# Spatial and Social Configurations in Offices

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**Abstract**
*The strength of space syntax is the potential to describe the interplay between spatial configuration and social behaviour. There are, however, some important differences between the urban level and the level of buildings. In studies of offices we have found that integration values do not explain the pattern of movements and the positions of interaction. The average interaction frequency is just the same for workstations in different positions, and in different office concepts, despite the fact that many of the "spontaneous" interaction occurs when people pass each other's workstations. To some extent there are spatial explanations for this homogeneity, the studied offices are shallow systems, both when it comes to cellular and to open plan offices. But when we investigate how interaction follows organisational borders in an open plan office we can see that these act strong as walls - almost no interaction crosses the departments borders in spite of some units being spatially well-integrated. So-called spontaneous interaction is obviously to a great extent socially programmed, the spatial influence is weak. Further on we see that visibility is important for social behaviour. Analyzing the social network we find that the office worker has most frequent interaction with persons sitting close by. To some extent this is an effect of placing persons according to the organisation scheme, but still - as we know that work processes in offices are, to a great extent, formed by context - this "use" of the neighbours is also an effect of seeing each other everyday. We also noted that openness is more problematic when it comes to sound. Many people are disturbed by talking in open plan offices and one conclusion is that work dominated by "long questions" suffers from this conversational overhearing, while work dominated by "short questions" has the possibility to balance the negative effects. There is a need both for new office design and for management strategies combining spatial and social configurations in a more conscious way. The findings presented in the paper are from studies of seven offices/companies with a total of about 1500 office workers.*

## 1. Introduction – the lack of knowledge

There is a lot of talk about the new age of office work and office design. Everybody seems to be afraid of being left behind when everything is supposed to relate to the new knowledge society. Consultants, producers and researchers are in the same discourse, using the same argument and aiming at the same concepts, even if elements of pure fashion are sometimes very striking.

Within the field of Space syntax research it has been a great challenge to understand how offices act as spatial configurations. It has been natural to test if the very fruitful results from urban studies correlating spatial properties with social behaviour is applicable also for buildings, and especially for offices, which are supposed to act perhaps differently from more anonymous socio-spatial situations. This interest for movement and co-presence, creating a potential for encounters and interaction, and, in the longer term, a potential for knowledge sharing, is strongly connected with the efficiency of buildings towards both human and economic life, and, by that, the possibilities for a more sustainable society.

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The strategy characterized in space syntax thinking is to keep the analysis on a principal level and look for patterns, not to drown in details which will make everything overly specific. On the other hand the problem may be that the aggregation of data on average levels will hide strategic differences. After some years of trying to understand a bit more of the spatial conditions interacting with social life in offices I think it is possible to take a step further in revealing the processes within offices. Our conclusions from these studies must, however, to a great extent be dependent on our capacity to formulate relevant theories and make relevant interpretations.

There are several important contributions to this building of theories, gathering of data and making interpretations (Grajewski 1993, Hillier1996, Penn, Desyllas and Vaughan 1999, Bafna and Ramash 2007, Peponis et al 2007). But the findings do not always point in the same direction, as recently stated (Sailer 2007). There is still a long way to go to more solid knowledge of the spatial influence on the knowledge processes. This paper is about what can be revealed if we do not only look at the social organisation as a bias when it comes to understanding offices (Markhede and Koch 2007).

## 2. Research question

Our focus is on interaction between office workers in the same businesses, the interaction which motivates a co-ordinated workplace. The main research question is how the spatial configuration of the office influences interactions in the office, and especially that interaction called spontaneous in contrast to the more planned interaction in meeting rooms and break areas. Our next question is how social conditions, like the organisational configuration and the character of occurring work tasks, influence the interaction – do these conditions support or hinder the conditions created by the spatial form.

## 3. Research strategy

Our strategy to investigate our questions have been to study similar office activities/work in different office concepts and different activities/work in similar office concepts. In the first case we studied a technician consultancy firm located in five different buildings (Steen 2001). The next cases were the headquarters of an insurance company with both individual rooms and landscapes and three tax offices with both cellular office, combi-office and cubicles (Blombergsson and Wiklander 2006). After that we studied a newspaper office with open plans, one for the editorial part and one for the administration (Markhede and Steen 2006). The latest case is the head office of the Swedish mail company where we studied three similar floor plans with some differences in work activities (Markhede and Koch 2007, Markhede and Carranza 2007). The idea has been to study what could be called normal office work, that is a relatively independent handling of a certain amount of tasks/commissions. The newspaper case was chosen to be somewhat different.



*Figure 1*
*One of the studied floor plan of the head office of the Swedish mail company Posten*

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Social data was collected by observations, logbooks, questionnaires and interviews, in the last case also by asking for the office workers own mapping of face to face interaction. Spatial data was initially a result of Axman-analysis, in the later cases we used Depthmap and completed with other spatial values.

## 4. Initial findings

In our observations of the so called spontaneous interaction we found that, on average, nine of ten interactions occur at the workstations and one in common areas such as in corridors or at printers. The highest value of interaction in common areas we found in cellular offices, 17% compared to 14% as the highest for open plan solutions. Worthy of note is that in smaller and more enclosed systems - in systems you do not naturally pass and see so many on your way to for example the printer - there are about six movements for every interaction compared to three for larger and more open systems.

In our analysis with space syntax methods we did not find any correlation between integration values and movements, and consequently, not to the outcome of interaction. On the global level there is more correlation with movement, but not with interaction. This is likely to be an effect of that a building as a whole must be, and act as, a tree-like structure.

One reason for this lack of correlation on the local level can be the existence of common functions, acting as attractors and in the position of either counteracting or supporting the spatial properties. And this is obviously not only a question of the position of hard artefacts, managerial persons and experts are also attractors in the spatial system.

Another reason can be that even if the spatial values in our analysis of big differences every studied office are shallow systems on the local level. Almost every workstation is positioned one or two steps from the main passages. The spatial configuration will therefore not create great differences for use and usability as expected.

So far the report has been on the general level, when we look closer at the individual level we will find more variation. On the general level the observed interaction is the same for office workers sitting in cellular concepts as in open landscapes. Looking more in detail we find that some persons sitting in individual rooms are involved in more interaction at the workstations than others in the same concept. If we exclude them who have more interaction depending on special work tasks we find that persons sitting in more visible positions have more interaction than others. This indicates that the distribution of interaction in space is more a question of accessibility for visibility than for movement. Our interpretation is that the longer time the sitting and the passing person can see each other the higher potential for any of them to reflect over the use of interaction and act according to a quick decision before it is too late. To this we can add the conclusion that individuals, who are seen more often than others, are experienced as useful, and therefore, more recruited to interaction (Penn, Desyllas and Vaughan 1999).

Another pattern we found that is strongly related to eye accessibility is the positioning of managerial persons, often a question of how they want to position themselves. Especially in open plan offices we found that the normal pattern is that the head of a group has his/her workstation in the most integrated spot in relation to the inferiors. The manager of the department will thus be found by a local spatial analysis (depthmap) and senior management by a global analysis. This pattern is obvious and, conscious or not, the role of management is without doubt connected to the quality of seeing others and being seen.

## 5. Further findings

In order to understand more of the mechanism which creates so called spontaneous interaction, and the role of the spatial properties in this, we used a new method in our last case, the head office of the Swedish mail company Posten. Our problem had been that we did not know who was interacting with whom. Now we asked every office worker on the three floor plans (in total 250 persons) to map all their interaction during two days. Every persons data is represented in one

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layer in the computer and tagged with the information of the organisation belonging (to departments of 30 to 50 persons).



*Figure 2*
*The same floor plan of Posten as above with organizational borders and dots for all self reported interactions, the colour indicates the reporter's department belonging*

This new method made it possible for us to see that 95% or more of all reported interaction occurs within the same department. And this is the case even in situations where two departments are closely integrated spatially. This means that the so called spontaneous interaction is very much programmed, meaning that you talk to persons who are appointed as your fellow-workers and with whom you are supposed to cooperate and produce a joint result. Perhaps we can say that people are not social in the sense that they are talking to anybody, they economize their sociality. That does not mean that every interaction must be of immediate importance and use, some interactions seem to have the primary role of maintaining the social system on the individual level. Organizational belonging both legitimize and cause the interaction. So perhaps we should not use the concept of spontaneous interaction, but still, if the interaction is programmed in the sense that it is related to work tasks and roles, we do not consider the every interaction to be a necessity, there will be a scale from probable useful to necessary interactions. But they nearly all seem to be related to the formal organisation in a way that can surprise.

What about the spatial preconditions, do they play any role? If every realised interaction was necessary for the work, I think the space design should play a less important role, you could for instance without problem work at distance and make your contacts on demand. It is, however, obvious that the interaction pattern to some extent is a result of each and every person moving around in the office, regardless of the origin aim for the movement. And we can also see in our observations that office workers moving around the office often do more than one activity on the same tour. To move to the printer, the toilet or a colleague will many times include talking to other persons who are passed. Looking at our floor plans in the Posten case with all marked interaction spots we are at first surprised at the homogeneous distribution of interaction in space. Even in the more peripheral parts there is a lot of interaction. Looking closer we can, however, see that there is some differences, in the more central part there is relatively more interaction. Some of this extra interaction we understand as a consequence of more people passing by the centre. If you are sitting in a peripheral part and are moving towards another person sitting in the opposite peripheral part you will pass people in the centre, going to someone in the centre means not passing by persons in the other peripheral part. That means that persons having their work stations in the centre can be sitting at their work station to a larger extent than others and still have their potential "need" of interaction with colleagues satisfied. We must remember that this is the case in a very open plan office concept, the mechanism should however be the same in less visible concepts.

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In order to value the interaction pattern we made a social network analysis. In the questionnaire to all office workers at the three floor plan at Posten we asked for the names of five persons within the whole organisation which the person in question had most frequent interaction with a) face to face, b) by mail respectively c) by phone. As we in this case knew the name and position of both the respondent and the names and positions of the persons pointed out we had the possibility to study the influence of physical distance and also the configurational relations in space.

We divided the floor plan in squares of four, or in some cases two, workstations. If the respondent named a person as sitting in the same square the distance is 0, if the person is sitting in the square next towards, in right angle or in diagonal, the distance is 1, and so on. If space did not matter the expected value should be 5,9 for interaction face to face, according to the answers in the questionnaire it is 1,2. It means that 41% of this kind of interaction occur within the same unit of workstations, 76% of these five-persons-most-face-to-face-contacts are sitting within the distance of 1 and 88% within the distance of 2.

Further on the existence of reciprocal connections are over represented comparing with the result of a random process. That supports the theory of balance stating that a friend's friend is also a friend. When the reciprocal connections count for 60% when it comes to face to face contacts it is much lower for mail and telephone contacts. If we only look at these kind of contacts on the same floor plan we also find that they depend on physical distances, the average distance is 1,8 and 2,5 respectively. It is clear how the mail function both as a substitute and a complement to face to face contacts.

We found this strong effect of distance in the early study of the technician consultancy firm, almost all sitting in cellular offices. We asked for the distance to the five most useful persons and in average the answer was that three of these had the workstation in the proximity (Steen 2001).

Back to Posten, when we analysed the spatial configuration (depthmap) and these reports on the five most frequent contacts we did not find any correlation, neither on the global or the local level.

## 6. Interpretation of the positive side of interaction

The impact of distance on the interaction frequency is significant. As the normal strategy is to position persons who are, or supposed to be, cooperating with each other close together it should not be a surprise. Members of a team obviously understand their task to cooperate for common benefits. But still, there are reasons to question how this positioning fits the organisation of the work tasks into different roles, or, in other words, the social configuration. In interviews aimed at understanding existing work processes in terms of similarities and differences we found that the level of cooperation between office workers in the same group/team is not at all so homogeneous as the results shown by the questionnaires. To some extent these differences are hidden behind "the five persons most contacted", they are relational values and say nothing of how many contacts there are per day.

A reasonable explanation for the importance of proximity is, to begin with, the confidence which is built up as a result of seeing a person regularly. Perhaps it is necessary to add that it seems also to depend on relations at an equal level, that is to say a mutual relation of giving and taking. The effect of proximity, that one talks more with people in one's immediate neighbourhood, is reinforced by the tendency to experience persons one sees often to be more useful.

I will, however, argue for one more explanation of this phenomenon which is about the content of the interaction. We know that it is extremely difficult to get information of what persons interacting are saying to each other without disturbing a situation. And still, if we get that kind of concrete information of the interaction content we would be forced to develop new theories to categorize the data in relevant ways.

Instead of drowning in many different categories of knowledge, some of them relevant for those working tasks and others relevant for these tasks, we have found a principle level where we differ from only two categories of knowledge, or knowledge-related interaction: fact-related knowledge and

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judgement-related knowledge. The point is that if one has a fact-related question one will carefully consider which person one will choose to ask, and if that person does not know the answer he/she will tell that and one will try to get the answer from someone else, or in written material.

When it comes to judgement-related questions one can ask anyone and there can always be an answer, everyone can to some extent understand the question and have opinions because it is not a question of right or wrong. But, just as these kinds of questions so much depend on the understanding of the context one must have confidence in the other's experiences and value system. It is here I believe that it is the persons in one's proximity who one see often and know as individuals to some extent that one will rely upon when it comes to matters of judgements. And this interaction process will strengthen the ties to the persons around. Further on, the possibility of face to face contact in these matters are crucial, many times it is enough to look at the other's facial expression to know his/her opinion. Fact-related questions are more easy to define and transmit via email or telephone.

## 7. The backside of interaction

So far we have looked at interaction as a positive force in office lives. But even if interaction is necessary for businesses there is also a negative side, which must be understood if we want to draw any conclusion about the design of office concepts.

In most office work you are forced to work individually to get expected results. There are limitations for how much time you can interact with others. And as we know that the normal work pattern for office workers is interaction integrated in individual work on an hourly basis - one of the reasons why teleworking is not more widespread – you must handle the surplus of interaction to minimise the disturbances to work concentration.

It is not accessibility to movement which causes disturbances, it is either accessibility to eyes or ears which causes problem. And here the open plan office offers problems of another degree than the cellular concept. The negative side of visibility is, however, more easy to handle as it is about not being forced to visually notice persons passing by. But every action to make a visual situation calmer, as having screens or turning one's back to thoroughfares, will restrict the positive side, the potential to look others in the eye and be recruited into interaction by others, or others by oneself.
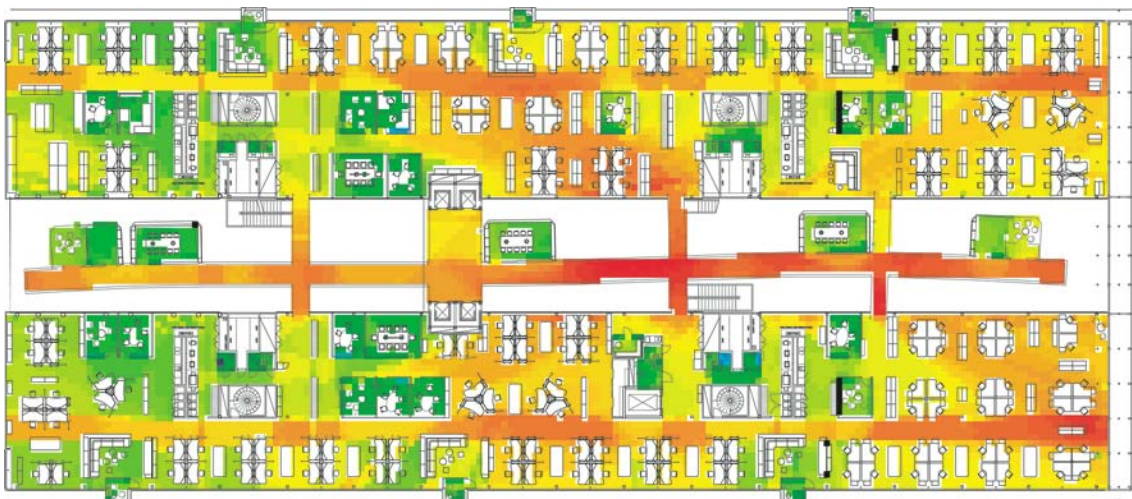


*Figure 3*
*Visual integration (VGA) of the same floor plan as above, 1,8 meters from floor level*

It is the audial accessibility in office landscapes, which causes the real problems if we look at the answers to our questionnaire in the Posten case. We discerned first disturbances in two categories: a) are you disturbed by others interrupting you, and b) are you disturbed by other's

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chat around you. We also asked about the possibility to talk to others undisturbed at one's own workstation as it expresses the feeling of disturbing others and perhaps restricting conversations.

Looking at our depthmap analysis of the three floor plans of Posten we do not find any correlation between spatial values and answers concerning disturbance by interruptions, by other's talk or the possibility to talk at one's own work station.

In order to further test the impact of spatial properties we divided all workstations in one group adjacent to main thoroughfares and another not adjacent. Of all having workstation adjacent answer 27% that they are disturbed several times per day, less people, 23%, answer the same in positions which are not adjacent. The answers for being disturbed by other's talk are similarly distributed, 38% of adjacent main thoroughfares are disturbed several times per day, 31% of those not sitting adjacent answer the same.

The answers to the questions about the possibility to talk undisturbed at one's own workstation have the surprising distribution of 82% of the persons sitting adjacent to the thoroughfares saying no and 86% of the others, in deeper positions, saying the same.

So, nor this division in two simple spatial dimensions show the expected differences in an obvious way.

When we, however, cross check different data from the questionnaires about disturbances and work content we find that the strongest connection to experienced disturbance to other answers is to answers saying that there is a need to be undisturbed mostly. The answer indicates that the kind of work to relatively high degree consists of concentrated work.

## 8. Interpretation of the backside

Many times there is said that the problems (some) people express about the disturbances of noise is an effect of individual properties. Of course it is to some extent true. I will, however, argue that the content of individual work is the key factor for the experience of disturbance. I will turn back to the discussion of the two categories of knowledge.

In my opinion there is a strong point in describing work processes as consisting of tasks which are either characterised as managing long or short questions. Long questions are about tasks which need consideration of the kind as we (above) described as judgement-related knowledge. That means that there is a need for reasoning and juggling, either in one's own head or with others. That is an effect of the fact that long questions must be understood in its context – and change implication when context changes – which demands a chain of thought.

Short questions are more simple to process, they consists of shorter chains of thought and of a bigger share of fact-related knowledge. I think you can say that work processes of this kind are more predictable.

Of course you will find both kinds of questions in most roles in an office. The point is, however, that work dominated by long questions will have more negative effects of interaction than work dominated by short questions, which to a higher degree can utilize the positive side of the interaction. Here we can add the information that one of two office workers at Posten answer that they often get useful information by listening to others' conversation.

According to our findings the negative side of interaction depends mainly on accessibility to sound and will above all affect persons with long questions. In audially open spaces there is a risk of lower efficiency, both due to interruptions and the restriction of more complex conversation as it will lead to others being disturbed. These problems can be hidden behind the fact that there are obvious knowledge exchange processes going on in the open plan offices – but perhaps this interaction over-stimulates the homogenizing of knowledge and the reproducing of the social systems, and not enhancing that kind of knowledge development which will lead to strategic development for the organisation as a whole.

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Looking at the visual accessibility it seems to have a more positive role, and perhaps a relatively active role, as mentioned above. To see others, to see that they are available for interaction, to be reminded that it would be a good idea to talk to that person etcetera – all these qualities will be positive, we think, for the efficiency of work processes. This is the background for our development of the Spatial Positioning Tool (SPOT) intended to be both an analytical and a design tool (Markhede and Koch 2007, Markhede and Carranza 2007).



***Figure 4***
*An example of the potential of Spatial Positioning Tool (SPOT), the users are marked with circles and the darker the more overlapping isovists*

## 9. Conclusions

Let us summarize in four points:

- Office work is to a large extent shaped in the ongoing work processes as a consequence of the combination of two types of knowledge in the work processes: fact-related and judgement-related knowledge. In spite of a wide range of activities in offices and of office concepts the behaviour of office workers is relatively similar, for instance the average frequency of face to face interaction is quite stable.
- Accessibility can be described in three dimensions, for movements which are fundamental to letting people pass each other creating the potential for face to face interaction, for sight which enhances the amount of interaction and hearing that will both be a carrier of information and a disturber. Office design with a new balance between visual and audial accessibility is of great interest.
- All interaction seems to be more or less programmed by the social configuration. Most interaction occurs at workstations and the distance to others plays an important role for especially the most frequent contacts face to face. Spatial distance will in this way

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enhance or reduce the effects of organisational ideas of collaboration between office workers.

- There is a need to understand the difference between work conditions that support work dominated by long and short questions respectively so that management can develop spatial strategies relevant for the aims of the organisation together with other applied strategies.

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