout	ISLE-TYPE									FREE		
	END			MID			HEAD			MIN	MED	MAX
Level of enclosure	MIN	MED	MAX	MIN	MED	MAX	MIN	MED	MAX	MIN	MED	MAX
Workers No.***	181	83	9	272	115	0	93	37	2	29	101	23
Workers %***	19.0	8.7	0.9	28.5	12.0	0.0	9.7	3.9	0.2	3.0	10.6	2.4
Q.A-1	2.99	3.20	3.34	2.92	3.16	n/a	3.01	3.16	n/a	2.79	3.16	3.52
	3.18			3.04			3.09			3.17		
Q.A-2	3.53	3.80	3.67	3.34	3.43	n/a	3.29	3.33	n/a	3.76	3.52	3.43
	3.67			3.39			3.33			3.57		
Q.A-3	3.45	3.55	3.50	3.43	3.48	n/a	3.57	3.34	n/a	3.22	3.25	3.18
	3.50			3.46			3.46			3.45		
Q.A-4	3.64	3.64	3.40	3.70	3.57	n/a	3.80	4.00	n/a	3.50	3.29	3.77
	3.56			3.64			3.90			3.52		

Q.A-1: Do you often feel you need more privacy at your workspace?
Ans.A-1: Strongly disagree(5), Disagree(4), Neutral(3), Agree(2), Strongly agree(1)
Q.A-2: Do you often get distracted when people move around you or drop by your workspace?
Q.A-3: Do you often feel uncomfortable, if many people can see your monitor?
Q.A-4: Do you often feel uncomfortable, being constantly seen by your boss at your workspace?
Ans.A-2,3,4: Hardly ever(5), Sometimes(3), Often(1)
* Possible answers 'Nobody can see my monitor' and 'I don't have a monitor' were not scored
** Possible answer 'Boss cannot see me directly' was not scored
*** Total 955 workers (100%) including 10 workers (1.0%) with no answer

Table 6. Mean values for visual privacy cross-tabulated by layout/seating and enclosure

4.2.2. Visual Privacy Issues

Perceived visual privacy was investigated with 4 questions in the questionnaire (see Table 6). Answers were measured with 3 and 5 point Likert scales and were all reverse-scored from 5-1; that is, a lower value indicating less visual privacy. Using the 945 sample, mean values were calculated and cross-tabulated by layout/seating and enclosure types.

Shaded areas in Table 6 indicate, that – seating position being constant – as enclosure level increases, so does the level of perceived visual privacy (darker areas indicating higher privacy levels). The ‘need for privacy’ variable (Q.A-1) showed this tendency most clearly. In Table 6, circles indicate, that comparing mean values of different seating positions in the isle-layout with the same (MIN and MED) enclosure levels shows a tendency of decreasing visual privacy as we go from the END to the HEAD of the row. Comparing the average mean values of enclosure levels of each seating positions (printed in *Italics*) also showed a tendency of decreasing visual privacy level from END to HEAD positions, regarding to the ‘distraction from people’ variable (Q.A-2). However, the lowest mean value (3.56) among the three seating positions in the isle-type layout shows that workers at the END of the row were more often uncomfortable when seen by their boss (see question A-4) than those in MID (mean value: 3.64) and END (mean value: 3.90) positions. The free layout showed the lowest visual privacy levels considering questions A-3 and A-4.

42.4% (n=401) of all workers expressed their disagreement that it was important for their work to be constantly seen by their bosses (Q.B-1 in Table 7). However, among these workers only 24.1% reported that they could not be directly seen by their bosses; 11.0% felt *often* and 36.0% felt *sometimes* uncomfortable being constantly seen (Table 7).

Q.B-1 *	SD		D		N	A		SA	
	23.4%		19.0%			24.4%		9.1%	
	(221)		(180)			(230)		(85)	
Q.B-2 **	42.4% (401)					33.5% (315)			
	HE	S	O	B		HE	S	O	B
	28.9%	36.0%	11.0%	24.1%		43.2%	39.8%	10.6%	6.4%
	(116)	(144)	(44)	(97)		(136)	(125)	(33)	(21)

Q.B-1: Is it important for your work to be constantly seen by your boss?
Q.B-2: Do you often feel uncomfortable, being constantly seen by your boss at your desk?

SD=Strongly Disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly Agree
HE=Hardly ever; S=Sometimes; O=Often; B=Boss cannot see me

Values in parentheses indicate number of workers

** Total: 945 (100% - with 3 no answers)*
*** Total: 401 (100%) and 315 (100%)*

Q.F-1 *	SD					N	A					SA												
	0.8% (8)						1.6% (15)					5.7% (54)					33.3% (315)					58.6% (553)		
	2.4% (23)						91.9% (868)																	
Q.F-2 **	SD	D	N	A	SA	N	SD	D	N	A	SA	N	SD	D	N	A	SA							
	17.4% (4)	17.4% (4)	17.4% (4)	34.8% (8)	13.0% (3)		2.0% (17)	11.0% (95)	17.3% (150)	49.1% (426)	20.6% (179)													
Q.F-3 ***	SD					N	A					SA												
	1.1% (10)						2.8% (26)					44.8% (423)					41.9% (396)							
	3.9% (36)						86.7% (819)																	
Q.F-4 ****	SD	D	N	A	SA	N	SD	D	N	A	SA	N	SD	D	N	A	SA							
	25.0% (9)	41.7% (15)	8.3% (3)	13.9% (5)	0.0% (0)		5.5% (45)	21.6% (177)	27.8% (228)	38.2% (313)	6.3% (52)													

Q.F-1: Is it important for your work to constantly get information from colleagues in your section?
Q.F-2: Do you get enough information from colleagues in your section?
Q.F-3: Is it important for your work to constantly get information from other sections?
Q.F-4: Do you get enough information from other sections?
SD=Strongly Disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly Agree
Values in parentheses indicate number of workers
* Total: 945 (100%)
** Total: 23 (100%) and 868 (100% - with 1 no answer)
*** Total: 945 (100% - with 7 no answers)
**** Total: 36 (100% - with 4 no answers) and 819 (100% - with 4 no answers)

Table 11. Importance of getting information

MED – see circled values), getting enough information becomes easier as we go from END to HEAD positions. In case of getting information from other sections, people with free layout reported the highest values.

91.9% (868) of all workers reported that it was important for their work to constantly get information from colleagues in their section (Q.F-1 in Table 11). Among these workers however, only about two-third reported that they actually got enough information (see Table 11 for details). Similarly, 86.7% of all workers reported the importance of constantly getting information from other sections, while only less than half of them actually reported getting enough information (see Table 11 for details).

Next, important ways of getting information from one's own section and from other sections were investigated with two multiple-choice questions in the questionnaire, where workers could choose one or more answers (Table 12). Possible answers of 'face-to-face talking' and 'leaving notes' were grouped under the category 'Personally'. Similarly, 'via e-mail' and 'via computer information system' answers were grouped: 'Via computer'. Here, only the two office layouts (without seating positions) were distinguished with enclosure levels for cross-tabulations. While phone or electronic communication was obviously not affected by physical characteristics, a surprising finding was that regardless to office layout or enclosure level, personal communication was prevailing in case of in-section communication.

Layout	Level of enclosure	Workers		From own section			From other sections		
		No.	%	Personally	By phone	Via computer	Personally	By phone	Via computer
ISLE	MIN	546	57.2	96.0% (524)	22.7% (124)	57.0% (311)	71.8% (392)	53.1% (290)	73.3% (400)
	MED	235	24.6	97.0% (228)	16.2% (38)	57.9% (136)	73.6% (173)	44.3% (104)	74.0% (174)
	MAX	11	1.2	100.0% (11)	18.2% (2)	63.6% (7)	63.6% (7)	45.5% (5)	81.8% (9)
FREE	MIN	29	3.0	100.0% (29)	24.1% (7)	65.5% (19)	82.8% (24)	44.8% (13)	82.8% (24)
	MED	101	10.6	90.1% (91)	20.8% (21)	64.4% (65)	75.2% (76)	41.6% (42)	85.1% (86)
	MAX	23	2.4	95.7% (22)	34.8% (8)	73.9% (17)	65.2% (15)	60.9% (14)	82.6% (19)
no answer:		10	1.0	NB: workers could choose more than one way of getting information. Percent values show distribution within one enclosure level. Values in parentheses are No. of workers					
Total:		955	100						

Table 12. Important ways of getting information from own section and from other sections

Intersectional communication was rather done by e-mail or telephone; however, percentage of personal communication was still very high (see Table 12).

4.2.5. Users' Needs for Changes

To the question: 'Do you want to move to another workspace?', workers gave answers on a 5 point Likert scale (see Table 13) and those who strongly agreed (8.3%) or agreed (9.5%) were asked to indicate their reasons with free answers. The reasons with considerable frequencies are reported in the lower part of Table 13. Most workers wanted to move because of noise, unable to concentrate and lack of privacy (workers could write more than one reason).

Finally, a question (free answer) asked workers: 'What would you change in your office in an event of a future remodeling in order to have a better work environment?' The response rate to this question was 66.7% (684 workers), and among these, 92.0% (629 workers) wanted to improve their environment somehow (while only 8.0% of them

	Do you want to move to another workspace?				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
% of all workers:	8.3	9.5	38	19.6	24.3
No. of workers: *	83	97	390	201	252
Reasons why workers wanted to move	% of the 83 workers	% of the 97 workers			
not enough space	8.2	13.4			
want different layout	4.9	5.0			
want corner-windowseat	8.2	12.2			
don't feel at ease	14.8	15.6			
lack of privacy / uncomfortable to be constantly seen	26.2	22.1			
bad personal relations	8.2	1.2			
noisy / disruptions by others / cannot concentrate	26.2	25.6			
unpleasant temperature or smelly	3.3	4.9			

Table 13. Why workers wanted to change their workspaces (* n=3 workers did not answer. Shaded areas indicate related issues to this article.)

Categories	What workers wanted	No.	%
storage	more/larger/better org. storage	154	22.6
air quality/natural light/lighting	better AC	83	12.2
	natural light/able to see/open window	56	8.2
	more light	23	3.4
space	larger workspace/table	75	11.0
	more spacious office/passages	54	7.9
common spaces	more/better meeting tables/rooms& common spaces	70	10.3
privacy/noise	higher or more partition	32	4.7
	more privacy/noise control/places for concentration	54	7.9
office/furniture layout, setting	change office layout to better, more functional	88	12.9
	lower/less partitions	6	0.9
secondary spaces & services	more places to relax, rest and drink	85	12.5
	/larger/better toilets/locker rooms	21	3.1
	better/more facility services (kitchenette, vending machines fridges)	9	1.3
office environment/interior design/ergonomics	better environment/full renewal	22	3.2
	better office design/interior decoration	32	4.7
	better ergonomics, new/comfortable furniture	14	2.1
	plants	18	2.6
office technology	better/more/faster office machines, OAcorners, networks, IT systems	40	5.9
	OA floor/elimination of open wiring	17	2.5
management/other FM problems	better/separated smoking places/non-smoking office	46	6.8
	other related organizational/management/FM issues	22	3.2
others/not clear		9	1.3
no needs, good as it is		55	8.1

Table 14. What workers wanted for a better working environment (Shaded areas indicate related issues to this article)

considered their workplaces 'good as it is'). Mentioning an improvement issue counted as one item; many workers wrote more than one item. Items were counted, and those with considerable frequencies are reported in Table 14. Many people wanted to change their office layout, wanted more privacy, or wanted higher or more partitions.

4.2.6. Correlations with Productivities

Pearson product-moment correlation coefficients were calculated to investigate the relationships of the psychophysical variables (questions A-1 to A-4, C-1 to C-4 and E-1 to E-2 – see Tables 6,8,10), and 6 productivity (work performance) variables from the questionnaire.

Q.No.	category	name of variable	Pearson	individual productivity	team's (section's) productivity	amount of work accomplished	quality of work accomplished	frequency of errors made	meeting deadlines (on-time work completion)
Q.A-1	visual privacy	need privacy	r	.021	.102**	-.001	.079*	.069*	.077*
			n	943	940	942	941	943	937
Q.A-2		distraction from people	r	.017	.088**	-.048	.046	.049	.109**
			n	943	940	942	941	943	937
Q.A-3	visual privacy	monitor seen by people	r	.087**	.090**	.070*	.088**	.065	.036
			n	884	882	883	882	884	878
Q.A-4	visual privacy	constantly seen by boss	r	.149**	.070*	.088*	.117**	.132**	.102**
			n	799	798	798	797	799	795
Q.B-1	acoustical privacy (noise)	noisiness of workspace	r	-.002	.070*	-.109**	.001	-.019	.112**
			n	942	939	941	940	942	936
Q.B-2		unwanted noise (people talking)	r	-.007	.071*	-.060	-.011	.040	.082*
			n	942	940	941	940	942	936
Q.B-3	acoustical privacy (noise)	want silence for concentration	r	-.042	.075*	-.094**	-.062	.009	.167**
			n	944	941	943	942	944	938
Q.B-4	acoustical privacy (noise)	stay late when less noisy	r	-.053	.039	.176**	-.055	.085**	.308**
			n	939	936	938	937	939	933
Q.C-1	communication	enough info from own section	r	.127**	.222**	.093**	.109**	-.005	.111**
			n	943	940	942	941	943	937
Q.C-2	communication	enough info from other sections	r	.145**	.183**	.106**	.111**	-.007	-.036
			n	922	919	921	920	922	916

Table 15. Correlation matrix of psychophysical and productivity variables (r=Pearson product-moment correlation coefficient; n=No. of valid data pairwise – cases were excluded pairwise for missing values)

**Correlation is significant at the 0.01 level (2-tailed)

Significant correlation values are shaded in Table 15.

Visual privacy showed significant positive correlations with most of the productivity variables: 'discomfort from monitor seen by others' strongly correlated with the 'individual' and 'team productivity', as well as the 'quality of work accomplished' variables. 'Discomfort from constantly seen by boss' significantly positively correlated with 'individual productivity', 'quality of work', 'frequency of errors made' and 'on-time work completion' variables.

Acoustical privacy (noise) mostly affected 'on-time work completion', somewhat affected 'frequency of errors made', but was surprisingly significantly negatively correlated with 'amount of work accomplished' and did not significantly correlate with any other productivity variables.

Variables of 'getting enough information from own section' and 'getting enough information from other sections' showed significant positive correlations with almost all productivity variables, while obviously they did not correlate with the 'frequency of errors made' variable.

5. Conclusion

Most of the findings of group interviews were confirmed by the

quantitative data of the questionnaires.

Comparing isle-type layout and free layout did not show much difference in privacy or noise issues, however, the latter one seems to allow better intersectional communication.

Considering seating positions in the isle-layout, people at the end of the row could get more visual or acoustical privacy, than those sitting at the middle or at the head of the isle. Getting information showed reverse tendency: those sitting at the end of the row got considerably less information from their own or other sections.

Enclosure levels had the strongest mediating effects on privacy and communication: as partitions' number and height increased, perceived visual privacy also increased, and distraction from noise decreased; however, the ability to get enough information also decreased. The latter one is probably because regardless to the layout or enclosure level, most of the workers communicated personally.

Regardless to physical characteristics, almost half of all workers thought their workplace was noisy. Among them, one third reported lack of concentration on their work. About one third of workers who had minimum enclosure around their workspaces wanted more or higher partitions. Almost half of all the workers felt it unnecessary for they work to be seen by their bosses, and among them, almost half reported discomfort being constantly seen. Almost 20% of all workers wanted to change their workplaces: noise and privacy complaints were the most common reasons. Most of those who wanted a better work environment mentioned the need for changing the layout to a better, more functional one.

The correlation analyses proved some of our hypotheses: ease of communication affected workers' productivity the most. Also, visual privacy significantly positively correlated with almost all variables of productivity. However, oppositely to our hypothesis, noise showed very little effect on productivity, and it was negatively correlated with the amount of work one accomplished.

In summary, we note that in our study a carefully designed amount of enclosure around individual workspaces turned out to be important. Some level of enclosure was necessary for privacy; however, too much enclosure could hinder productivity and face-to-face communication. Noise, though in our study did not affect productivity, was a serious issue.

Notes

- Brill et al. (1984)³⁾ and the writers of this paper call these 'psychophysical factors'.
- Brill et al. (2001)⁴⁾ defines 'workspace' as "the space where an employee sits (mostly) when in the office" as opposed to 'workplace', "a general term for the entire physical environment for work ..."
- Landscape offices were originated in Germany in the 50's and were called "Bürolandschaft".
- Brill et al. (2001)⁴⁾ warn that 'systems furniture' and 'open office' are not interchangeable terms: "Systems furniture is furniture and panel units whose dimensions, geometries, and connections are pre-engineered for compatibility."
- The 'isle-type layout' is called 'obeya-shimagata' in Japanese. In this study we define 'isle-type layout' as workers facing each other in a row of desks, which are laid out in a neat order, forming several isles in a large, open room with desks at the head of each isle looking towards the row (see Figures 2 and 3).
- In this study, we define 'free layout' as an open office with individual workspaces laid out in a free order, as opposed to the strict layout of the 'isle-type'. Free layout is different from the landscape-office, as the first one does not necessarily integrate systems-furniture and partitions (see Figure 4).
- Kupritz (2003)²⁴⁾ refers 'speech or conversational privacy' to "a person's ability to

Figure 2. Isle-type layout with no partitions around workspaces

Figure 3. Isle-type layout with low partitions around 3 sides of workspaces

Figure 4. Free-layout with medium partitions around 3 sides of workspaces

hold conversations inside a workspace without being overheard and understood by people outside the workspace.”

- h) According to Kupritz (2003)²⁴⁾, ‘acoustical privacy’ “includes speech privacy and isolation from environmental background noise.”
- i) Kupritz (2003)²⁴⁾ defines ‘visual privacy’ as “isolation from unwanted observation.”
- j) BOSTI – Buffalo Organization for Social and Technological Innovations
- k) The floor plans and some of the pictures were asked to remain confidential.
- l) Out of the 6.9% ‘other’ category, 0.7% worked in isle-type layout but did not check their seating positions, 2.1% worked in ‘fishbone-layout’ (in an open office, desks are facing in one direction, with a long, common table between desks), 3.1% had desks in small groups in their offices and the rest, 0.9% were not specified.

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和文要約

1. 研究目的

本論は、オフィス環境に関する広範かつ複合的な研究の一部である。ワークスペースのデザイン・就業者の知覚・環境および仕事に対する彼等の満足、ならびに生産性の間の関係性を描き出すための、仮説的な総合的モデルを図1に示す。

日本のオフィス現況に対する評価を通して、「生産的なワークスペース」計画の情報を得るために、本論は就業者の視覚的・聴覚的プライバシー並びにコミュニケーションについて検討する。それらは、オフィスレイアウト・座席位置・ワークスペースの囲みによって媒介されると示唆される。ノイズは生産性を阻害し、プライバシーとコミュニケーションのし易さは生産性を向上させると仮定される。

2. 研究の背景

2.1. オフィスの物理的特性

オープンオフィスに関する研究は相反する結果を示している。肯定的な結果では、Zahn(1991)⁵⁾、Oldham ら(1979)⁶⁾、Ellis ら(1980)⁷⁾及びBoyce(1974)⁸⁾は、就業者間のコミュニケーションの向上を見出し、Brooks ら(1972)⁹⁾は、相互交流の増加を報告している。否定的な結果としては、就労者の環境的な不満足や作業遂行性能の低下 (Oldham 1979⁶⁾, Hedge 1982¹¹⁾, Canter 1972¹²⁾)、心理的なプライバシーの水準低下(Brookes ら 1972⁹⁾, Hedge 1982¹¹⁾)、および作業の阻害(Canter 1972¹²⁾, Ellis ら 1980⁷⁾, Brookes ら 1972⁹⁾, Hedge 1982¹¹⁾) が示されている。

ワークスペース間の仕切の数や高さ等の囲みのあり方について、Brill ら(1984)³⁾は仕切の高さとプライバシー・コミュニケーション・作業遂行性能との正の相関を見出し、Sundstrom ら(1980)¹⁷⁾は仕切の高さが増すとプライバシー・ワークスペースの満足・作業遂行性能が増すことを報告している。

2.2. オフィスにおける心理物理的要因

既往の研究は、就業者の心理的なプライバシーと建築的なプライバシー(Sundstrom 1980)¹⁷⁾とは連合していることを示している。Kupritz(1998)²³⁾は、プライバシーの欠如がもたらす視覚的・聴覚的阻害は生産性を減じエラーを増すことを見出している。Brennan ら(2002)¹⁾によるオープンオフィスに関する調査によれば、就業者の主要苦情はプライバシー・秘密の欠如とノイズ増大である。

オフィス就業者にとって、ノイズは作業関連ストレスによる否定的な影響をもたらす得るものとして深刻な問題である(Kahn 1992)²⁹⁾。スチールケースの1978年調査(Harris 1978)²⁸⁾によれば、就業者は「ノイズやその他の邪魔無しに集中出来ること」をオフィス環境における16の指標の中で最も重要なものとして指摘している。Brill ら(2001)⁴⁾の調査でも、「妨害なしの単独作業」が10項目の中で第1位に挙げられている。Boyce ら(1974)⁸⁾は、オープンオフィスに働く就業者の半分以上はノイズによって妨害されており、ノイズの55%は周りの人々の会話に依るとしている。しかし、Sundstrom ら(1994)³²⁾は、ノイズと作業遂行性能との関連を見出していない。

適切なコミュニケーションは、家具・オフィスレイアウトによって影響される対人関係に関連する重要な側面の一つである(Ha ら2002)³⁴⁾。BOSTI(Brill ら2001)⁴⁾による最新の調査では、就業者の87%は情報をインフォーマルに入手しているが、オープンオフィスに働

く者の58%は、偶然耳にする他人の会話からは何も得ていない、としている。

3. 研究の方法

日本の建築設計主要組織の建築計画実務家への予備的インタビューを行った上で、17の大企業オフィス就業者に対する19のグループインタビュー調査が行われた(参加者計42名)。ここで得られた結果に基づいて、総合的質問紙調査が設計され、プリテストを経た上で、日本の大都市にある42の様々な事業所の就業者1,233名に配布され、1,039名の回答(回収率84.3%)を得た(表1, 2)。

4. 結果と考察

インタビュー調査における結果の多くは質問紙調査による定量的データによって確認された。大部屋島型配置とフリーレイアウト(表3)を比較すると、プライバシーとノイズについては大差はなかった(表6, 8)が、フリーレイアウトはセクション間のコミュニケーションにおいてより優れていると言えよう(表10)。

大部屋島型における座席位置について、末端部座席は座席列の中央部や頭端部よりも多くの視覚的・聴覚的プライバシーを得ることが出来る(表6, 8)。情報の入手については逆の傾向を示し、末端部座席は中央部や頭端部に比して、自身のセクションからも他のセクションからも僅かな情報しか得られていない(表10)。

座席の囲み方(表4, 5)はプライバシーやコミュニケーションに最も強い媒介的な影響を与えるようであり、囲みの数と高さが増すにつれ知覚された視覚的プライバシーも増し(表6)、ノイズによる阻害も減じるが(表8)、しかし、十分な情報を得ることも出来にくくなっている(表10)。これは、配置や囲みの程度とは関わりなく、大多数の就業者が個人的に情報交換を行っているという、日本の就業環境における特徴に依るものと考えられる(表12)。

物理的な特性に関わらず、約半数の就業者は彼等のワークスペースを喧しいと思っており、その約1/3は仕事に集中しにくいとしている。最低の囲みしかない就業者の1/3は、より多くの・高い囲みを求めている(表5)。すべての就業者の半数は、上司に見られることは不必要なことであると感じ、彼等の半数は不快を訴えている。5人に一人はそのワークスペースを変えたいと望んでおり、ノイズとプライバシーに関する苦情が最大の理由となっている(表13)。より良い就業環境を望む彼等の殆どは、より適切な、より機能的なレイアウトへの変更を述べている(表14)。

相関性に関する分析によれば、コミュニケーションのし易さが生産性に最も関係し、また、ある程度の視覚的プライバシーの確保は、生産性に関する殆ど全ての指標に関連している。しかしながら、ノイズは生産性とは殆ど関係せず、就業者の完成し得る仕事量とは逆相関している(表15)。

フリーレイアウトと大部屋島型配置とを比べると、後者も又効率的であり得るが、囲みのあり方の注意深いデザインが重要である。生産的なワークスペースにとって、有る程度の水準の囲みは提供されるべきであるが、過度の囲みは生産性とフェイスツーフェイスのコミュニケーション(今もなお、日本の組織における情報獲得の主要方法)とを阻害する。

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