THE MOSAIC OF THE URBAN LANDSCAPE OF STOCKHOLM. AN ATLAS OF THE URBAN STRUCTURE OF THE STOCKHOLM REGION

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ABSTRACT
The context for creating this atlas was the urban and regional planning of Stockholm metropolitan area. The purpose of the project was to create a cartographic “meeting place” between the regional planners and the citizens – a common cartographic frame of reference for public and private thinking and interests (MacEachren 1994). The interpretation of this main task was to create clarity in visual terms about an area of great complexity i.e. the Stockholm region. The atlas was published in winter 2009. It was appointed by the Swedish Cartographic Society as “The Map of the Year 2010”.
The process of design includes creating
1. THE FRAMEWORK OF REFERENCE: to identify and delimit the area. Thereafter to create a cartographic framework of reference, a cartographic background, that is clear and understandable enough to be shared amongst planners and citizens. The clarity of this orientation system, this background map (-system), is of critical importance for such a project, often difficult to create and frequently neglected.
2. THEMATIC CONTENTS: the aim is to create an analytically oriented cartographic portrait of the region. The approach can be seen as an attempt to describe “the urban drama” – the everyday life in the region. It takes place on the urban scene, populated by actors who play their parts – carry out their activities. The chosen balance between these three components will be one of the results of the analytical process when the atlas is created.

INTRODUCTION
Background
The Stockholm area has probably the most comprehensive geographical-statistical data collection for urban and regional planning in Sweden. The county is one of the very few areas with elaborate and systemically updated regional planning system in Sweden. A great number of planners are active in the region. A great number of planning studies were carried out and published during at least during four decades. The studies and plans cover a vast array of architectural, infrastructural, social, environmental etc topics. The sheer amount of information in different specialities in itself create a necessity of rather concentrated yet easily accessible survey of the area covering some of the most central elements of the regions structure.

MAKING THE ATLAS – THE TRUE, BUT SUBJECTIVE STORY
The conventional way of presenting a project like this is to describe the process as a logically connected chain of efforts. In many cases – and definitely in this one – the truth is somewhat different. The first part of this presentation is an attempt to describe the process according to how the author of the atlas and for these lines, experienced the process. Thereafter a systematic analyses will follow.
Even if it recognised that the process is not entirely systematic, there are two basic elements reoccurring: the exploration – systematic analyses of data and other sources - and the design, the syntheses of the findings to a cohesive image

The exploration
The real process of the introductory study is very much alike traveling by an airplane above the region. The plane is circulating over and over again, sometimes diving to very low levels, where details of the landscape reveal themselves but later on rising to much higher giving a good overall picture above the region. The view is confusing first and changing all the time, resulting in still more confusion. Afterwards a few glimpses of clarity show themselves and growing afterwards to a more and more cohesive structure. The process of “circulating” is of course means making a series of maps as sketches (based, of course on a sample of data), and trying to find a main underlying structure of the region. The sketches give sometimes satis-factory results, sometimes just the opposite. The failure depends frequently poor treatment of the subject, poor cartographic design (that, fortunately, can be improved by repeated attempts) but sometimes that the whole approach turns out to be wrong and must begin at an-other end. In that way the analytical “exploration” and the design, the synthetically elements are interwoven leading to a successively growing understanding of the region and a parallel growth of the cartographic stuff. Then you sort out, say, half the
maps aside when you coordinate the singular maps to create an intellectual cartographic structure mirroring the geographical structure of the region you found. At the end you have – hopefully – an atlas with acceptable quality, where the single maps area clear, they contents are carefully interconnected and which fulfill at least the most central, previously formulated, requirements.

**The design**

The essence of cartography is communication: the map (or whatever cartographic product it may be) talks – hopefully – to the reader. The process of making the map – the cartographic design – in itself contains also central element of communication. It is basically a long chain of dialogs. It is only in limited extent verbal – it is mostly visual, taking form in sketches – and its content can only partially be expressed by words. Some fragments of the dialog could be transcribed by words as follows.

The cartographer turns in his mind to his would-be reader and asks questions like “Who are you? What does your world look like? What is important in your visual surroundings? What spatial elements are important in your professional life? How do you read maps? Why do you read maps? Do you read maps at all? How can I translate your world to maps? How can I help you to find your world in my maps and express your ideas and requirements with their help? How can I introduce you to my world, expressed by my maps?” Etc.

You present the developing atlas to your colleagues, who advice you as would-be users, and others, who support you with finding your way in the labyrinth of data sets. You ask questions and listen care-fuly to their comments, what is new there even for them and what they find interesting and uninteresting. You listen also with grate care to the specialists in data sources to find new, for you previously unknown entrances to the treasury of data sets.

The design process in itself is an ongoing dialog. You talk to your-self while working: “What is my real purpose with this map (or atlas)? What am I trying to tell the reader? Does this map tell him just that? Does this type of symbols express this specific information? Is there other type of symbols which are more expressive? Can I design a new type of symbol instead? Does the background map show enough details so the reader can locate the symbols? “

You look at the first version, the first sketch of the map and ask questions, like: “Does this map talk? Would it be more expressive if I emphasize these elements more (in practice: would a more intensive colour in combination with another type of line make it easier to perceive the map as a whole? Do I need play down some areas by using another pattern?)”

You look at the first layout of the would-be atlas and go on asking questions like: “Is the disposition OK? Does the reader have a real opportunity to get an overall picture of disposition by the table of contents? Are there to many maps? Are there missing elements? Are all the maps necessary in that one sequence or should I place several of them in an appendix for keeping the main line of reasoning clear? Are the text commentaries enlightening enough to support the understanding of map? Do I use a language which is understandable to others than professionals? What do my colleagues say about that?”

This flow of question is bombarding you all along the process until you print/publish the map/atlas and probably even thereafter. There is no strict logic in that flow: questions of different levels used to blend. In the beginning of the process you frequently have a hazy but coherent image in your mind what do you want to achieve. The longer the work is going on, the stronger the turbulence grows and the questions of main disposition blend with the seemingly elementary design decision. This turmoil not always an expression of confusion: the smallest design decisions frequently have a bearing on the qualities of the whole product – even if that instinct is more intuitive than logically formulated. The closer the finished product you get the clearer the evolving picture grow. The clear picture of the result appears – as everybody knows – first after a longer time, when you finished your project.

The contents of the section above can be and used to be summarized in a few lines. The price for the concentration is that real human essence of the process is suppressed. It is surprisingly difficult to find descriptions of the real cartographic design process. A probable reason is that it is rather difficult to denote the personal experience of it. A second reason that those experiences are strictly personal and their relevance for other cartographer can be questioned. A third reason can be that it is difficult to express the process with the stringency demanded by professional publications.

The author of these lines does no share these points of view. The cartographic design process is a personal experience. It is a complex process, where professional knowledge of the subject – here: knowledge about planning and geography - meets the cartographer’s ability of visualization and enriched by and synthesized through his imagination. That complexity gets lost in summarizing elements of the process. And besides
that: student of cartography might find stimulating and perhaps also rewarding to read about the real, personal experiences of mapmaking. Even experienced colleagues might do so.

**THE TRUE, BUT EDITED VERSION OF THE STORY - SOME BASIC MOMENTS IN THE PROJECT**

1. Identifying the potential reader’s requirements for contents and cartographic qualities
2. Delimiting the geographic extent of the project
3. Building up a referential system
4. Filling the system with adequate information contents

**1. Identify the potential readers' requirements**

*Who are the potential users?*

Urban and regional planning is essentially a process of communication. In this process two group of people meet: the planners and the citizens, for whom the planners work. The two groups have two different geographical approaches when entering the planning process. The citizen’s approaches the planning problems through his own personal mental map. Its focal points are the places he frequently visits – place of work, place of residence, place of school (of his children or of his own), place of his holiday cottage but even place of the frequently visited downtown area etc. The personal mental map may be rather hazy outside the area defined by these focal points and the communication lines connecting them. The image can be described as egocentric, not in psychological but geometrical terms as described in the theory of central perspective (the closer an object is to the viewer the larger part of his view it occupies). The citizen formulates his requirements on the plans with his mental map as departure point. In the Stockholm area there are more than one million citizens – all of them having their own personal mental maps.

The urban and regional planners look at the region with birdeye or satellite perspective. The task is to get the two set of images closer to each other.

The problem is, however, more complicated than that. The “planner” is not a single person or a homogeneous body of persons with identical views of the world. A few of them are experts in regional, integrated planning. Most planners are however, trained specialists (traffic planners, public health planners etc.) Their way of looking at the region is just as “egocentric” as the citizen’s but their “egocentricity” is not geographical but rather professional ones.

At the end there are another group of decision-makers: the politicians, who gave the directory lines for planning the region, and who not only decide about single projects but also about the main lines of the development in the region.

The goal for creating an atlas for the region is then to create a framework where all those different “planners” – all the citizens, planning their own life - and the manifold of more or less professional planners can find their own place and to which they can connect their personal and professional mental maps.

**Information strategy**

The key word is clarity. The question is, however, what does this self-evident word mean in this context?

In this particular case first of all it was necessary to understand the reason, why it was so difficult to get a cohesive, clear picture of the region. Then, when the underlying main geographic structure of the region was found, it must be presented by a carefully chosen visual strategy. This strategy must include both the design of singular maps and the composition of the whole atlas.

**Clarity – the interpretation in this project**

Clarity is interpreted here as the possibility for the reader to connect his own mental image to the different cartographic presentations in the atlas. With other words: he must be able to recognize crucial elements of his personal mental image in the different maps. Then, with help of the presentation he must be able build upon his own, previous knowledge of the region.

These requirements must be fulfilled for potential readers with many different backgrounds. The maps have to be eligible to any reader who is able and willing to read a map but he is not supposed to have any professional background. The atlas must function like a narrative, where the overall image of the region reveals itself by reading chapter by chapter. Hence the key notions must be introduced successively. A zoom technique is frequently used. Maps of the whole county faces frequently the central part of it, enlarged and more detailed. As alternative to the narrative technique even singular maps must be readable without a long introduction. Every map must have exhaustive legend, if necessary completed with inserted
notes and explanations within the surface of the map. Every map is completed by explanatory text to create together with the map a “self-contained” unit.

2 The geographic extent of the project

There is a strong interaction between the Stockholm area and the rest of the country. Yet the area of analyses were delimited to the county of Stockholm, not least because the data availability. The region is shown in a national geographic context but the interactions are out-side the scope of the atlas.

When looking for the main focal point for the atlas a peculiar question arise: what does the name “Stockholm” mean to different people? The County of Stockholm is known as an administrative area. The name stands also for the City of Stockholm, the administrative area of the city (well known to all citizens – you pay your tax there). For most Swedes “Stockholm” means the cohesive, densely built up city like area in spite the fact that it contains only a few percent of the county’s urbanized area. The name is frequently associated also with downtown Stockholm, a minor part of the city. An entity which is absolutely unknown to most people is the agglomeration of Stock-holm, the largest agglomeration in Sweden. Even if its identity was not well known, it is a coherent functional unit, making up the functional core of the region and the whole country. The mapping process revealed also that a visual realization of its extent and central position was necessary to understand the county’s urban pattern. Hence it was chosen as the geographical focal area and got a specific cartographic expression.

3. Building up a visual referential system

Basic elements I: Urban agglomerations

All urban areas in Sweden are registered as urban agglomerations, usually mentioned just as “agglomerations”. The criterion for an agglomeration are high density – distance between buildings less than 200 meters – and population weight – a population 200 inhabitants or more. Hence the single term “agglomeration” includes everything what previously was called “city”, “town”, “village” etc. The agglomerations are delimited each third year.

Basic elements II: Administrative divisions

The urban agglomerations together represent the physical extent of the built up and inhabited areas. There is, however, another, related but independent system: the administrative division of the country. It is hierarchical division with county and municipality as main elements. In many parts of Sweden there is a further hierarchic division into areas for planning purposes and for collection of statistic data with the single real estates as the smallest unit.

The clash of the two systems

The anonymity of Stockholm’s agglomeration depends mainly on the lacking conformity between the physical pattern of the urbanised areas on one side and the administrative division of the land by municipality borders on the other. This culminates in the agglomeration of Stockholm: it is divided by no less the eleven (11) municipalities. One of this is the Stockholms Stad, the municipality of Stockholm, containing a large part of the agglomeration’s inhabitants and area. The name and identity of the municipalities are well known – in contrast to the agglomerations’.

Establishing the focal area

To begin with the known and move towards the unknown: this was the – once again self –evident – approach. The Stockholm agglomeration was introduced by a fantasy air tour, passing over Stockholm. The well known downtown and the just as well known densely built up city area was emphasised on a map, followed by the almost as-well-known municipality of Stockholm, the administrative area. In connection to this the next step was to introduce the unknown outline of Stockholm’s agglomeration, with its special colour and out-line, which was used thereafter consequently. In addition the neighbouring urban agglomerations were also pointed out. They are smaller and easier to identify. Hence the lesser known outer parts of the Stockholm agglomeration could be identified. The array of all urban agglomerations was one of the main elements in the reference framework, used throughout the entire atlas. The second one was the administrative division of the county into municipalities. Both were presented in separate maps in the inside cover of the atlas. These maps were designed with extreme care to reveal the structure of the two elements and the interaction between them. The main agglomeration of Stockholm filled the end paper of the atlas with carefully chosen set of names. The central part of it got an enlarged version with still more detail.

THE THEMATIC CONTENTS

The basic idea for developing the atlas is “the urban drama”. It is taking place on the urban scene which is populated by the actors who are playing their rolls there. These elements are the integrating parts of
planers as well as the inhabitants’ world. The design process is then to create a series of maps showing these three elements. If the themes of these maps are well chosen and well coordinated and maps are well designed, then a portrait of the region will emerge. It is, however, a portrait, not the portrait of the region – there are many other possible interpretations.

**The scene**

The 120 urban agglomerations of the county are the most important elements of the urban scene. Main part of them is concentrated in a square with a size of 33x33 km. Beside these agglomerations there are several other smaller agglomerations of building without be qualified as urban agglomerations. There are 332 agglomerations of holiday houses, with no less than 50 houses close to each other, almost 300 rural agglomerations (with 50-199 inhabitants) and 56 agglomerations of working places, without residents. The holiday houses are mainly concentrated along the coastline.

The definition of the “(urban) agglomeration” contains the criterion “no more than 200 meter between the buildings”. If we change this maximum distance to 2000 meter a larger, cohesive and organically connected “mega-agglomeration” appears. It contains besides the Stockholm agglomeration several smaller urban agglomerations close to the main one. If the 200 meter criterion could be related to a walking distance, the inhabitants supposed be able to keep contact with each other by walking, the 2000 meter criterion can be interpreted as the distance covered by bicycle or by shorter car movements. This enlarged agglomeration is developed around the main local railway lines.

**The internal structure of the scene**

If looking for a common characteristic of the urban agglomerations in the county, particularly in the Stockholm agglomeration, the word is “fragmentation”. The Stockholm agglomeration contains more than 1600 discernable, homogenous areas while the larger agglomeration no less than 3000, the city of Stockholm being just one of them! Main part of them is small (less then 20 hectare) but almost 500 of them have an area between 20-2000 hectares. Such an area can be a high-rise-building area, or an area of semi-detached buildings etc. The build-up areas are separated by open areas, often green areas, frequently containing highways, streets and railway lines also. These areas between the densely builtup enclaves make up 1/3 to almost ½ of the areas of agglomerations. This factor along the sizes of the different areas is shown in separate maps. In next step the building character of each area is shown.

A more precise expression is the building quota, i.e. the relation between the floor areas of the buildings compared to the land area of the block where the buildings are erected. It is mapped with a specially designed composite symbol to enlighten the real significance of this somewhat abstract expression.
Also some main lines of the development of agglomerations are treated. After periods of intense growth of areas the agglomerations ceased to expand. The population growth results in higher density of buildings. A few maps show where this is occurring.

A special type of development occurs outside the urban agglomerations. A number of holiday cottages are growing and not least a growing number of holiday cottages are transformed to permanent residence, also shown on maps.

**The actors**
The main actors on the urban scene are the inhabitants in an area and persons working there. A series of maps shows different aspects of the two categories. The spatial distribution within the different urban agglomerations is shown on maps, followed by maps on the resident populations’ age structure, social composition and economic status. Special studies are shown about the population’s ethnical composition.

A high degree of segregation between people with or without Swedish roots is a common comprehension. A series of maps demonstrate, that, in spite of the existence of a few, highly segregated areas in Stockholm, a major and growing part of the population with non-Swedish roots are living in geographically integrated areas with Swedish-rooted people.

A few maps show the internal differentiation of the population according income and wealth.

**The play**
We have no general methods to register a collected view of human activities in a place. Hence we have to use indicators, which can give us a comprehension of them.

Each person has one of the main concentration of his activities closely the place of his residence. The amount of these activities in this place depends on, if he is there all day or he moves somewhere else to work. The distribution of the resident population, shown in previous maps, indicates the spatial distribution of the “resident-activities”. The same can be said about the economically active (daytime) population.

To get a closer estimation the activity level in an area during the night (more precisely: late afternoon-evening-night) is comparably easy: it is represented by the sum of all residents. None of the economically active daytime population is supposed be in place. Thus the amount of activities in the area is proportional the number of inhabitants. The intensity of activities is proportional to the density of them, i.e. the number of inhabitants per unit of area.
In the morning the situation changes. A part of the inhabitants moves to other areas for working, while other persons move into this area for the same purpose. The amount of activity during the day - i.e. from morning to evening - is indicated by the number of persons present in the area. This is the sum of all persons with place of work in the area and all residents, not working outside their homes but still present and active in the area. The intensity of activities is indicated by the density of all those persons.

The change between the two situations gives the pulse of an urbanised area and results in heavy traffic flows all over the urban landscape. The change between the two situations within a chosen part of an agglomeration, a district, is visualized by semicircular diagrams, divided in three sectors. The size of the semicircle is proportional to the number of individuals living and/or working in the district.

1. Sector 1 represents the residents, who remain in their home district all day long.
2. Sector 2 shows the number of inhabitants who have work (inside or outside the home district), hence who leave their home to work during the day.
3. Sector 3 represents the persons working within the district (having their homes inside or outside the district).
During the night period the diagram sectors 1 and 2, representing a district, are filled, while sector 3, representing work places, is empty. During the day sector 2 is empty while sector 1 and sector 3 are filled (the non-working residents and persons working in the area are present, the place of the residents having work is empty).

In the atlas a pair of maps faces each other showing the population distribution during day and night. The comparison reveals the changing pattern of activities in different areas.

Other maps summaries the intensity of activities per unit of area. It is supposed to be the collected amount of all activities of all residents and all working persons in the area. This term is called here “structural population density”. Numerically it is the sum of all residents and all workers per unit of area. When studying the spatial pattern of this expression in concentric circular zones around the centre of the region, a regular diminishing of structural population density is noticeable. Its rate can well be expressed by a negative exponential function. If we concentrate on its component of workers density, its diminishing rate is higher, with exceptionally high values in the centre of the city – i.e. in the centre of the agglomeration of Stockholm – and rapidly dropping density, which can be well approximated by the negative power function (Szegö 1994).

Another way to indicate the pattern of urban activity is to study the geographic distribution of work places within the region. (The term work place refers to a physical and not an administrative centre of an economic unit, where frequently several work-places are administrated.) The mapping shows, naturally, a heavy concentration of work places in the centre of the region, particularly of the ones with large number of employees. In downtown Stockholm the density of work places is 50-300 units per hectare. More surprising is the even distribution of the smaller units all over the agglomeration of Stockholm. Most parts of the whole agglomeration (375 square km) contain at least 1 work place per hectare. There are also several local centres, with heavy concentration of work places dispersed over the whole agglomeration of Stockholm.

CONCLUSIONS

The design of this atlas took advantage of the possibilities the printing technology offers for presenting great amount of geographical information with high degree of details and still with good legibility. The application of GIS technology supported the basically traditional work process in an efficient way. The result is, however, “only” a printed, manual information system, as all printed atlas are. The next step seems to be the development of a combined technique of printed and screen-based interactive technology. Advanced forms of reading the atlas/textbook in combination with analyzing the presented data and even making added, new, own presentations to the contents of the atlas/textbook seems then be possible. The
author hopes to be able to contribute to such a development in connection with the ongoing revising of his formerly presented Human Cartography (Szegö, 1987).

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