

Urban structures and substructures

Lidia Mierzejewska^{CFMR}

Adam Mickiewicz University in Poznań, Institute of Socio-Economic Geography and Spatial Management, Dzięgielowa 27, Poznań, Poland; phone: +48 618 296 145; e-mail: mierzeja@amu.edu.pl

How to cite:

Mierzejewska L., 2017: Urban structures and substructures. In: Chodkowska-Miszczuk, J. and Szymańska, D. editors, *Bulletin of Geography. Socio-economic Series*, No. 36, Toruń: Nicolaus Copernicus University, pp. 117–125. DOI: <http://dx.doi.org/10.1515/bog-2017-0019>

Abstract. In urban geography, a traditional but always important research problem has been the spatial-functional structure of towns and changes that occur in this field. Two approaches can be distinguished here: the sociological and the geographical. The former follows in the steps of the so-called Chicago school, i.e. Park, Burgess and Hoyt, and the other of Ullman and Harris. It seems, however, that those two approaches do not exhaust the range of spatial-structural studies which may be conducted in modern towns since there are areas within them endowed with specific properties that can be called their substructures. This paper will present the general characteristics of such substructures and identify factors responsible for their appearance and development. It will also propose an empirical research pattern. The term ‘substructures’ is taken to denote relatively autonomous, highly uniform wholes standing out in the spatial-functional structure of a town, distinguished on the basis of spatial relations generated by people. While structural elements of towns in the approach of the Chicago school or that of Harris and Ullman can be identified with structural regions, urban substructures show a similarity to functional regions in their organisation, structure and operation. Thus, towns with identified substructures have a polycentric spatial-functional structure, favourable in terms of both the level of service of their inhabitants and their sustainable development.

Article details:

Received: 07 March 2016
Revised: 10 September 2016
Accepted: 01 February 2017

Key words:

town,
spatial structure,
nodal region,
substructure.

© 2017 Nicolaus Copernicus University. All rights reserved.

Contents:

1. Introduction	118
2. Research assumptions.	118
3. The concept of urban substructures	120
4. Conclusion	124
References	124

1. Introduction

For decades, towns have been the objects of special interest of researchers in a variety of disciplines in various parts of the world. This is due primarily to dynamic urbanisation processes as a result of which not only towns themselves, but also their immediate and farther surroundings undergo transformation, and to the special role they perform in settlement and socio-economic systems. The complexity of issues and problems connected with the formation and development of towns makes them interesting study objects not only to urban planners, architects, sociologists, psychologists, economists, or ecologists, but also to geographers. One of the indications of geographers' growing interest in towns is the emergence of a separate field of their discipline, namely urban geography. A research problem traditional in urban geography is the spatial-functional structure of towns and changes occurring in this field, although not geographers, but sociologists were the first to explore here. Hence it is possible to distinguish two slightly different approaches in theories or models of the internal structure of towns: the sociological and the geographical one. The first draws on the output of the so-called Chicago school in which Park, Burgess and Hoyt worked out concentric and sectoral models, and the other on Harris's and Ullman's polycentric model. Their characteristic feature is distinguishing areas in the space of a town that are uniform in terms of a specified attribute or set of attributes, primarily similar social features of the population living in an area or a similar land-use pattern (areas with similar functions). However, the research approaches presented in those models do not exhaust possible types of spatial-structural studies allowed by modern towns, in particular large cities, because there are areas in them that can be termed substructures. Owing to their specific organisation, spatial structure and manner of operation, those substructures are similar to functional regions rather than areal ones treated in the above-mentioned classical models of the internal structure of towns. Thus, they have a distinct nucleus in which the socio-economic life of a fragment of a town concentrates, and a zone of influence connected with it. The goal of this article is to present the concept of substructures together with their

general characteristics, factors responsible for their appearance and development, and a model of an empirical study of them. The term 'substructures' is taken to denote relatively autonomous, highly uniform wholes standing out in the spatial-functional structure of a town, distinguished on the basis of spatial relations generated by people. The article is theoretical in nature and offers preliminary reflections on substructures indicative of a polycentric spatial-functional structure that is favourable to the town and its inhabitants.

2. Research assumptions

The term 'spatial structure' in geographical research is usually understood to denote an ordered pattern of economic or social entities and the spatial-economic links holding among those entities (Kuciński, 1996; Słodczyk, 2003). Thus, the spatial structure of a town is a set of overlapping systems (including systems of places of work, residence, shopping, leisure, social and other contacts) corresponding to the basic spheres of human life and activity (Korceli, 1974). Thus understood, it is also called the internal structure of a town. Its analysis involves a description of the existing arrangement of social and economic elements filling the town's space or a description of the spatial and functional relations holding among them (Maik, 1997; Słodczyk, 2003).

The models of the internal structure of towns commonly known and most frequently described in the literature are those worked out by the Chicago school. Created in the framework of social ecology, they rested on an empirical analysis, hence they focused on relations between people and their surroundings understood as the material environment (Pióro, 1962).

The first of the models, perhaps the most famous one, widely discussed (and criticised) in the literature on the subject, was a concentric one, first presented by Burgess in 1923. It was worked out on the basis of an analysis of the spatial structure of American towns developing very dynamically in the early 20th century in the conditions of a free-market economy, primarily as a result of intensive migration movements. Migrants came to the USA from a variety of countries located in various parts

of the world, which meant that they differed widely in national, ethnic, cultural, linguistic, denominational and other terms. In accordance with the model, a town develops exclusively in a radial way, five zones (rings) forming around its centre that differ in land development, especially in residential construction, the character of which changes with the distance from the centre (Korceli, 1974). Zone 1 is the central business district with shops, offices and banks. In the next – a zone of transition, usually neglected – there is an old housing stock, often demolished because of a growing demand for investment land near the centre. Then come the zones of workers' homes, of better residences, and a commuters' zone (Pióro, 1962; Domański, 2002). In the model, individual users compete for a location in the centre, but the privileged social strata have a leading role in settling in the new peripheral areas (Korceli, 1972).

The criticism of the concentric model, the lack of corroboration of concentric zones in urban development by other researchers, as well as further, in-depth studies of the spatial structure of towns led Hoyt (1939) to the opinion that the basic factor determining the spatial structure of a town was not the distance from the centre, but the direction. In the sector model, he worked out next (also called a wedge model), the factor decisive for the spatial structure of a town is a system of transport lines along which there develop wedges differing in land development and settlement patterns, widening from the core towards peripheries, and having a similar character over all their area. Wedges of a particular land use, resembling the arms of a star and initially formed near the town centre, extend outwards with time. As a result, as the town develops, higher-standard residential areas, first located in the centre, move outwards pushing lower-standard housing out. Similar processes take place in other wedges differing in terms of the predominant land use, giving the town a sectoral form (Domański, 2002).

The wedge model became a competition to the concentric one, although it differs from it in only a few aspects. Both models concern primarily the distribution in the town's space of various, more or less privileged, social groups seeking the best possible location for themselves. However, while the concentric model assumes an inter-zonal succession in

accordance with succession cycles (also a family cycle), in the sector model the place of privileged social groups is limited by the location of other social groups, and the entire system develops (expands) while keeping its initial internal structure. Although by assumption the sector model only concerns differences in residential areas seen in terms of the economic status of their residents as measured by the rent they pay, it has often been applied to the full land-use structure of a town (Korceli, 1974).

However, the internal structure of towns has been a matter of interest not only to sociologists, but also to geographers. The best known are Harris and Ullman (1945), who worked out the concept of a city with many centres, generally regarded as equal in rank and complementary to the two preceding ones (Korceli, 1974). Such a system, according to the authors, comes into existence as a result of a synergic effect of such factors as: (1) different location requirements of various economic entities (e.g. a shopping-service centre must be readily accessible, while industrial plants need extensive premises readily accessible by transport), (2) mutual attraction (leading to an agglomeration) or repulsion (leading to segregation – a conflict of interests) of some kinds of economic activity, with attracted entities that form separate groups because of the advantages of cooperation often giving rise to a new centre, and (3) differences in land prices depending on the location, which means that not all kinds of activity are profitable enough for a business to operate in an area where prices are the highest (Korceli, 1974; Domański, 2002). In the multiple nuclei model, towns are perceived as mosaic systems. It assumes that while there might have been only a single shopping-service centre in a town, with time there will appear other centres in it.

There are some differences between the models worked out by sociologists and geographers, but also many similarities. The chief difference is that in the sociological (concentric and sector) models of the spatial-functional structure of a town it is seen as monocentric, and in the multiple nuclei model, as polycentric. What makes them similar, in turn, is that all those models distinguish areas in this structure that are similar in their settlement pattern (e.g. residents of a similar ethnic, economic, or family status) or in their land-use pattern. They can therefore be identified with structural regions uniform in

character over all their area. However, assuming after Maik (1997) that an analysis of a spatial structure involves, among other things, a description of the spatial and functional relations holding among its elements, and after Harris and Ullman that a city is a polycentric, multiple-nuclei entity, it is possible to distinguish areas in the structure of a town that can be identified with nodal regions in terms of their organisation, structure and manner of operation, although at a considerably smaller spatial scale. Areas of this type can be called urban substructures.

The similarity of a substructure to a nodal region calls for listing features characteristic of this type of regions that determine their identification and operation, and then using them to formulate theoretical assumptions underlying urban substructures. The features of a nodal region as given in the literature include the following:

- it is an economic region, i.e. a distinct part of the socio-economic space that we want to learn about (Dziewoński, 1967);
- it is an area where components (including spatial structures) and spatial relations make up a uniform whole that can be distinguished from its surroundings using specified criteria. One of them is the consistency of a structure determined by interdependent fields of human activity conducted in that area (Domański, 2002);
- it has one or more nuclei (cores) that are centres of its organisation, connected with the background (the impact zone) via a mutual exchange of people, goods, services and information, but mostly via journeys to school and work as well as trading and services (Kosiński, 1958; Domański, 2002);
- it consists of both a human community together with its socio-economic activity and an area of land with a more or less distinct but also diversified geographical environment. Thus, each such region has its own material form and substance (people and their activity) (Dziewoński, 1967);
- with time, the new substance creates not only new spatial forms, but also fills old ones, thus leading to the crystallisation of a certain regional structure. It is for this reason that the basic features of an urban region include some permanence, even while its spatial structure keeps changing slowly over time (Dziewoński, 1967);

- the regional awareness of the population, understood as a set of its opinions, beliefs and attitudes towards the region of its residence and activity. Regional awareness is therefore a state of awareness determining regional identity (Chojnicki, 1996, 1999).

Thus, urban substructures treated as nodal units of a lower order than regions should have, if not all, then at least a decided majority of features attributed to functional regions.

3. The concept of urban substructures

Urban substructures should be understood as relatively autonomous wholes standing out in the spatial-functional structure of a town for their high level of uniformity and distinguished on the basis of spatial relations generated by people. It is those relations that determine the uniformity and the relatively autonomous nature of such substructures within the town. However, there is also a morphological aspect, i.e. a substructure is more or less readily visible in the town's space.

Within identified substructures, their residents satisfy basic needs, like everyday shopping, basic services and social contacts, but also needs connected with education, work, recreation and leisure, religious practices, etc. They also feel an emotional link, similar to regional identity, with the area of the substructure where they live, conduct activities, and satisfy all those needs.

Urban substructures should not be identified with the functional areas of a town distinguished in its classical spatial-functional structure (residential, transport, industrial, green areas, etc.) because their significant feature is that they embrace inhabited areas united by spatial relations generated by the satisfaction of everyday needs. It is residents, and more precisely their decisions concerning places of satisfaction of those needs (spatial relations: place of residence – place of goal attainment or need satisfaction), that decide about whether or not it is possible to delineate a concrete substructure in an area. It should be emphasised that what is meant here are the so-called basic general social needs of residents of an area, because they usually satisfy their more

individual or higher-order needs mainly in the city centre (the downtown).

Substructures, like the structure of an entire town, undergo the processes of succession; they are dynamic in nature. This means that they appear, develop and function, but can also disappear with the transformation of the spatial-functional structure of the town, socio-economic changes, changes in lifestyle and consumption models, or technological changes (motorisation and the popularisation of the car as a change-generating factor). What changes over time are both the social structure of residents and forms of economic activity. A more stable element of a substructure is its built fabric and land development, although here, too, some changes occur.

There are several ways leading to the formation of urban substructures:

- 1) substructures that have formed earlier in the process of historical development (spatially and functionally uniform areas of villages, estates or towns) are included within the boundaries of a city under administrative decisions enlarging its area (often as a consequence of suburbanisation or the wish to secure the city's development needs) – an example of this type of substructure in Poznań is the former village of Jeżyce, today lying within the city's boundaries, or the recently included Kiekrz (Fig. 2);
- 2) properly planned and implemented investments by city authorities or private investors (mostly property developers) lead to the appearance of new substructures in the form of multi-functional estates that satisfy basic needs not only of their residents, but also those living nearby (e.g. a so-called city within a city) – an example is Nowa Huta in Cracow or Nikiszowiec in Katowice (Fig. 3); and
- 3) substructures emerge when the infrastructure of existing estates, which mostly function as dormitories, is complemented with shopping-service areas (squares, streets, commercial zones, etc.) that allow the residents of an estate or neighbouring ones to satisfy their basic everyday needs; this type of substructure develops, for example, in Poznań at the boundary between the Lech and Czech housing estates (Fig. 4).

Generally, therefore, there are two ways leading to the creation of nuclei in the structure of a town, and in effect to the emergence of substructures. Nuclei

can form as a result of bottom-up processes, which often happens in estates where the shopping-service infrastructure necessary for their residents' everyday life has not been planned, or where such infrastructure, although planned, has not been built. This is often the case with block-of-flats estates in post-socialist towns that for decades had usually one shopping-service centre with a single shop of a supermarket type and a few service stations (among which there was often a library, a restaurant and a cinema) that failed to meet the requirements of a free-market economy and near which, with time, multi-functional markets or shopping arcades started to develop. Another way leading to the emergence of places focusing the socio-economic life of people living in an area is one that can be called 'top-down'. Those are all kinds of investment and administrative decisions resulting in the creation of structurally and functionally uniform estates, or in the inclusion of already-formed substructures within city limits.

A matter still to be resolved is the delimitation of boundaries of urban substructures. Since they show a close similarity to nodal regions, as has already been mentioned, they must have a well-developed nucleus (a lower-order centre) and an area of influence. The nucleus is usually a market, a square or a street, i.e. a place of the concentration of shops and services, and often also of administrative, educational, manufacturing, cultural and recreational activities (Figs. 1, 2, 3, 4). It is a place in which local residents usually do their shopping and use all kinds of services (hairdressers, beauty parlours, restaurants, cafés, insurance agencies, post offices, banks, etc.), where they meet and establish social contacts. The integration of residents makes them feel attached to a place, identify with it, as in the case of regional identity. However, the spatial range of influence of such a nucleus is sometimes very hard to establish because the boundaries of substructures can be more or less fuzzy. They can be quite distinct in the case of villages incorporated into a town not long ago and whose spatial-functional structure has not yet fully integrated with the town as a whole, thus preserving their individual character. They are less distinct in the case of settlements, small towns or villages incorporated a long time ago, the spatial structures of which have been transformed by urban investment, or which only now develop within the existing in-

ternal structure of the town. In theory, the boundaries of urban substructures, as in the case of nodal regions, should run in places where links with one nucleus weaken in favour of another neighbouring nucleus. In practice, however, it is very hard to delineate a range, mostly because of the absence of suitable data. However, it can be assumed that the identification of a nucleus where the everyday life of an area's residents concentrates and which generates strong spatial links is indicative of the presence of a better- or worse-developed substructure in this area.

There are several research methods that can be helpful in identifying substructures. The basic one is

the analysis of spatial relations involved in the operation of households and the satisfaction of people's basic needs, complemented with an analysis of the building pattern and sometimes of the population density. In the core of a substructure, the density of both buildings and people is usually greater than in farther-lying areas. A core can be a particular area (usually a square), but also several units generating spatial relations. With respect to relations, it can be assumed that what defines a substructure is the predominance of internal relations generating its uniformity over external ones, which make it similar to a nodal region.



Fig. 1. The core of a substructure on the Jeżyce Estate in Poznań

Source: own preparation on the basis of www.google.pl/maps (DoA: 12 July 2016)



Fig. 2. The core of a substructure on the Kiekrz Estate in Poznań

Source: own preparation on the basis of www.google.pl/maps (DoA: 12 July 2016)

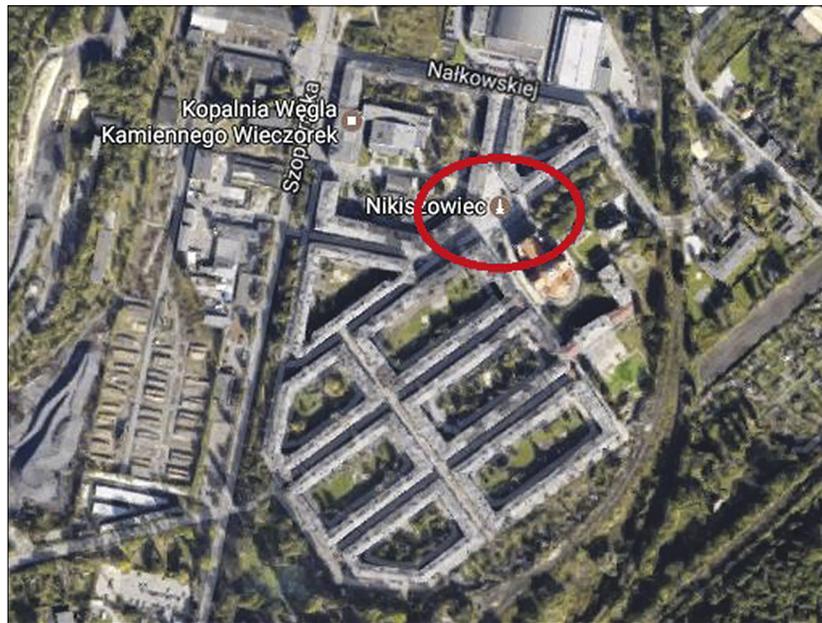


Fig. 3. The core of a substructure in the district of Nikiszowiec in Katowice

Source: own preparation on the basis of www.google.pl/maps (DoA: 12 July 2016)



Fig. 4. The core of a substructure at the boundary between the Lech and Czech housing estates in Poznań

Source: own preparation on the basis of www.google.pl/maps (DoA: 12 July 2016)

There are various factors responsible for the emergence of a substructure. The chief ones include:

- suburbanisation leading to the spatial-functional development of towns;
- a demand generated by residents of an area seeking to satisfy their everyday general social needs. In the conditions of a market economy, this de-

- mand decides about the location of specific economic entities in a place and the profitability of their activity;
- a tendency to minimise the distance (measured in spatial, economic or temporal terms, or in terms of the effort needed to cover the distance) between the place of residence and the places

of work, shopping, services and social contacts as well as other places of goal implementation, that leads to a de-concentration of workplaces. This tendency has been called the statistical rule of spatial self-organisation of the population distribution in relation to the cost of covering a distance measured by the time it takes to do so (Korceli, 1974; after Golc, 1972);

- a tendency for various kinds of activity to cluster, forming separate groups on the principle of advantageous cooperation in a small area, in a place of the highest possible accessibility (Domański, 2002);
- decisions of investors (mostly property developers), leading to the creation of structurally and functionally uniform estates; and
- administrative decisions on the strength of which pre-formed substructures are included within city limits where they undergo a further transformation.

In the historical approach, some substructures were created and functioned for a variety of reasons, hence there are several types of them. They include such functional units as *begijnhofs*, *jurydykas*, military grounds, prison premises, some multi-functional university campuses, or some housing estates. Also villages, estates, etc. incorporated into a town can form, and often are, substructures.

The identification of more than one core is evidence of a town's polycentric spatial-functional structure. This type of structure seems to be highly favourable in terms of both spatial order and sustainable development, i.e. the chief principles of physical planning and spatial management, because it contributes to a better, more equal access of residents to goods and services, and thus to a better satisfaction of their needs, especially basic ones, reduces transport needs, enriches the offer of jobs near the place of residence, etc. The formation of such a spatial structure results from putting into practice the principles of smart growth, new urbanism or urban design, i.e. concepts and models of sustainable urban development.

4. Conclusions

As follows from the conducted analysis, the spatial structure of many towns is polycentric. This means

that within it, it is possible to distinguish lower-order centres beside the historical one. Centres that together with their zones of influence form relatively autonomous, uniform structural and functional wholes can be called substructures.

In terms of their spatial organisation, structure and operation, substructures can be identified with nodal regions, even if lower-order ones. The basis on which substructures are distinguished is spatial relations generated by people. Within them residents of a given area satisfy their basic everyday needs and feel a link with a substructure, similar to regional identity.

Substructures are dynamic and undergo succession. Their more stable element is the built fabric and land development, and the more variable ones are the social structure of their residents and forms of economic activity.

In theory, the boundaries of urban substructures should run in a place where links with one nucleus weaken in favour of another, neighbouring nucleus. In practice, however, their delimitation is difficult because the boundaries can be more or less fuzzy.

A polycentric spatial structure, composed of several substructures, has several advantages for both a town as a whole and its inhabitants. Thus, it is helpful in the implementation of spatial order and in its sustainable development.

References

- Burgess, E.**, 1925: The growth of the city. In: Park R.E., Burgess E, McKenzie, R.D editor, *The City. Chicago and London*: The University of Chicago Press, pp. 46-64.
- Chojnicki, Z.**, 1996: Region w ujęciu geograficzno-systemowym (Region in a systems-geographical approach – in Polish). In: Czyż, T. editor, *Podstawy regionalizacji geograficznej*, Poznań: Bogucki Wydawnictwo Naukowe, pp. 7-43.
- Chojnicki, Z.**, 1999: Podstawy metodologiczne i teoretyczne geografii (Methodological and theoretical foundations of geography – in Polish), Poznań: Bogucki Wydawnictwo Naukowe.
- Domański, R.**, 2002: Gospodarka przestrzenna (Spatial economy – in Polish), Warszawa: PWN.

- Dziewoński, K.**, 1967: Baza ekonomiczna i struktura funkcjonalna miast. Studium rozwoju pojęć, metod i ich zastosowań (The economic base and functional structure of towns. A study in the development of concepts, methods, and their applications – in Polish). In: *Prace Geograficzne*, No. 63. Warszawa: PWN.
- Harris, Ch.D. and Ullman, E.**, 1945: The nature of cities. In: *The Annals of the American Academy of Political and Social Science*, No. 242, pp. 7-17.
- Hoyt, H.**, 1939: The structure and growth of residential neighborhoods. In: *American cities*, Washington D.C.: Federal Housing Administration.
- Korceli, P.**, 1974: Teorie rozwoju struktury przestrzennej miast (Theories of the development of the spatial structure of towns – in Polish), Warszawa: PWN.
- Kosiński, L.**, 1958. Zagadnienia struktury funkcjonalnej miast polskich (Issues in the functional structure of Polish towns – in Polish). In: *Przegląd Geograficzny*, Vol. XXX, pp. 59-96.
- Kuciński, K.**, 1996: Geografia ekonomiczna. Zarys teoretyczny (Economic geography. A theoretical outline – in Polish), Warszawa: Oficyna Wydawnicza Szkoły Głównej Handlowej.
- Maik, W.**, 1997: Podstawy geografii miast (Foundations of urban geography – in Polish), Toruń: Nicolaus Copernicus University in Toruń.
- Pióro, Z.**, 1962: Ekologia społeczna w urbanistyce (na przykładzie badań lubelskich i toruńskich) (Social ecology in urban planning: Lublin and Toruń studies – in Polish), Warszawa: Wydawnictwo Arkady.
- Słodczyk, J.**, 2003: Przestrzeń miasta i jej przeobrażenia (Urban space and its transformation – in Polish), Opole: Universitas Opoliensis.



Ministry of Science
and Higher Education
Republic of Poland

The proofreading of articles, positively reviewed and approved for publishing in the 'Bulletin of Geography. Socio-economic Series', was financed from the funds of the Ministry of Science and Higher Education earmarked for activities popularizing science, in line with Agreement No 509/P-DUN/2016.



