

The Impact of Land-division on Long-term Occupation

The possibility of such a thing as 'natural occupation'.

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Abstract

Within space syntax, space on the urban level is usually studied as the continuous space we commonly refer to as the streetscape of cities. But cities obviously do not only consist of the continuous space of streets and squares, but also consist of the discontinuous space that we commonly refer to as blocks. On the level of the city, streets and squares can be primarily regarded as spaces for movement and blocks primarily as spaces for occupation. By extension, it can be explanatory to say that cities on the most fundamental level are spatial answers to the reconciliation between the two generic functions of movement and occupation. Regarding movement, Hillier et al. has formulated a most convincing and useful concept in 'natural movement' (Hillier et al., 1993). To bring the generic function of occupation on a par with that of movement in the discussion on urban form, maybe we can use this concept as an analogy, asking ourselves what 'natural occupation' would be. If natural movement is "the proportion of movement that is determined by the configuration of space itself, rather than by the presence of specific attractors or magnets", it is proposed in this paper that 'natural occupation' could be "the proportion of occupation that is determined by the division of space itself, rather than by the presence of specific briefs or regulations".

Keywords:

urban form,
occupation, working
areas, legally defined
space, actors,
capacity

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1.Introduction

1.1.'Natural occupation' and 'spatial capacity'

Within space syntax, space on the urban level is usually studied as the continuous space we commonly refer to as the streetscape of cities. But cities obviously do not only consist of the continuous space of streets and squares, but also consist of the discontinuous space that we commonly refer to as blocks. Obviously, both movement and occupation can be found within blocks, just as they can both be found in streets and squares. But it is equally obvious that, on the level of the city, streets and squares can be primarily regarded as spaces for movement and blocks primarily as spaces for occupation. By extension, it is explanatory to say that cities on the most fundamental level are spatial solutions to the reconciliation between the two generic functions of movement and occupation.

There furthermore is a strong argument for such an understanding within the theories of space syntax itself. Hillier points to the fact that the two generic functions of movement and occupation, generally speaking, are difficult to reconcile within one and the same space (Hillier, 1996, pp. 323-325). Therefore, he continues, as buildings grow larger we generally find that different spaces are specialised for one or the other of the two generic functions. Put differently, as buildings grow larger we do not, as in smaller buildings, move from one room with a specific occupational use to another, but rather have specialised spaces for movement (cor-

ridors) connecting other spaces specialised for occupational uses (convex rooms). Now, what is the city if not the very largest 'building' we have, and what is the system of streets and squares we generally refer to as public space if not a system of 'corridors' primarily used for movement, and finally, what are the blocks of our cities with their different premises and properties if not 'convex rooms' for different occupational uses?

Though Hillier's argument that movement is the more influential of the generic functions when it comes to the overall configuration of space in cities is most convincing (Hillier, 1996, pp. 168-170), it does not leave the question of occupation as a generator of urban spatial form without interest, especially if we want to bring the internal spatial order of blocks into the picture. Regarding movement, Hillier et al. has formulated a most convincing and useful concept in 'natural movement' (Hillier et al., 1993). In this paper this concept is used analogically as a means to focus the generic function of occupation, proposing that, if natural movement is "the proportion of movement that is determined by the configuration of space itself, rather than by the presence of specific attractors or magnets", then 'natural occupation' could be 'the proportion of occupation that is determined by the division of space itself, rather than by the presence of specific briefs or regulations'.

To study this, a different conceptual understanding of both urban space as well as the function of occupation is further proposed. Normally we understand the relation between urban space and occupation to be a relation between physically defined space and certain occupational uses, such as dwelling, work or shopping. It is suggested here that this can be a misleading conceptual understanding of the relation, stemming from a too direct interpretation of the metaphor of the city as a 'building'. It is proposed here that the activity of building cities has quite a different rationality than the activity of building buildings. While the building of buildings is a goal-rational activity, that is that the meaning of the activity is fulfilled first when the building is finished, the building of cities can not to the same extent be described as such. Even though one characteristic streak in urban building in the 20th century clearly can be said to be the inclination to understand the building of cities as goal-rational activities, in that cities or large parts of cities clearly seem to have been built as final statements where no future change is expected, it soon turns out to be an absurd attitude. Rather the building of cities necessarily are permanent activities with self-fulfilling rationalities, that is that the meaning of such an activity appears simultaneous with the activity itself (This argument is carried out in further detail in Marcus, 2000).

Figure 1. Physically defined space and legally defined space.



Drawing this to a conclusion it can be argued that cities are quite different spatial entities than buildings in that they on a fundamental level not are spatial artefacts that, at the side of organising movement, organises a series of occupational uses, such as dwelling, work and shopping, but spatial artefacts that organises a single activity that all these other activities have in common, namely the activity of building. This finds historical support in that what through history has been the fundamental concern in urban planning, not so much has been the urban fabric of actual buildings, as the urban structure of building sites, that is the plots or premises of cities. Thus we can start to formulate a conceptually different relation between urban form and occupation. Instead of being understood as space physically defined by buildings, urban space can be understood as space legally defined by land-division, and the activity of occupying space in the city, especially long term occupation, can instead of a series of occupational uses such as dwelling, work and shopping, be understood as the single activity of building. The connection being the premises of the city which on the one hand are legally defined spaces for the activity of building, and on the other are spaces where different actors in the city occupy space by building.

Thus a tool aimed at analysis of urban space for occupation, where this space is legally rather than physically defined has been developed. Basically it is a measure of the ratio of premises per area unit, applied to selected parts of an urban context, such as a street or a block. This variable is called capacity, as it can be understood as a tool to measure the capacity of urban form to carry differences when it comes to occupation. The assumption is that parts of cities with a high capacity are able to hold more occupants in the sense of land-owners - understood as the primary building-actors in the city - and thereby more differences than parts with a low capacity. This would seem to be an obvious relation, but what is also proposed is that a high capacity can have an impact on secondary actors or occupants, such as businesses leasing or renting space from the primary actors. We thus have two kinds of actors where the fundamental division of land into premises is proposed to have an impact on their distribution. Firstly, landowners, which are called primary actors, and secondly, businesses of different kinds, leasing land or renting floor-space from primary actors, which are called secondary actors.

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2. The spatial capacity of Sodra Hammarbyhamnen

2.1. The working area of Sodra Hammarbyhamnen

In a study in 1995 of a working area close to the city core of Stockholm called Sodra Hammarbyhamnen, interesting correlations were found between the spatial division of land and the distribution of actors in the above sense, which seemed to point to the existence of

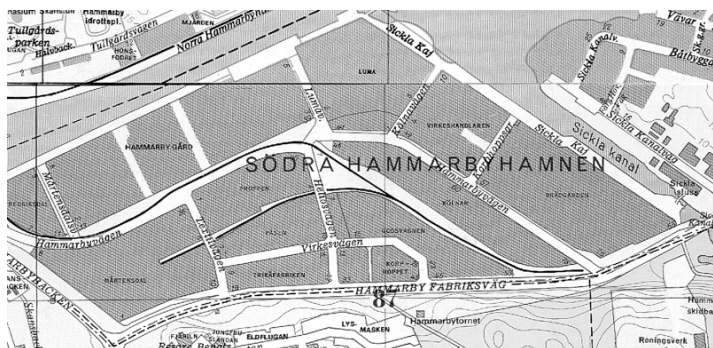


Figure 2. Sodra Hammarbyhamnen.

a relation between spatial capacity and the frequency of actors, as well as the diversity among them. This makes the study of general interest and it will be presented in some detail before heading on to further studies of the same kind.

The working area of Sodra Hammarbyhamnen was until recently used solely by work places, ranging from small offices and artisan and trade activities to light industries and warehouses. Thus the density of the area varied greatly, as well as the standard of buildings located in it.

The frequency of premises in the area is calculated per block rather than per street, in order to avoid lack of clarity as to what street an actor belongs, since many of the premises border on more than one street.

2.2. Spatial capacity and primary actors

It came as no surprise that there was a strong correlation between the frequency of premises, that is the spatial capacity, and the frequency of property owners, that is the primary actors in

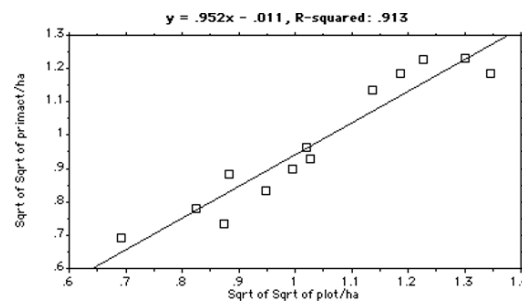
the area. Calculated for every one of the thirteen blocks in the area, the correlation value for this relation was 0.913, meaning that blocks which had more premises per hectare also had more property owners per hectare.

This is more or less self-evident.

Still, the difference between urban areas where you can find many primary actors and areas where there are few, is nothing less than fundamental. However much we try to create diversity - meaning everything from architectural variation to diversity of social and economic content - within the same premises, there seems to be a homogenising effect that over time subverts such ambitions. Thus, the lack of recognition of this relation within urban planning and design in the 20th century, can be said to be one of the major reasons why in recent years, when facing a growing demand for traditional urban qualities, one has not been able to recreate them.

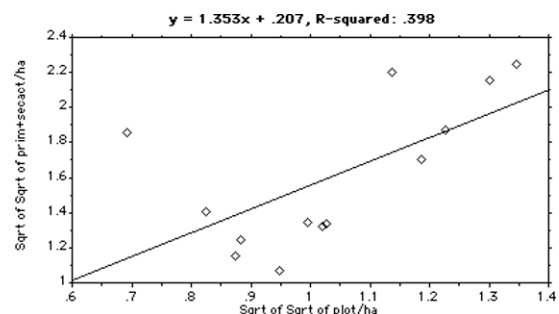
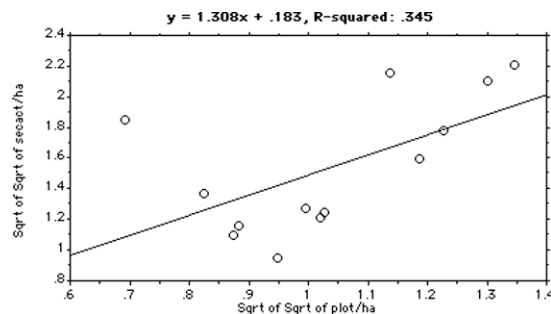
The tentative theory to explain this effect, which we are about to check empirically, goes like this: Since a set of premises can only have one owner they can only be subject to one economic strategy, while the same area divided into many premises can have many owners and therefore be subject to many strategies. Even if the strategy of an owner, in the case of only one set of premises, may aim for great diversity, such diversity, in the case of many premises, seems to be more or less a function of the spatial division of land itself.

Figure 3. Correlation of capacity (x) and primary actors (y).



**Left
Figure 4. Capacity (x) and secondary actors (y).**

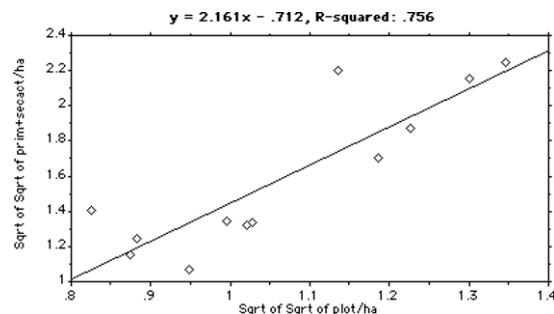
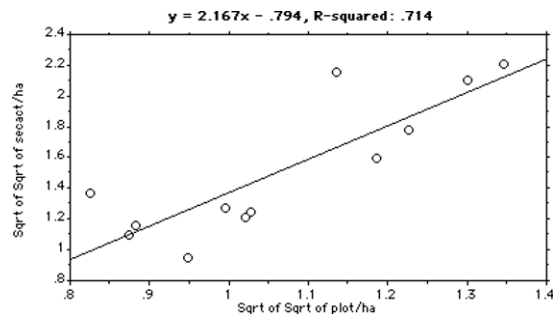
**Right
Figure 5. Capacity (x) and actors in general (y).**



2.3. Spatial capacity and secondary actors

When comparing the frequency of premises to the frequency of businesses renting floor space, that is secondary actors, from primary actors within the area, the correlation value is 0.345.

That is not a strong correlation, but when looked at in some detail it is quite clear that the bad correlation to a large degree is due to one single block, called Luma. This block further consists of only one set of premises, which means that it has only one primary actor and consequently is subject to only one strategy. Thus we here have a case where diversity is reached without the presence of high spatial capacity.



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Generally speaking though, diversity seems to follow capacity, which becomes clear when leaving the block Luma out. The correlation between the frequency of premises and the frequency of secondary actors among the remaining 12 blocks is no less than 0.714, and when also including primary actors, considering them as general economic actors in the area, 0.756.

Thus we can see how a great number of secondary actors could be generated irrespective of space, but also that, generally speaking, a high spatial capacity seems to also imply a high number of secondary actors. We must remember that what we are looking for here is if and to what extent space can have an impact on this matter. That other variables can be more important in certain cases does not contradict the importance of space and for that variable, we have also seen a rather clear correlation between the division of space and the number of actors.

2.4. Spatial capacity and economic diversity

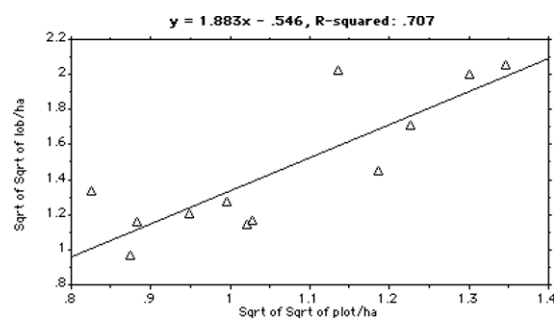
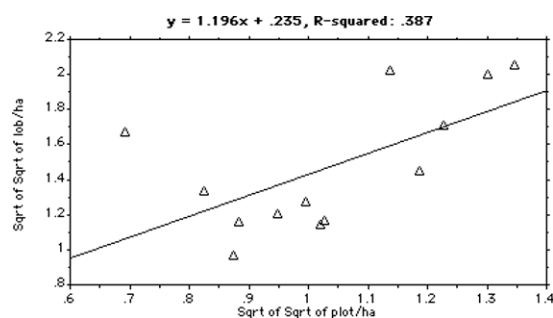
The next step was to see if this also implied a correlation regarding the degree of diversity among the secondary actors. The correlation between the frequency of premises and diversity proved similar to that between frequency of premises and secondary actors. For the whole

Upper-left
Figure 6. Capacity (x) and secondary actors (y), leaving out one item.

Upper-right
Figure 7. Capacity (x) and actors in general (y), leaving out one item.

Lower-left
Figure 8. Capacity (x) and lines of business (y).

Lower-right
Figure 9. Capacity (x) and lines of business (y), leaving out one item.



sample, the correlation is only 0.387, but once again, when leaving the block Luma out it rises to 0.707. To be more specific, this implies that blocks with more premises per hectare to a fairly strong degree are blocks with more lines of business per hectare.

This seems, as far as this very limited study goes, to suggest that there can be not only a correlation between spatial capacity and the frequency of primary actors, but, more interestingly, between spatial capacity and secondary actors and furthermore the diversity among these actors. Since diversity, at least since the publication of *The Life and Death of Great American Cities* by Jane Jacobs, has been one of the urban qualities most searched for, this finding seemed promising and called for further studies. Thus four more areas were looked into to investigate if this pattern was of a more general kind.

3. The spatial capacity of other working areas in Stockholm

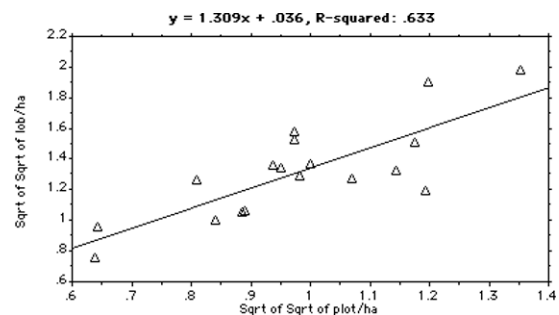
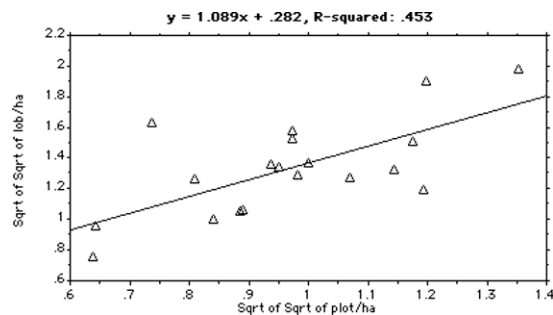
3.1. Kista

Kista is the most recent of the working areas in the study. It was developed during the second half of the 1970s and was from the start very successful, as it soon managed to establish itself as the centre for high technology in Sweden, with renowned companies like IBM, Hewlett Packard and Ericsson choosing to settle there. This also implies that the area is very different from Sodra Hammarbyhamnen.

To start with the relationship between the frequency of premises and the frequency of property owners there is, as expected, again a strong correlation. The correlation value, at 0.916, is very close to the level in Sodra Hammarbyhamnen, which implies that most property owners in the area own one set of premises per block. When it comes to the impact of spatial capacity on the frequency of secondary actors, the correlations are once again weaker, being only 0.352, while rising to 0.460, when calculating primary and secondary actors together. Just as in Sodra Hammarbyhamnen though, the bad correlation is to a high degree due to only one item, a block called Keflavik.

Left
Figure 10. Capacity (x) and lines of business (y).

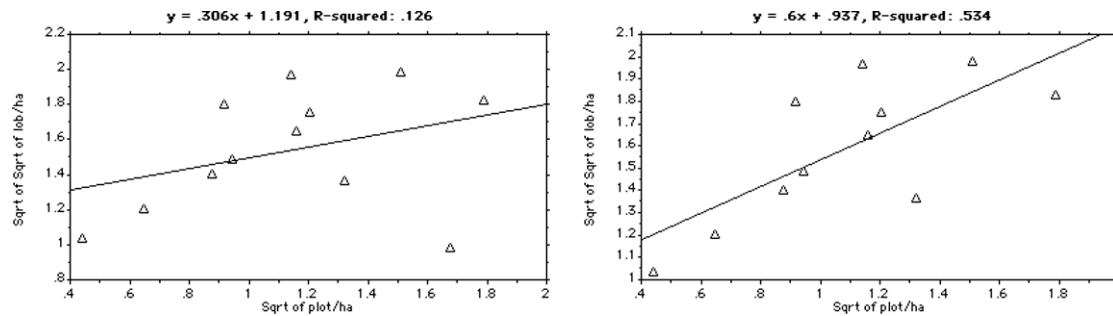
Right
Figure 11. Capacity (x) and lines of business (y), leaving out one item.



When leaving that block out and calculating the correlation for the remaining 18 blocks, a considerably higher correlation of 0.571 is found, rising to 0.687 when calculating primary and secondary actors together. This showed that the earlier pattern where a high frequency of premises - and therefore a potentially high frequency of economic strategies - implied a high frequency of secondary actors, also could be found in this area, though not as strong. This is

still gratifying, since Kista is a very different kind of area, in regard to both its economic contents and built form. The similar patterns found in both areas, suggests then that the spatial variable of capacity and its impact on long-term occupation can be of a general kind.

Finally, the pattern was also found regarding the diversity of lines of business among the secondary actors. Leaving out the block Keflavik, which diverged from the pattern earlier, resulted in the correlation value of 0.633.



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3.3.Liljeholmen

Liljeholmen is an area in transition. Large parts have already changed from industrial to office use, while other parts currently face development for housing. This makes the area one with relatively large differences in use, density and building standard. This area proved to be the one that complied least with the patterns found in other working areas.

The correlation between the frequency of premises and the frequency of property owners, which earlier on had proven to be most reliable, was still found, but to the surprisingly low degree of 0.605.

Still, the results are far worse when turning to the relation between frequency of premises and secondary actors. Here not much of a pattern is found at all. The correlation value is only 0.075. Grouping primary and secondary actors together does not help much; it only brings the value up to 0.122. Still, even though the scatter is most uneven, one item deviates more than others, a block called Stranden. This time it is a block underproducing compared to the more general trend. Leaving this item out, the correlation value rises to 0.359, for secondary actors and to 0.399 for primary and secondary actors calculated together, still not producing much of a pattern. The situation is better though, concerning the diversity among the secondary actors reaching a value of 0.534, when leaving Stranden out.

Liljeholmen does not seem to comply with the patterns found in the other areas then, and the conclusion could be that even if there seems to be a correlation between the frequency of premises and the amount of secondary actors as well as the diversity among them, it is not very robust. It can easily be overthrown, since diversity also can be created irrespective of space. Still the correlation in two of the areas is fairly strong, which implies that space also plays a part in the matter.

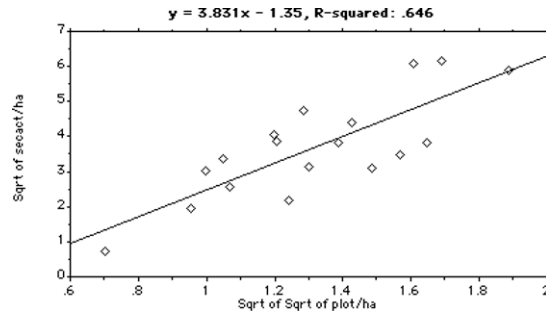
3.4.Ulvsunda

Ulvsunda retains much of the character found in Sodra Hammarbyhamnen, with a basic mix of artisan and trade activity together with light industries, warehouses and a few offices.

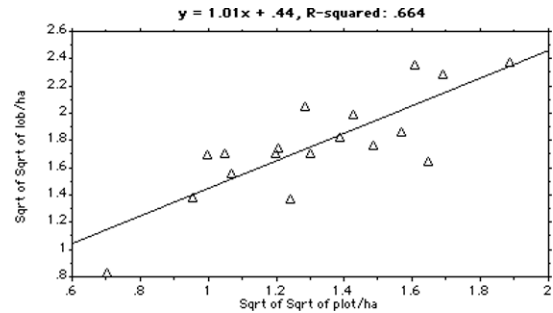
Figure12.(Left)
Capacity (x) and lines
of business (y).

Figure 13.(Right)
Capacity (x) and lines
of business (y), leav-
ing out one item.

Starting with the relation between frequency of premises and frequency of primary actors, the correlation for this area is 0.812, a bit lower than expected. A correlation is also found at the next stage when looking at the relation between the frequency of premises and secondary



Upper-left
Figure 14. Capacity
(x) and secondary
actors (y).



Upper-right
Figure 15. Capacity
(x) and lines of
business (y).

actors. The correlation value for this relation is 0.646, rising to 0.738 when combining primary and secondary actors. This is a quite strong and convincing result, since the area comprises the largest sample (18 blocks) and does not produce any clearly deviating items. The same thing happens when we go to diversity among the secondary actors, where a clear correlation at 0.664 is found.

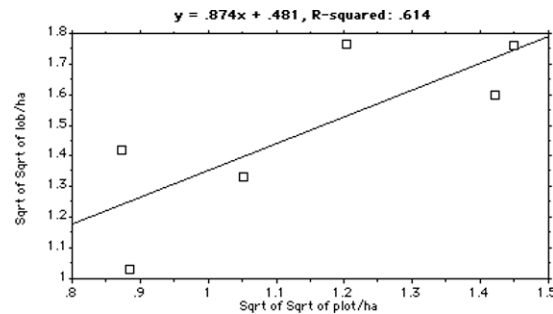
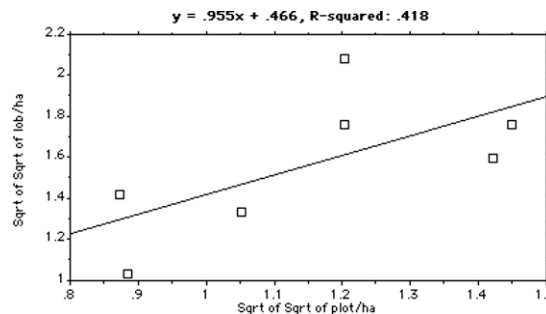
On the whole, Ulvsunda seems to be a most consistent area that confirms the patterns found in Sodra Hammarbyhamnen and Kista, thus supporting the impact of land-division on long-term occupation.

Lower-left
Figure 16. Capacity
(x) and lines of
business (y).

3.5.Vinsta

Vinsta is a working area developed in the 1950s and 1960s, giving it a character somewhere between the older working areas of Sodra Hammarbyhamnen, Liljeholmen and Ulvsunda and the fairly new one in Kista.

Lower-right
Figure 17. Capacity
(x) and lines of
business (y), leaving
out one item.



The correlation between the frequency of premises and the frequency of primary actors proved to be clear and strong in Vinsta at a value of 0.959. Moving to secondary actors the correlation was similar to that in Sodra Hammarbyhamnen and Kista, with a value at 0.425 that rose to 0.540 when calculating primary and secondary actors together. Just as in these areas though, there was a stronger pattern hidden behind the distortions caused by one single block. This block, called Stenen, once again comprised only one set of premises. Leaving this block out, the correlation rises to similar levels as in the earlier areas. To 0.632 for secondary actors by themselves, and to 0.748, for primary and secondary actors together.

A similar pattern is found when looking at the diversity among the secondary actors. With the whole population the value is 0.418, but when leaving Stenen out it rises to 0.614.

	S. Hammarby	Kista	Liljeholmen	Ullsunda	Vinsta
blocks(ha)	0.6-10.8	1.1-7.9	0.5-15.5	0.2-20.7	0.4-9.8
plots/block	1-6	1-10	1-11	1-15	1-11
plots(ha)	0.1-4.9	0.2-6.0	0.1-12.2	0.04-13.6	0.1-5.1
cap./prim.act.	0.913	0.916	0.605	0.812	0.959
cap./sec.act.	0.345(0.714)	0.352(0.571)	0.075(0.359)	0.646	0.425(0.632)
cap./p.+s.act.	0.398(0.756)	0.460(0.678)	0.122(0.399)	0.738	0.540(0.748)
cap./lin.o.bus.	0.387(0.707)	0.453(0.633)	0.126(0.534)	0.664	0.418(0.614)

3.6. Conclusions

On the whole, these studies seem to suggest that the spatial variable of capacity has an impact on the economic content of different working areas. Firstly, there is a strong correlation between the frequency of premises and the frequency of primary actors, that is property owners. While this is more or less self-evident it is a quality of great importance to the character of urban areas that clearly can be said to have spatial roots. What was not self-evident though, and which the studies at least suggests, is that a high frequency of premises also have the potential to bring in more secondary actors to an area, that is companies or other economic enterprises renting floor space from the primary actors. The studies also suggest that this in turn has an impact on the diversity within the area, in the sense that more secondary actors were found in different lines of business when the frequency of premises was high than when it was not.

4. Conclusions concerning the spatial capacity of five working areas in Stockholm

4.1. All the working areas taken together

We seem to have found the same patterns in all our working areas, except in Liljeholmen. Each of them, taken alone, constitutes a rather small sample though, varying between seven and 19 units, which makes it interesting to see how they would perform if taken together. We would then have a sample of 69 units, taken from five working areas of quite different character.

If for these 69 units we again start with the correlation between the frequency of premises and the frequency of primary actors, we get a value of 0.863. This relationship has shown itself to be consistent and clear throughout the different areas and remains so when the areas are taken together. This is no great surprise, but constitutes the first step towards more rewarding patterns.

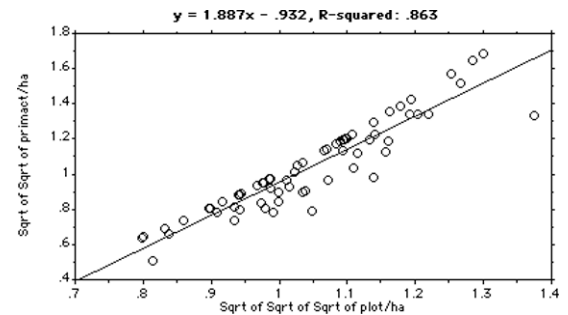
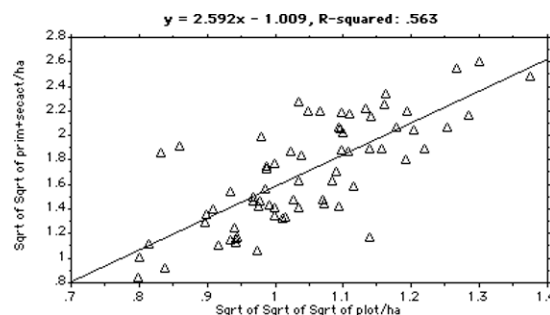
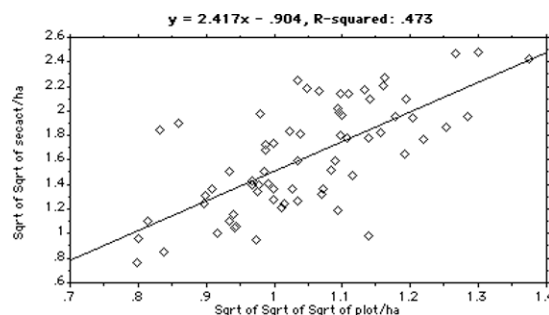


Figure 19.

Lower-left
Figure 20.

Lower-right
Figure 21.



38.10

A scatter plot showing the relationship between the square root of the square root of the square root of the plot area (x-axis) and the square root of the square root of the square root of the seed yield (y-axis). The x-axis is labeled 'Sqrt of Sqrt of Sqrt of plot/ha' and ranges from 0.7 to 1.4. The y-axis is labeled 'Sqrt of Sqrt of Sqrt of seed/ha' and ranges from 0.6 to 2.6. A regression line is fitted to the data points, with the equation $y = 2.812x - 1.327$ and an R-squared value of .611.

Figure 23.

$y = 2.964x - 1.409, R\text{-squared} : .693$

Sqrt of Sqrt of prime/sect/ha

Sqrt of Sqrt of Sqrt of plot/ha

A scatter plot showing the relationship between the square root of the square root of the square root of the plot area (ha) on the x-axis and the square root of the square root of the lab area (ha) on the y-axis. The x-axis ranges from 0.7 to 1.4, and the y-axis ranges from 0.6 to 2.6. A positive linear regression line is fitted to the data points, with the equation $y = 2.223x - .786$ and an R-squared value of .536. The data points are represented by open squares.

Figure 25

$y = 2.535x - 1.118$, $R\text{-squared: } .659$

Y-axis: Sqrt of Sqrt of lob/ha

X-axis: Sqrt of Sqrt of Sort of Sort of plot/ha

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same premise. All these three cases also turn out to be owned and maintained by property-owners with a rather new property strategy which we can call 'office-hotels', that is letting floor-space to businesses, often rather small, while also offering more than just the basic services. There can be a common switchboard, restaurant and meeting-rooms for example. This shows that diversity can be generated within premises as well as between them; but when taken by itself, the spatial division of land seems to have a strong impact in itself.

4.2. Conclusions

Having taken the five working areas together like this, I think it is possible to say that we have detected a general pattern within them, which connects a spatial variable to a social variable. The spatial variable of capacity, here defined as the frequency of premises per hectare, counted per block, correlates to varying degrees, to the frequency of both primary and secondary economic actors, in the sense discussed earlier on, and furthermore, to the diversity among these actors. This seems to be of great interest when it comes to spatial analysis, since it seems to be a relation that describes the impact of space on long-term occupation in an area. Since we are dealing with working areas with their very few regulations I believe we can speak about something resembling 'natural occupation', in that what seems to determine the distribution of occupation is the division of space itself rather than certain briefs and regulations.

It is important to note that the degrees of correlation were not very robust though, in that they varied within the analysed areas as well as between them. A fundamental reason seems to be the inherently local character of this measure, which solely relies on values within the unit analysed. From this one can draw the conclusion that the variable of capacity could probably be developed into greater robustness and accuracy if one could find means to relate it to more global measurements. One obvious such measure is spatial integration as developed within the tradition of space syntax. It seems promising to try to couple this measure to capacity in some way, since it seems likely that variations in degree of integration in the street system also influences the occupation ratios in the premises.

To illustrate this, one possibility would be to represent the different premises by lines on an axial map (A preliminary study in this direction is found in, Marcus and Steen, 1999). This would for one thing influence the overall integration pattern to a certain degree, possibly offering a more precise description in certain cases. Further, it would present the possibility of capturing in the same analysis not only movement, but also occupation. It simply would be possible to relate the integration values in such an analysis to movement, while the connectivity value - that is how many lines are directly connected to each line - would come very close to the number of premises along a line, which as suggested above, would capture aspects of occupation (Another and maybe more precise procedure would be to represent premises as added spatial elements to a street grid, as Hillier has done with retail units, Hillier, 1999, p. 177).

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