Useful Spatial Systems for Office Activities

Royal Institute of Technology
School of Architecture
Stockholm, Sweden
Work Space Design
Jesper Steen, Professor
Magnus Blombergsson, M Arch, Ph D student
Johanna Wiklander, M Arch, Ph D student

Keywords:
office, office activities, office concepts, interaction, configuration, work space design

1. Abstract

Our study of office buildings is focused on how social and spatial systems interact. In our cases in progress, we on the one hand study similar spatial configurations used by different organisations, on the other hand different spatial configurations used by similar organisations. In this way we will understand to which degree similarities and differences depend on spatial respectively social properties. Our aim is to develop descriptive methods and define new categories of office buildings based on possible usage concerning the patterns of interaction and individual work. The three case studies in the project will make it possible to make comparative analyses.

The basis is that communication between co-workers is of vital importance for the progress and prosperity of the organisation. Concurring with Space Syntax-theories, the spatial configuration defines the playground for this important interaction. This potential grows or diminishes depending on the location of different generators as common functions of different kind. A main point is to look for interactions within groups on one hand and between groups on the other. The first kind is claimed to have a more reproductive function where as the former is supposed to be more productive. The character of the work organisation, including questions as applied management strategies, will have a great impact of the outcome of this potential for interaction.

The results from the project are supposed to facilitate for property developers to define the usability of office buildings towards their clients. It will also help office activities as tenants to specify their needs of the built space provided by the property developers. The developed analytic tools will make it possible to appraise the potential for usability for office buildings in new ways.

2. Starting-points developed in earlier studies

Let us summarise experiences from earlier research in some critical points as a frame of reference for the on-going research:

2.1 The nature of office work

It is obvious that the office work we studied is dominated by what Hillier terms social knowledge (Hillier, 1996, pp 246-250), that is to say, something that develops through actions and that one normally does not reflect upon. This means that it is not easy to formulate the problems involved in the relationship between the working process and physical-spatial

conditions. At a more all-embracing level, it appears however to be possible to differentiate between the main categories of office work, namely, thought processes for which a precondition is concentration and interaction for which a precondition is openness to influence. Between these two it appears as though activities of a practical nature make up a relatively fluid boundary in the sense that practical tasks can be done in connection with either thought processes or interaction.

2.2 The significance of the space

The spatial configuration is clearly significant for how office workers move and which potential is created for interaction. The placing of common functions in the spatial system can strengthen or weaken this influence. Furthermore, the density of work places affects the total extent of the interaction. If it were possible to separate the time for thought processes from the time for interaction, it would be possible to allocate particular rooms for thought processes without paying attention to the spatial context. As it appears that thought processes and interaction will to a great extent be integrated activities, the positioning of the workstation in the spatial system is of great importance for potential interaction and development of knowledge.

2.3 Independence creates specific conditions

The desire to increase efficiency in a given production process may lead to the physical-spatial conditions as the means of productions will be given a very specific design. This holds, not least when a flat organisation of work is introduced and the respective groups within office work acquire greater independence. In addition it appears that increased independence will be expressed in increased self-sufficiency, the responsible for and use of common functions will be kept within the group. Both of these conditions, that the space becomes more specific and that contacts with other groups are reduced, can have a conserving effect on the work as a whole.

2.4 Standardisation for change

Workstations are increasingly designed as standardised modules. This applies both within an office and within the office building as a whole. This leads to an exchangeability which gives the operations management room for action when it comes to opportunities to reorganise and regroup the work. It appears that such building of new relations is an important method for creating dynamism and contributing to increasing income. The desire to reduce costs leads, however, to a reduction of the area of the workstation. It limits the office workers' space for action to form their workstations into efficient means of work on the basis of their current needs.

2.5 Generality through a flat spatial structure

The same insight is not found in the spatial system's design and qualities as in those of the different parts', that is to say the individual workstations', designs and qualities. That the work stations which are less accessible are both more undisturbed and more isolated is an experience that develops among those who use these environments but does not appear to be dealt with in the design process. The desire for space for action for change seems neither have any effect on the design of space as a spatial system. The trend towards an increasingly open office concept without walls appears to create greater flexibility or space for action, with

regard to the way one can move on the floor and the way workstations can be placed. In many cases, however, the central positioning of stairwells and common functions creates a hierarchical spatial structure that gives the various workstations specific positional qualities.

2.6 Knowledge about the interaction patterns of different types of work

In a simplification, one could say that the interaction between a group that in some sense is working together is less problematic; the need for contacts that exists is at least to some extent predictable. Communication in a horizontal direction between different sections and different areas of competence is for natural reasons less developed and their internal usefulness is more difficult to predict. This entails a risk that no attention is paid to the conditions for unplanned and random interaction. An important step is to increase knowledge about this interaction on a level between the interaction within small units and the interaction between companies. It is particularly interesting to study in which way established respectively potential contact patterns vary depending on the nature of the operation in the offices. This creates preconditions for a categorisation of work on the basis of its relationship to the physical-spatial conditions. Penn and others mention especially the interaction in between the local and the global to be of great importance (Penn et al., 1999). Concerning the interaction between companies in the urban context we will refer to Marcus research in Stockholm (Marcus, 1999; Marcus, 2000).

2.7 To make conscious choices of the spatial form of office work

With new knowledge about the interaction patterns of different types of work, it becomes possible to formulate problems about office buildings and office premises on the basis of the usefulness of the spatial structure. In this process three actors exist, who have partially different requirements: The Property Owner who wants a building that is in demand by a broad group of clients who can afford to pay; the Tenant who wants a specific solution to his needs, which nevertheless is general enough to adapt to future changes within the tenants organisation; the Architect who ought to have knowledge about how differences in form are related to function and usefulness, that is to say has knowledge about what are physical-spatial characteristics of a more general and a more specific kind. By making this knowledge discursive, preconditions are created for an increased competence among the customers – both those who own and those who use the premises. This may in turn lead to built forms that balance between the specific and the general in a productive way.

3. The problem

In spite of better understanding of different aspects of the relationship between office activities and the premises there are almost any studies of how office activities of different kind have different demands regarding the spatial system. Nor either there is any knowledge of in what way different forms of building are useful for different office activities.

The problem for the actors on the market is that they cannot make conscious choices in case of looking for premises or building and rebuilding offices. The consequence is great risks for bad efficiency and lack of capability of developing in the office companies on one hand and on the other for the usefulness of the buildings and their market value.

4. Aim

The aims of our studies of offices are on a concrete level:
- to find the different types of office activities demanding different spatial concepts;
- to find the different types of office buildings which are relevant for different types of office activities.

This kind of knowledge will support both people in search for office space and those providing it. It will also contribute to property developers, including architects and builders, understanding the market potential of specific office buildings.

The aim on a principal level is:
- to develop methods and tools for analysing office activities respectively office buildings.

This kind of knowledge will be used in further research and at schools of architecture. A main question here is to understand which properties of a building are active in determining the generality respectively the flexibility versus different kind of use.

Photo: The first case study, an insurance company

5. Analytic model

5.1 The social system

Our task is to understand the interplay between office activities and office buildings. As we know that interaction within the organisation is the main reason for using a collective work place, the interaction will be in our focus. As we know that the other side of office work, the thought processes, to some extent demands conditions of an opposite kind we have to study the whole work situations to understand what is supporting what. The fabric of interaction and thought processes must be understood through analysis of different persons and different activities on a detailed level and how these activities form sequences depending on roles and tasks.

Secondly we are interested in the interaction as both a reproductive respectively a productive mechanism, that is to say that we are interested in sorting interaction within groups respectively between groups. This is a key question for the spatial system, but continuing the discussion to the social system we understand that the interaction pattern within an organisation will to some degree depend on in what way the organisation is divided into groups.

To illustrate these always present possibilities in choosing between different organisation concepts we can use definitions from industrial production. There the term "functional workshop" is used for a concept where each groups consists of similar operations and the term "product workshop" for a concept where each group consists of different operations producing more or less a ready product. As the idea of the product workshop is to facilitate the production by shorter ways of information and material we must suppose that this will have effects on the need of interaction between groups in fulfilling their tasks. The degree of independence for every separate group will influence the interaction pattern. This is to say, that the centralisation or decentralisation of responsibility and authority will influence the frequency of programmed interaction. In general, work organisation can be described in terms of the horizontal division of labour (the flow of operations) and the vertical division of labour (the hierarchy of power).

The third social variable is the configuration of the social network within the office. In this we can find relationships with different functions, discern relations dominated by professional support, relations dominated by business judgements support and relations dominated by a more individual, social support. The pattern of the social network will of course be a result of the work organisation, the proximity between persons and so on – but it is not only a result of the actual situation, there will always be traces from earlier organisations in the present situation.

The fourth variable of importance in the social system is the matter of time. For us the more specific question is if time makes it possible for people to use the potential of interaction embedded in a specific spatial system. On a principal level the basis of every work organisation is a conception of how people and time should be used to form the most effective production process. The space for action, or the limitations, for choosing different ways in full filling the tasks will very much rely on the available time. Simplified it can be said that plenty of time will let you think of and discuss improvements in the ongoing work processes. If you are short of time you will only do what you have to do (which will be effective in a short time range). If still more time "is taken away" you will have to rationalize the work process, in the end so hard that you will have to skip some actions and you will be stressed by not knowing the consequences.

The fifth variable of interest is how the social system is located within the office space. Is the order of placing people strongly determined of the organisation map or are there ideas of mixing people from different groups or of different competences?

According to this discussion the social system of the office will be studied in the five variables:
- types of work (in terms of the fabric of thought processes and interaction);
- the work organisation (the division of labour horizontally and vertically);
- the social network (different kinds of personal connections and support);

- time at hand;
- the principles of placing groups and individuals relatively to each other.

5.2 The spatial system

Coming to the spatial system, we know that the spatial configuration is of great importance and possible to describe and analyse with Space syntax-tools. The first variable is how differences in integration values within the space system influence movements. The second is how differences in openness and spatial structure have effects on visibility.

The third variable in the spatial system is density: How many workstations will the building, or the actual part of the building, accommodate? As spatial configuration is about the probable distribution of encounters in space high density increases the probability for random interaction in the whole system.

Capacity is a fourth variable for grasping the question of "space for action" in a spatial system. Our thesis is that the number of enclosed spaces within a spatial system gives an indication on independency. In every room one actor can do things of greater difference to actors in other rooms than if two or more actors are in the same room. The capacity value must be correlated to the other spatial values.

As a fifth variable we will introduce the geometric form in three dimensions of the spatial system. The idea is that the movement behaviour differs if the office area is spread out in narrow houses and on many floors or is more concentrated in more compact houses. In the first case people are supposed to be more reluctant to look for colleagues by chance.

The sixth variable is how common functions act as generators or attractors and to what degree their locations will strengthen or weaken the effects of other variables, especially the spatial configuration.

In our analytic model we will describe the spatial system in the six variables:
- the configuration (in terms of tree structured or ring structured and of depth);
- the visibility;
- density (in terms of workstations per floor area);
- capacity (in terms of enclosed rooms per spatial system);
- the geometric form of space and houses;
- the location pattern of common functions (in terms of centralized or decentralized).

5.3 Combining the variables of the two systems to a model

These variables describing the social respectively the space system are the basis of our analytic model. By using the social variables we will be able to define relevant types of office activities and by using the spatial variables we will be able to define relevant types of office buildings. By using both we will be able to make conclusions about the interaction between the two and how different values will strengthen or weaken the other.

In other words, we can say we think that these variables are forming the work processes at the office – they will be active in reproducing the work processes and they set the frames for the development within the organisation.

6. Case studies

The ambition to search for similarities and differences in different office activities and different buildings leads to a research concept with several comparative case studies. In order to make it possible to better understand the influences of the social system and the spatial system respectively, the cases are selected so some variables can be kept more fixed. Accordingly, we on one hand study similar office activities in different spatial concepts and on the other we study different activities in similar spatial concepts. These differences or similarities do not have to exist on the company level, on the opposite we believe they mainly will be found on the level of different departments.

The first case study is an insurance company in Stockholm. A total of 500 employees work on three floors. The building was built in 1975 for the insurance company. It was designed and erected as a 50-50 answer to the dilemma of open plan versus cell offices. Half of the layout consists of three hexagons originally with open landscapes in all. The other half is a 180 metres long double corridor plan. Between these distinct forms there is a lobby with escalators, meeting rooms and coffee area. The case study comprehends the second and third floor.

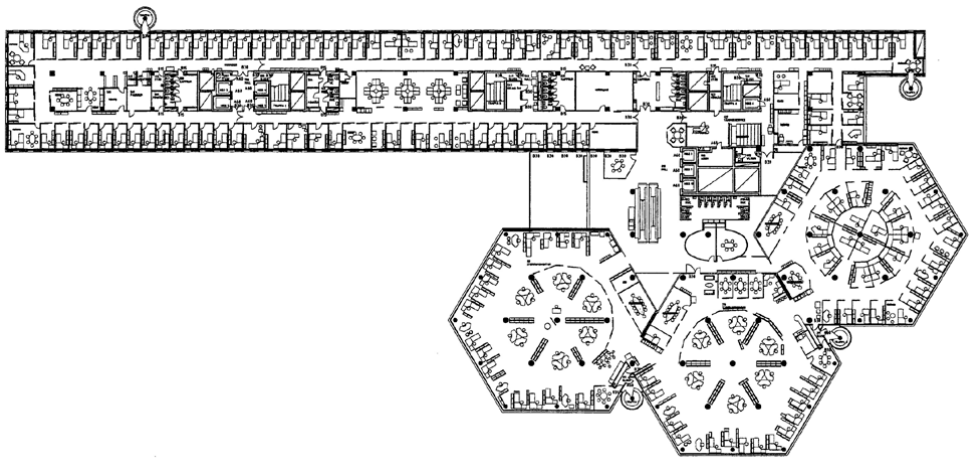

Figure 1. The insurance company, the 2nd floor

The second case study will be on two local revenue offices in Stockholm: two similar organisational units that use different offices with different spatial configurations.

The findings from the first case study are now being processed and will be presented in February 2003. The second case study will start in March 2003. A third study is scheduled for autumn the same year. The whole study will be reported in June 2004.

7. Methods

The work organisation is investigated in interviews with several key persons within the actual company. These interviews also give information about the sequences of work activities for different groups or roles and make it possible to discern different types of work according to the fabric of thought processes and interaction.

The social network analyses are investigated by questionnaires to all persons within the studied organisation. The persons are asked to point out the five most valuable contacts in every of the three mentioned kind (professional, business and social) of support.

The question of time will be discussed in the interviews, asked about in the questionnaires and also registered in the observations. The tool to grasp this variable will however be quite blunt.

The principle of placing different groups and persons within the given spatial system will be studied by comparing the work organisation and the personal work stations at drawings and in reality.

In observations according to the snapshot method, we register on drawings the doings of every person including social interaction. Used categories for persons at their workstation are sitting/standing and alone/talking in telephone/interaction face to face. In common space the categories are for instance meeting/coffee and walking alone/walking and talking. The observations are repeated several times during two or three days in order to get satisfactory statistical mean values.

Simultaneously with the observations the employees are asked to register activities and contacts during the days on a special formula as a logbook.

The building as spatial system is analysed with Space syntax tools as Web Map and Depthmap. The result of these analyses is spatial models showing the degree of integration of different passages and locations. To study visibility we use isovists on two different levels, eye height sitting and eye height standing.

After collecting these empirical data they are processed statistically to see how different values correlates to each other. The starting points from earlier research give us preliminary hypothesis for searching interesting correlations. In this work we study different levels of aggregation of the office workers regarding type of tasks etcetera and personal profiles.

The last moment in every case study is to interpret the correlations, to understand what they are saying. But it is first in the final step in the research project, after the three case studies, that we can analyse and draw conclusions on a higher level according to the aims of the research.

8. Results

As mentioned the work processing all data from the first case study is in process at the moment. Later in spring it will be possible to present both descriptions of the social system and the spatial system and the correlations of these. Here it is only possible to present some rough data.

At the company level we compare values from the earlier study of a company of technical consultants with values from the insurance company. The different activities are compiled in five categories, showing the observed percentage distribution of all persons present at the time of the observations.

Table 1.

	individual work	telephone conversation	interaction (unplanned)	being in common areas	in meetings (planned)
Consultancy company	48%	9%	20%	14%	9%
Insurance company	41%	13%	22%	9%	15%

The differences are very small especially considering that the consultants to very high degree are working in project-teams while the insurance people to high degree work with individual tasks.

The next table shows the observation data from the three different spatial systems within the insurance company building:

Table 2

	individual work	telephone conversation	interaction (unplanned)	being in common areas	in meetings (planned)
Hexagon, open plan	45%	11%	20%	11%	15%
Hexagon, with cells	31%	13%	28%	10%	19%
Double corr. with cells	48%	13%	20%	8%	12%

The configuration of the hexagon - or the spatial form of space for moment – is almost the same for the open plan and the one with cells. What we can read from this, so far, is that the differences in interaction frequency cannot be explained by the degree of openness or spatial integration values, it will be explained by differences in work tasks. In the hexagon with cells we find a concentration of people with special authorities (underwriters, etcetera) in the company, they can be considered as attractors. If we add the information that the walls of the cells are made of glass we understand that it is easy to see when passing by if the person is in the cell. And if the person in question one is looking for has time to talk to you the cell will offer un undisturbed environment for talk.

Figure 2

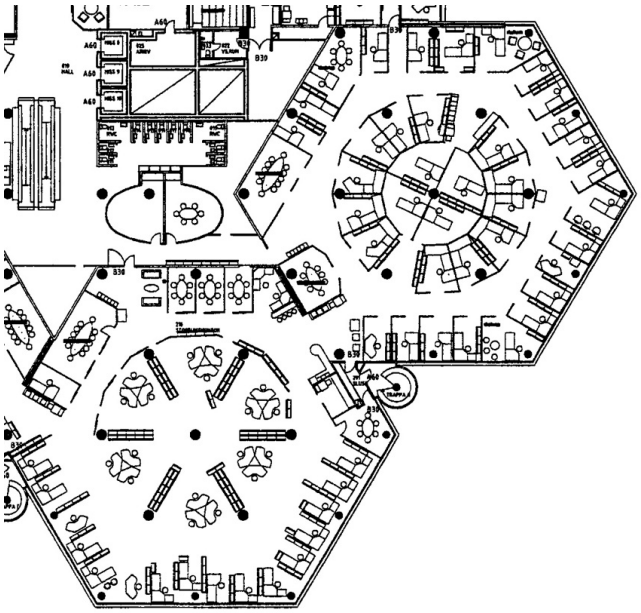

Figure 2. The insurance company, 2nd floor, the hexagon to the right with cells, the hexagon to the left with work stations in open area

Next question concerns the development of spontaneous interaction. To what degree does interaction occur in the common areas respectively at the workstation? The following data is from the logbooks and show how many of different interaction situations there are per person and per hour:

Table 3.

Insurance company *amount of interaction per hour and person*	in common areas	at colleagues work station	colleagues visit my work station	sum
Hexagon, open plan 3rd floor	0,67	0,55	0,66	1,88
Hexagon, open plan 2nd floor	0,56	0,52	0,57	1,65
Hexagon, with cells 2nd floor	0,54	0,47	0,60	1,61
Double corr. with cells 2nd floor	0,46	0,45	0,54	1,45
Double corr. with cells 3rd floor	0,43	0,44	0,56	1,43

On this stage in the research process it is not possible to say anything about the differences in the table. They are effects to some extent of the variables in the social system respectively the spatial system. First after processing our huge amount of data we will be able to analyse and interpret our findings according to our aims.

Bibliography

Hillier, B, 1996, Space is the Machine (Cambridge University Press, Cambridge)

Marcus, L, Steen, J, 1999, "Physical planning for economic growth: a study of urban areas", in Proceedings of Second International Space Syntax Symposium, vol.II, 42.1.

Marcus, L, 2000, Architectural Knowledge and Urban form: the Functional Performance of Architectural Urbanity (dissertation, TRITA-ARK 2000:2, Royal Institute of Technology, Stockholm)

Penn, A, Desyllas, J, Vaughan, L, 1999, The space of innovation: Interaction and communication in the work environment, Environment and Planning B: Planning and Design 26

Spiliopoulou, G, Penn, A, Organisations as Multi-Layered Networks, 1999, in Proceedings of Second International Space Syntax Symposium, vol.I, 13.1

Steen, J, 2000, Kontorsarbetets form (The form of office work), (report, TRITA-ARK 2000:7, Royal Institute of Technology, Stockholm)

Steen, J 2001, "The Office: Form and Space for Action", in Proceedings of Third International Space Syntax Symposium, 45.1