

Using Space Syntax in the Study of the Medieval Urban Network as Exemplified by the Bailiwick of 's-Hertogenbosch, the Netherlands

Marlous Craane

Tilburg University, Faculty of Social and Behavioural Sciences, Tilburg, the Netherlands
m.l.craane@uvt.nl

Keywords

spatial configuration; methodology; modeling; conurbation; urban networks; urban history

Abstract

The economic history of the countryside is usually studied from a town's perspective. It is, however, the countryside which supports a town's existence. Without the first providing the latter with foodstuffs and raw materials for construction and other industries there cannot be a town. In order to understand these economic interactions more successfully this article suggests to study them not from the perspective of a town but from the perspective of the countryside.

This paper will build on this idea by analysing the network of markets which linked town and countryside in a particular region. Moving on from Von Thünen and Christaller, a schematic representation of a concrete example will be created to show how the markets and fairs in this region were linked to form a system. The analysis of this system will significantly enlighten the economic relationship between town, village and countryside and will aid the creation of a model to chart this relationship.

This paper will argue that the application of space syntax in the analysis of medieval urban economic networks can be the start of the development of such a model as it provides a valuable insight into the way in which these were organized. This paper, therefore, provides a methodology for using space syntax in the analysis of these medieval urban networks, as well as some preliminary results regarding the functioning of these medieval urban networks and the system of markets and fairs in the Bailiwick of 's-Hertogenbosch between 1255 and 1555. Until now the techniques of space syntax have mainly been used on an urban or building scale. This paper presumes that medieval regions operated as a conurbation and can be compared with modern cities, which are in essence conurbations, and can therefore be analysed as one system by using space syntax.

Previous studies of medieval economic networks have used the locations of markets and fairs as network determinants. In order to show the advantages of using space syntax and models in the analysis of medieval networks this paper compares and contrast this more traditional information with the results of space analysis and will show space syntax's added value. This paper demonstrates that the location of markets, fairs and other economic spaces in the medieval period is predetermined by the street grid and by the transport links with the hinterland. Moreover, this paper will provide a different insight into the functioning of the medieval economy, and its methodology will therefore help further research on this topic.

This paper is part of current research on the urbanisation and spatial patterns of production and consumption in the Bailiwick of 's-Hertogenbosch between 1180 and 1568.

Introduction

The medieval economy has always been a popular subject among historians and archaeologists, especially because it has always been perceived that the golden age of the seventeenth century

only could occur because of what was started in the medieval period. Research of the medieval economy, however, has had a primary focus upon the town and only a secondary focus upon the countryside. The countryside, however, supported the town's existence in the middle ages. Without a countryside providing the towns with foodstuffs and raw materials for construction and other industries, they could not have existed. In order to understand the medieval economy more completely this article will analyse it by investigating if and how town and countryside were linked together through this economic relationship and in what way these relationships formed a network between town, villages and countryside.

Markets and fairs have always been considered a good indicator for urban networks and economic relationships (von Thünen 1863, Unwin 1981, Britnell 1996, Stabel 1997). However, did such a thing as a network of markets and fairs exist linking town and countryside within a region? In a previous article (Craane 2007) as well as in my paper on *The Medieval Urban Movement Economy*, also proposed for this symposium, I have shown that topology is the main explanation behind the location of economic space by discussing the potential of spatial analysis for research into the medieval urban economy. This paper will explore whether topology is also the main explanation behind the links between town and countryside and behind the establishment of a medieval urban economic network.

Despite the popularity of urban networks and town and countryside relationships as topics in the medieval studies, there has not been a definitive method found for studying these topological relationships since the models of Von Thünen, Christaller and Berry (von Thünen 1863, Christaller 1935, Berry 1967). Moving on from those models, space syntax will be used to create a schematic representation of a concrete example, the region of the Bailiwick of 's-Hertogenbosch in the Netherlands, to show whether the markets and fairs in this particular region were linked together to form the economic system upon which the medieval economy was based. Recent research has already shown that space syntax can be used not only in the analysis of the internal structure of settlements and buildings but also in the analysis of twentieth century settlement patterns and urban networks (van Nes 2008). The case-study for this analysis will be the Bailiwick of 's-Hertogenbosch, because of the large number and variety of evidence available for this region and because of its geographic make-up.

The hypothesis of this paper is that already in the medieval period towns and their surrounding villages were linked together more or less like a conurbation, and that therefore conurbation is not a modern phenomenon. In order to test this hypothesis, the paper will firstly investigate which markets and there were within the Bailiwick. Secondly, their spatial and temporal spread will be analysed in order to find out whether there is a logical explanation of their spatial and temporal organisation. In the extended version of this paper as it will appear in my PhD thesis on 'Urbanisation and Spatial Patterns of Production and Consumption in the Bailiwick of 's-Hertogenbosch 1180-1568', demographic, economic, topological and institutional determinants of their location will be investigated. was felt that the other explanations than topological could be omitted because of the focus of this conference and the restriction in paper length. Since it is anticipated, and proven in my PhD thesis chapter, that the topological reasons behind the market and fair locations are the most prominent, those reasons will need to be investigated in greater detail. It The third part of this paper will therefore focus upon the reconstruction of the medieval infrastructure of the Bailiwick of 's-Hertogenbosch, to see to what degree transport and infrastructure influenced the creation of an urban network. Subsequently, the fourth part of this paper will suggest a suitable methodology for analysing the medieval urban network as well as provide the results of this methodology. Finally, the conclusion of this paper will bring together all of the findings of this paper and will try to answer the question whether there was a medieval urban network, in what way it manifested itself, how we can best analyse it and whether there is such a phenomenon as a medieval conurbation.

Markets and Fairs in the Bailiwick of 's-Hertogenbosch

The main source for markets and fairs in the Bailiwick are the market and fair charters. Fortunately, many of these market and fair charters, or copies thereof have survived for the Bailiwick. They can

be found in the archives of the Brabants Historic Information Centre (BHIC), the municipal archives of 's-Hertogenbosch (SAH), Regional Historic Information Centre Tilburg (RHCT) and the Regional Historic Information Centre Eindhoven (RHCE), and are often named in secondary literature (Frenken 1975, Lijten 1991, van Asseldonk 2002). There are only a few towns about which the situation is unclear. The next section will discuss these in more detail. However, it is in almost all cases impossible to know whether the year in which a market charter was issued also denotes the year in which the market or fair was first organised, or whether the market or fair had been organised for much longer but simply had never received a charter. It is therefore important to note that the years used in this paper signify the year in which the market or fair was first mentioned rather than the year in which the market or fair was first held, even though there is a large possibility that these years are actually the same.

The main reason for issuing market charters is that a local lord could demand taxes from buyers and sellers. This is why many lords established markets as it would provide them with an extra income. It is presumed that there were also many unchartered markets, at which no taxes had to be paid. These markets were in essence illegal but as far as is known not regularly persecuted. Because they were unchartered there is no evidence available about them, save for the occasional mention in legal documents. It is therefore impossible to take these unchartered markets into account when analysing the systems of markets and fairs within the Bailiwick, and this paper therefore focuses solely upon the chartered markets.

Apart from regulating the payment of taxes, people were also told to attend the markets and fairs in the market and fair charters. Even those people who had committed crimes and feared arrest could attend the markets and fairs as the charters provided freedom of persecution for buyers and sellers alike. This freedom started for the market usually at noon the day before the market was held and lasted until noon the day after the market. Fairs usually had a longer freedom period, most lasted usually about a week.

Up until now markets and fairs have been named and discussed as one item. There are, however, significant differences between them. These differences shall now be explained as in the next sections they shall be discussed separately.

If a town in the Bailiwick had a weekly market (from now on referred to as market) it was held weekly on one specific day. This is in contrast to some of the larger towns in England (Farmer 1991, 335), which held their markets on several days a week. Despite the market day being officially chartered, religious feast days took precedence. If the market day happened to fall on a religious feast day, the market was cancelled. In 's-Hertogenbosch it was decided that from 22nd of August 1515 the Thursday market, if it coincided with a religious feast day it would be held the preceding Wednesday (SAH 3877 = SASSEN 700: d.d. Brussel 1515 aug 22). In Helmond, a similar decree was passed on the 10th of March 1544. Helmond's Saturday market would be held the preceding Friday if that Saturday was a religious feast day. Before this decree was passed, the market would simply have been cancelled if it happened to fall on a religious feast day (Frenken 1975, 82). Moreover, markets were never held on Sundays. Fairs' however, sometimes were. Helmond and Valkenswaard, for instance had fairs which were held on Sundays.

Yearly markets (from now on referred to as fairs), on the other hand, were always held annually on a set date associated to a specific saint's day or other religious feast. The fair was always registered by the saint's day, e.g. two days before the feast of Saint John, or on Saint Nicholas' eve, rather than by the actual date it was held on. Almost all towns which had fairs had several throughout the year.

Weekly markets provided an opportunity for people to sell their surplus produce and buy what produce they needed. Whereas markets provided the main opportunities to buy and sell the staple items of diet, fairs were the place to buy and sell livestock and bulk goods. The fairs were also an important source of farm equipment (Farmer 1991). Moreover, the large fairs (only the fair of 's-Hertogenbosch in this region) also had a more international character and one would have been able to buy import wares such as imported stoneware and wines at these fairs. Archaeological

research will show whether the other towns and villages in the Bailiwick benefited from this international fair in 's-Hertogenbosch. The more regional and local fairs will probably have played a larger and more important role in the regional (agrarian) economic network.

Markets

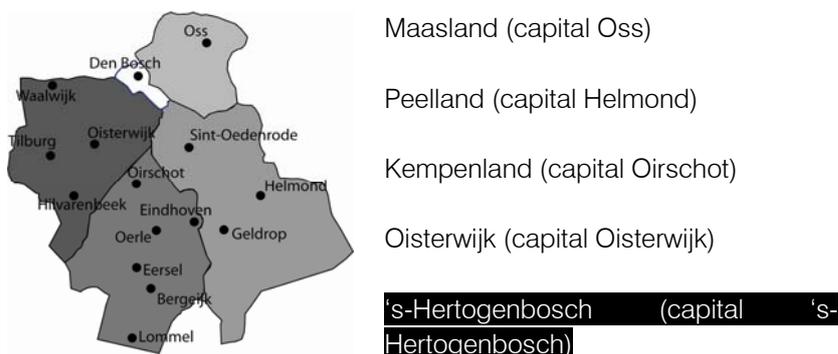


Figure 1

Map of the Bailiwick of 's-Hertogenbosch with its 4 quarters

The Bailiwick of 's-Hertogenbosch was divided into four quarters and the freedom of 's-Hertogenbosch. Each quarter had its own capital as figure 1 illustrates. There were about ninety-six towns and villages in total in the Bailiwick. Of all of these fifteen had markets which received their first charter between 1232 and 1551.

Quarter	Town	Mon	Tues	Wed	Thur	Fri	Sat	Sun
's-Hertogenbosch	's-Hertogenbosch [1]				1328			
Kempenland	Oirschot [2]						xxxx	
	Eindhoven [3]		1232					
	Lommel [4]	1422						
	Bergeijk [5]						1468	
	Eersel [6]			1544				
	Oerle [7]	1551						
Maasland	Oss [8]		1399					
Oisterwijk	Oisterwijk			1355				
	Hilvarenbeek [9]					<1400		
	Waalwijk [10]					1516		
Peelland	Helmond [11]		1376				1538	
	St-Oedenrode [12]			1403				
	Budel [13]				1534			
	Geldrop					xxxx		

Table 1

First recorded appearance of a market in the quarters and towns of the Bailiwick of 's-Hertogenbosch (capitals of the quarters in bold)

¹SAH 3876 = SASSEN 45: d.d. Brussel 1328 mrt 26.; ²(Lijten 1991); ³ONB no. 165: d.d. 1232 April 9- 1233 April 2 (van Oudenhoven 1670, 51, Melssen 1994, 99, van Asseldonk 2002, 276); ⁴BHIC 8 Leen- en Tolkamer van 's-Hertogenbosch, no. 139, p. 167 (Kappelhof 1997, 19 (nr 59 f 172r)); ⁵(van Oudenhoven 1670)61; ⁶ARAB 642 ARK, no. f 1r 1544 okt.; ⁷(van Oudenhoven 1670); ⁸BHIC 7362 Oss Stadsbestuur, no. 1; ⁹(Hoozemans 1998)60; ¹⁰SAH 79 = SASSEN 1782: d.d. 1403 Brussel 10 Augustus, p. 143 (Kappelhof 1997, 18 (nr 54 f 137r)); ¹¹(Krom and Sassen 1884, 41-42, Frenken 1975, 79-82, van Asseldonk 2002, 276); ¹²BHIC 7633 Dorpsbestuur Sint-Oedenrode (1232) 1315-1811, no. 91; ¹³RHCE A-258 Gemeentebesuur Budel 1307-1810, no. 1-a-1-15 c-007

As is evident from table 1 there were only two places with a Thursday market, 's-Hertogenbosch and Budel. Because of the popularity of the 's-Hertogenbosch market it was unwise for any other town or village to hold its market on that day. Budel, however, is located in the southernmost point of the Bailiwick and presumably far enough from 's-Hertogenbosch not to be affected by the 's-Hertogenbosch market. It is also the case that the capitals of the four quarters had their markets on either a Tuesday or a Wednesday, apart from Oirschot. In Kempenland, Eindhoven had the Tuesday market. This seems to indicate that Eindhoven was more important as an economic centre of the Kempenland than Oirschot, while Oirschot was the political centre. It seems likely that the main towns in the four quarters had their markets on Tuesdays and Wednesdays in order to collect produce from the hinterland and take it to 's-Hertogenbosch' market one or two days later. This supports Unwin's point about regional market groupings (Unwin 1981, 241). He states that fewer markets on a particular day of the week usually denote a larger market, whereas days with a larger number of markets usually denote markets of a smaller size.

Moreover, as the table shows, by the end of the fourteenth century every quarter of the Bailiwick had its own weekly market. Eindhoven in Kempenland, Oss in Maasland, Oisterwijk in Oisterwijk and Helmond in Peelland and of course 's-Hertogenbosch itself. The quarters of Kempenland and Oisterwijk might possibly have had two markets by the end of the fourteenth century as the official foundation dates for the markets of Hilvarenbeek and Oirschot are not exactly known.

Since new markets were subsequently founded it seems evident that, with time, one market per quarter was not enough. It is, however, difficult to establish what would be an adequate number of markets. There could be various possible causes for these extra markets. By investigating possible demographic, economical, topological and institutional causes this paper will try to find an explanation for these extra markets.

Topological

Could there be a topological cause behind the establishment of these extra markets? One way to see whether this is the case, would be to use the limits of short haul marketing to illustrate the coverage of each market. For this we may refer to the English Henry of Bratton, judge of the king's bench from 1247-50 and again from 1253-57, who, in his legal treatise, which was compiled between 1235 and 1259 and which is a rational description of English law, argues that six and two-third miles (10.67km) would be the limit for short haul marketing. This was because the seller or buyer would otherwise not be able to get to market and back home in a single day (Woodbine, vol 3 p.198-199). It needs to be said that his remarks concern the geographical and infrastructural situation in England, which of course is different from that in the Bailiwick of 's-Hertogenbosch. However, his measures can be used as a rough indication of the influence of a market. On the other hand, it needs to be taken into consideration that sometimes, and especially in times of good weather or high prices, sellers were prepared to travel much further, which became a realistic option if one could make use of river- rather than land-transport. However, because of the limited resources available many sellers preferred to sell small amounts over shorter distances than larger amounts over longer distances.

When we draw Bratton's maximum reach of each market (10.67km) on the map of the Bailiwick, a possible need for more markets during the fifteenth century is immediately apparent. Most of the early markets did not cover the entire quarter in which they were situated let alone cover the entire Bailiwick. Moreover, since the location of these new markets lay outside of the maximum reach of the established markets there was a clientele to establish these markets for. This then explains the establishment of the markets of Lommel, Bergeijk, Budel, Oirschot, Hilvarenbeek, Waalwijk and Sint-Oedenrode. Moreover, it explains why the Maasland quarter only had one market, Oss, as the maximum reach of this market nearly covered the entire quarter. However, it does not explain the later establishment during the sixteenth century of the markets of Eersel and Oerle.

Having discovered this pattern behind the establishment of the markets in the Bailiwick, can this pattern be used to solve the anomalies, such as confusion about dates and proximity to other markets, which exist in some of the charters? There is for instance a problem with Geldrop's market. At the beginning of this chapter it was stated that there were fifteen markets in the

bailiwick. However, there is no firm confirmation of the date of Geldrop's market charter. By 1670 Geldrop had had a market but as a result of wars and the plague it had been stopped (van Oudenhoven 1670). The question remains when exactly it was held. It could be that Geldrop received a charter for its market at the same time as for its fairs in 1371. Unfortunately no sources confirming an exact period have yet been found. The disappearance of Geldrop's market can also be explained by the market reach map. It shows that Geldrop's market did not occupy a specific niche, and nearly all of its area was covered by neighbouring markets. It was therefore not deemed necessary to continue Geldrop's market.

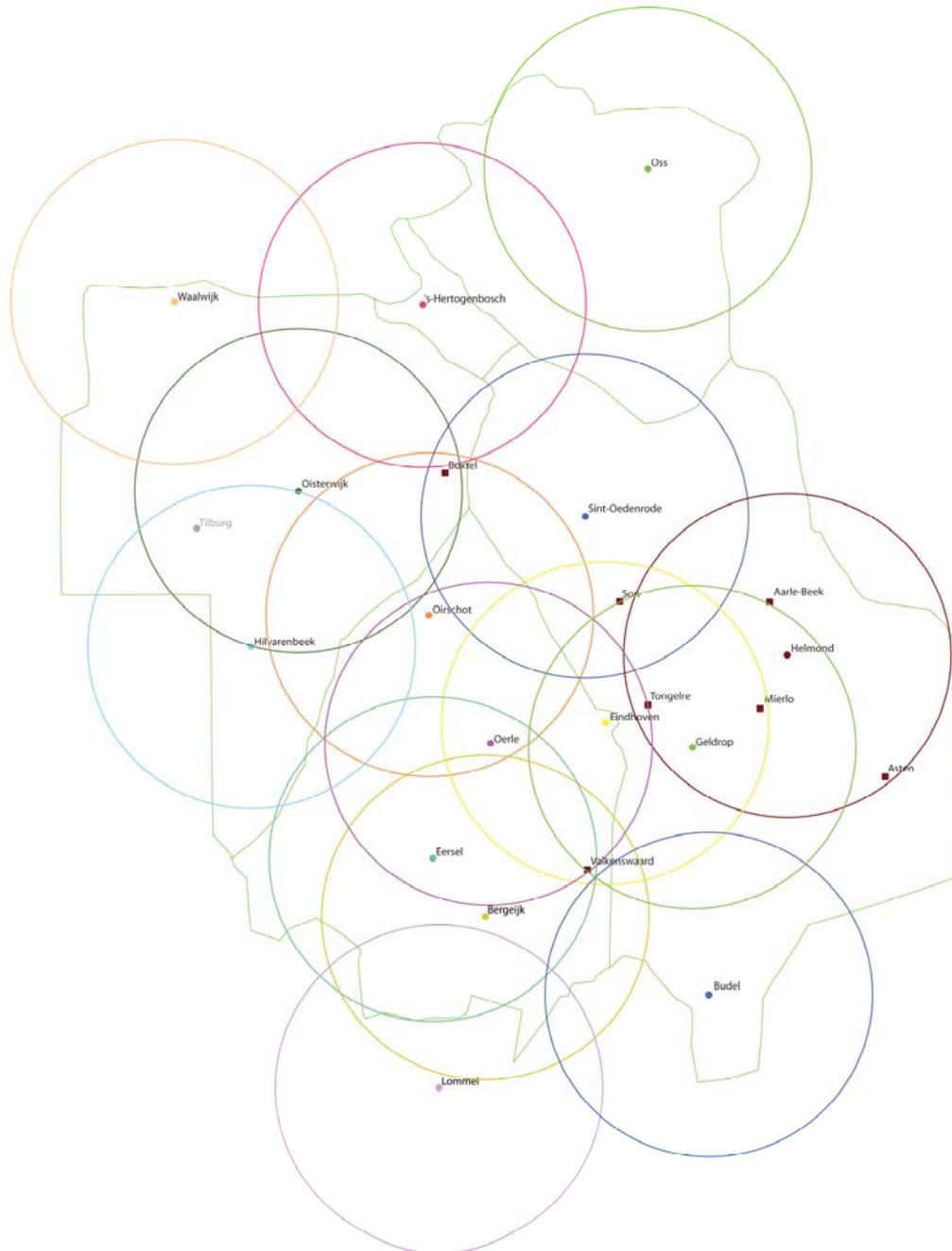


Figure 2

Market reach of the all the Bailiwick markets taking Bratton's 10.67km limit as an indicator. Coloured dots signify the towns with markets and fairs. Red squares are the towns with only fairs.

Like it was the case with Geldrop's market, the year in which Oirschot received its first market charter is also unknown, because in this instance the original charter is believed to have been lost in a church fire in 1462. It is presumed that Oirschot had received a charter before this date because of

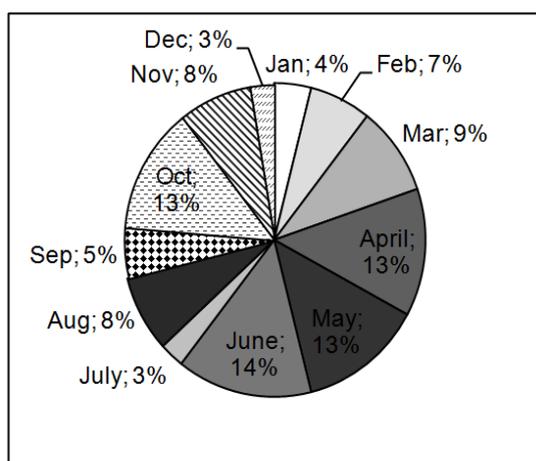
an entry in a ledger of 1524. This is why it has been included in the list of thirteen markets of which we have certainty about the year of the first charter (van Asseldonk 2002, appendix 5). However, the present research has raised some doubt about the day and date of the Oirschot market. The 1538 charter reaffirming the rights of Helmond suggests the movement of the Helmond market from a Tuesday to a Saturday because none of the towns in the Bailiwick had their market on a Saturday and because of competition with Eindhoven's Tuesday market (Frenken 1975). This would indicate that Oirschot's Saturday market was not in direct competition with Helmond's Saturday market. If one examines figure 2 displaying the maximum reach of these markets taking Bratton's 10.67km limit as an indicator this is actually the case as they lie outside each other's circle. The same would apply to Bergeijk's market in relation to the markets at Helmond and at Oirschot. Bergeijk's market was held on a Saturday since 1468, but also lies outside Helmond's and Oirschot's circle. This therefore means that the town-councils of the Bailiwick of 's-Hertogenbosch were aware of a similar maximum market reach value as Bratton's, as in the establishment of new markets they clearly ignore markets which were held on the same day but were located at too great a distance, and would therefore not compete with the newly established market.

There is, however, an anomaly with Bergeijk's market as testified by the vidimus of the Eersel market. Eersel was granted its Wednesday market in 1544 as evident from a vidimus of 1613. In this charter it states that Eersel could have its market because there is not another market within three hours travel with which it would compete. However, the town of Bergeijk had had a market for seventy-six years and Bergeijk is within two hours travel from Eersel. Eersel's charter presumably only meant by 'competing markets within the three hour radius' markets held on the same day.

Fairs

Temporal Distribution

The previous section has shown that we know which towns had markets and from when they were held. We also have a rough idea when some of the fairs originated and an even better idea on what dates in the year they were organised, and which towns had fairs. The later issue will be dealt with in the next year, this section will firstly discuss on what dates in the year fairs were organised. Since, we know on what dates fairs were held, it becomes possible to create a calendar of all the fairs in any one year. Since the dates of most fairs are recorded using the liturgical calendar, which varies from the civil (calendar) year because the dates relating to the most important feast of the year Easter are changeable, most fairs were not held on the same date every year. One way to illustrate the equal staggering of fairs is to average out the changeable feast days to Ash Wednesday in February, Reminiscere Sunday in March, Easter in April and Pentecost in May. The number of fairs peak in the spring months of April, May and June and the Autumn month of October. Most towns had a reasonable even temporal spread of fairs, and only the town of Hilvarenbeek had two fairs in one month.



Graph 1

Temporal Distribution of Fairs in Percentages of the total number of fairs in the Bailiwick

This relatively logical temporal distribution already provides an indication that fairs could not just be held on any date. In principal they were not allowed to clash with another fair in the vicinity. Moreover, even if a particular fair did not clash with one within the Bailiwick it might have received or given direct competition to one just outside it. This was the reason for the shift of one of 's-Hertogenbosch' fairs in 1464 from 19 to 22 October to 23 to 31 October because the earlier dates clashed with those of the market in Arnhem (SAH 3882). Moreover Oirschot was denied a fair on the first Thursday and Friday after Easter because there already was a fair in Hoogstraten on those days and therefore Oirschot was granted a fair on the Monday and Tuesday after Low Sunday.

	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Aarle-Beeck			1			1							2
Asten		1			1								2
Bergeijk				1		1				1			3
Boxtel				1									1
Budel					1	1				1	1		4
Eersel			1	1				1			1		4
Eindhoven	1	1		1		1	1		1	1			7
Geldrop	1			1		1			1				4
Helmond			1		1					1			3
Hilvarenbeek		1		2		1			1				5
Lommel				1	1					1			3
Mierlo			1								1		2
Oerle		1	1		1	1	1	1					6
Oirschot	1			1	1						1		4
Oisterwijk					1			1		1			3
Oss						1			1				2
s-Hertogenbosch			1	1		2		1		1		1	7
Sint Oedenrode					1					1			2
Son			1					1			1		3
Tongelre					1					1		1	3
Valkenswaard		1				1					1		3
Waalwijk					1			1		1			3
Totals	3	5	7	10	10	11	2	6	4	10	6	2	76
Percentage	4%	7%	9%	13%	13%	14%	3%	8%	5%	13%	8%	3%	100%

Table 2

Distribution of Fairs throughout the year

Spatial Distribution

During the later middle ages, there were more towns with fairs than with markets. They numbered twenty-two in total. However, for some it is not known from which year (before 1670) they originated. All towns which had a market also had a fair. However, they did not necessarily originate from the same year. Most of the fairs seem to have originated at an earlier date than the markets.

As explained in the introduction, this paper will focus upon the topological causes for this unequal distribution.¹ Almost all of the towns which had fairs but not markets were located in the Peelland quarter and one in the Kempenland region. Their distribution was therefore anything but equal. Whereas the markets seem to have been relatively evenly spread, this was not the case with the fairs. Also Bratton's market reach patterns, which have proved very useful in explaining the pattern of markets does not explain the distribution of fairs. It is therefore important to find a different topological explanation for the distribution of fair. In the last section of this paper the evidence of the spatial location of the markets and fairs and the evidence of the roads and waterways will be combined and it will answer the question if there is any topological explanation for the distribution

of markets and fairs by using the space syntax methodology. Before the space syntax patterns are discussed, the methodology for creating the maps of the medieval Bailiwick and the subsequent spatial analysis need to be explained first.

Spatial distribution of market and fair towns

The previous sections have clearly shown that market and fair foundation is more than likely due to topological reasons. It is therefore important to try and reconstruct the medieval infrastructure of the Bailiwick of 's-Hertogenbosch in order to see to whether transport and infrastructure influenced the market and fair foundation and to see whether the infrastructure is at the heart of the medieval economic urban network. After having reconstructed the medieval infrastructure this paper will use space syntax to analyse it, in order to find out what is the underlying topological reason behind the establishment of markets and fairs and whether there is an underlying topological structure of the medieval urban network. Unfortunately the absence of accurate maps from the Middle Ages is a large obstacle one has to overcome in order to be able to reconstruct the medieval infrastructure and to use spatial analyses in historical research. Previous research has shown that by using the technique of Conzenian Morphology it is possible to create accurate medieval town plans from the first cadastral plans of the nineteenth century by incorporating historical, archaeological, and standing building evidence (Lilley 2000, Craane 2007). However, this morphological technique has mainly been used on villages and small towns, not on entire regions. The reason for this is that this technique, albeit it very successful, is rather time consuming. As a result I have decided, in contrast to my suggested methodology for medieval urban analysis (Craane 2007), not to create medieval town plans using Conzenian morphology and subsequently analyse these using space syntax. Instead I have applied my methodology in reverse order by first creating an axial map and using Conzenian Morphology to create the medieval axial maps. Firstly, I have created a 'fewest line axial map' in Adobe Illustrator from the base town plan (Historical Atlas 1836-1843), using Turner's road-centre line method (Turner 2007), as illustrated in figure 3. This 'fewest line axial map' is a map of all of the streets and roads in a system, in this case the Bailiwick of 's-Hertogenbosch.

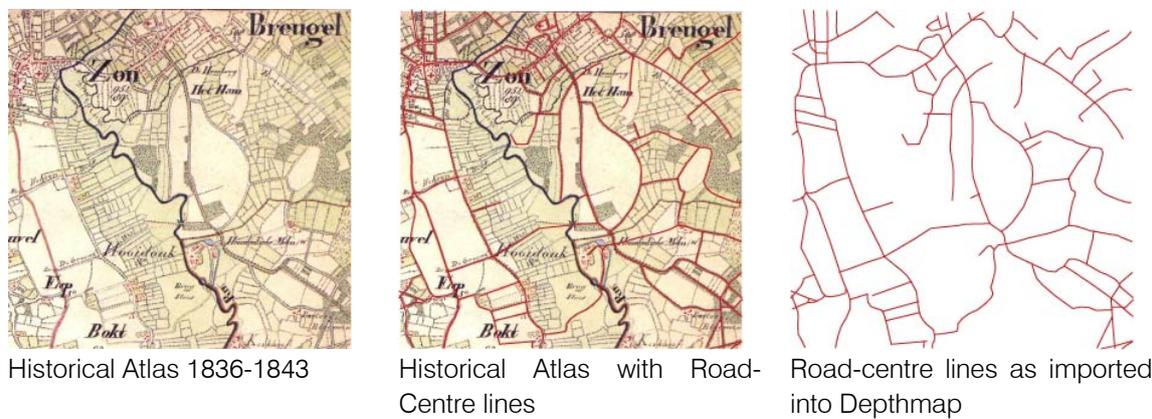


Figure 3
Illustration of the 'Fewest Line Axial Map' creation process

Secondly, using this 'fewest line axial map' as a base I have employed the Conzenian Morphology methodology and used antiquarian maps, archaeological evidence, historical sources and secondary literature such as Horsten's 'Doorgaande Wegen in Nederland' (2005) to create maps of the medieval and early-modern period. These maps are of the same format as the original 1843 'fewest line axial map' and show only the streets and roads within the Bailiwick.

Apart from being used as space syntax maps, these 'fewest line axial maps' can also be used as maps in their own right since they depict all of the roads and streets at a particular period in time and will therefore aid the analysis of the economic relationship between town and countryside.

Space Syntax methodology

After uploading the 'fewest line axial maps' of all the periods into Depthmap,² it firstly performed the axial line analysis to check whether my axial map is correct and all axial links are made (i.e. that there are no lines which do not connect with any other). Subsequently, Depthmap performed the main analysis; the segment angular analysis and the topological segment analysis. Since the map was drawn using the road-centre line method, segment angular analysis has a higher correlation to actual movement patterns than axial line analysis. Axial line analysis would have segregated shorter lines, even if they join another line at a near 360 degree angle. Segment angular analysis takes into account this obtuse angle and makes the joining segments more integrated.

The space syntax measures I have used in the segment analysis are integration/mean depth, i.e. the segment which you are more likely to go to if you travel from anywhere to everywhere else, and choice, i.e. the segment which you are more likely to pass through if you travel from everywhere to everywhere else. It needs to be noted that space syntax only uses these topological features (streets and roads) in its analysis, and does not use any information regarding the current location of economic spaces, residences, and other buildings (Hillier 2005).

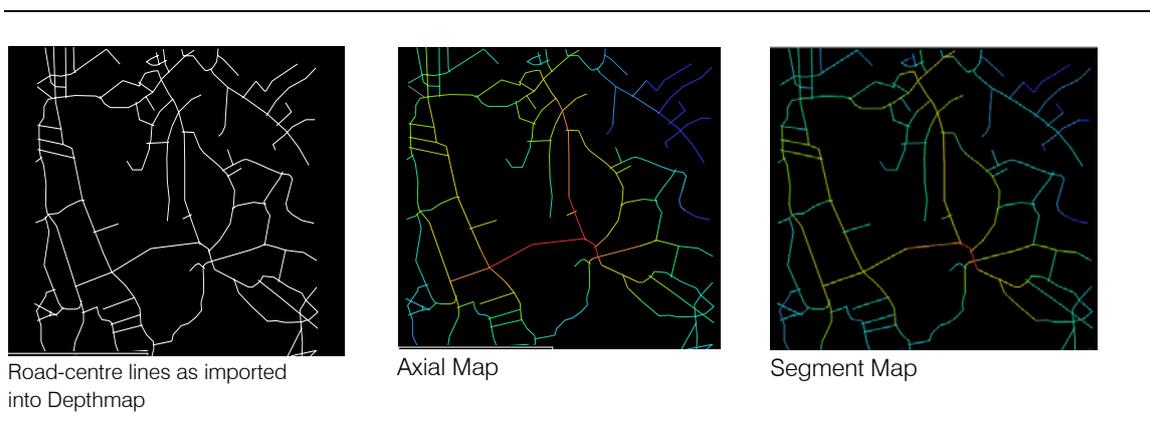


Figure 4

Illustration of the colours from Depthmap

Depthmap displays the results of the axial, segment angular and topo-met analysis in a range of colouring from red (most integrated) to violet (most segregated). The calculations have assigned every line a value and colour is assigned accordingly. These values can be presented in a table, however, this visual method by using colours is much more meaningful as displayed in figure 4.

The street system

It is of course inevitable that the further back one goes in history the number of roads one can successfully identify substantially decreases. However, the main roads are the ones, which remain identifiable for the longest period of time and it is by these roads that most producers, consumers and merchants travelled to and from the market or fair.

On the map of 1550 it is notable that nearly all of the market and fair towns are situated on one of the main roads. Some towns are merely a point along a route whereas others, such as Oirschot, Eindhoven, Oisterwijk, 's-Hertogenbosch and Eersel are situated at crossroads. Would it then be presumptuous to note that four of those crossroad towns were the first to have a market? Accessibility is therefore key in the establishment of markets and fairs. However, good accessibility does not automatically create a market, as the villages of Westelbeers (on the crossroads of the roads between Hilvarenbeek and Eersel and Oirschot and the Border) and Leende (on the crossroads from the roads to the Border from Eindhoven and Mierlo) illustrates. This suggests that there are other factors rather than only accessibility influences the establishment and profitability of markets and fairs. However, it is the case that accessibility is a pre-requisite for having a market or a fair in the first place. Without good accessibility they simply cannot exist. It is my opinion that the establishment of a market or fair cannot be solely due to a random choice by a local lord.



Figure 5
Roads in the Bailiwick in 1550

Space Syntax Results

The segment angular maps (normalised mean depth) of the Bailiwick in 1550 shows some interesting results. On a more local scale (radius 400) 's-Hertogenbosch has the highest integration value, whereas on a more global scale, the Oirschot area in particular has a high integration value, closely followed by Eindhoven.

The topological choice maps roughly show the same patterns with high choice values for the town of 's-Hertogenbosch on a local scale, and high choice values for the road between Oirschot and Eindhoven on a more global scale. Despite the low choice values of the town of 's-Hertogenbosch as a whole on a global scale the main roads towards 's-Hertogenbosch (especially the one from the south) continue to show high choice values. The choice values also seem to indicate that main road from 's-Hertogenbosch to Eindhoven ran via Oirschot, rather than the perceived shorter route from Boxtel.

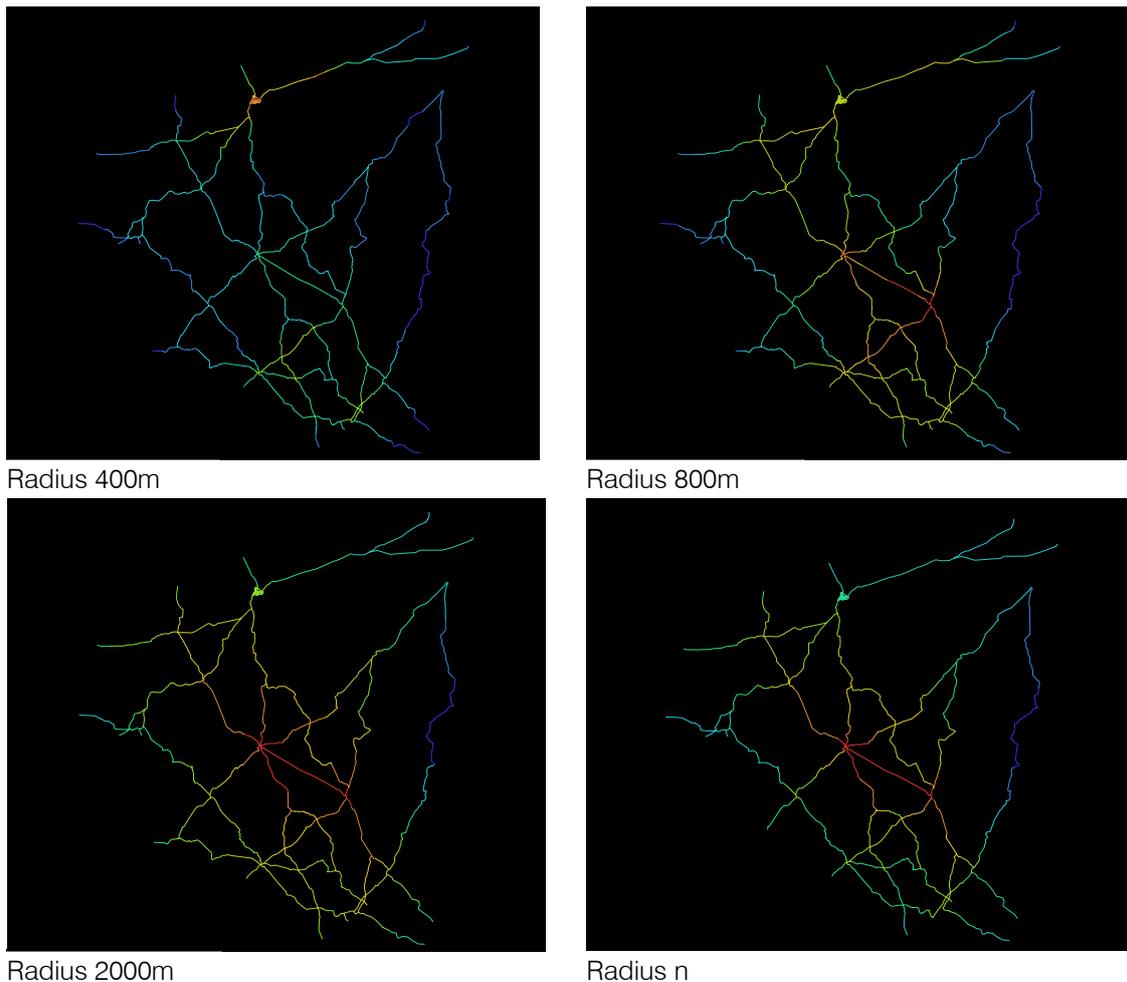


Figure 6

Normalised Mean Depth Radius 400m, 800m, 2000m and n of the Bailiwick of 's-Hertogenbosch in 1550.

Zooming into the local level in table 3 shows that 's-Hertogenbosch is a very important centre by itself (radius 50) and is important for the region as a whole (radius 2000). Oirschot and Eersel, however, have very low choice values on a local scale (radius 50) and have higher values on a more global scale. The situation at Eersel is slightly different from the one at Oirschot, as Eersel's radius 2000 value is significantly lower than its radius 800. On the other hand, we can conclude for both towns that they are not very important centres by themselves (radius 50) but have a very strong spatial position in the countryside (radius 800). This corresponds with the historic information about Oirschot and Eersel especially. Both are relatively small places but are important for their markets and their place in the regional and interregional trade network.

Moreover, the space syntax maps confirm the central function of the town of Eindhoven within the Bailiwick. Eindhoven is not the capital of the Kempenland quarter in which it is situated, Oirschot is. Eindhoven's Tuesday market and its integrated location within the Bailiwick, comparable to the one of Oirschot, both suggest an importance of that town, which previously has remained relatively unnoticed. The high levels of archaeological finds in the area are surely testament to the town's importance during the later Middle Ages.

Space syntax also explains the absence of markets or fairs at Westelbeers and Leende, despite being located on crossroads, their location is relatively more segregated.

In addition, as expected, Maasland, especially the area north of the road 's-Hertogenbosch-Oss, is a very segregated region. This area had suffered economically from the wars with Gueldres and, due to its situation near the Maas river suffered frequent flooding, and it had the largest percentage of poor compared to the other quarters.

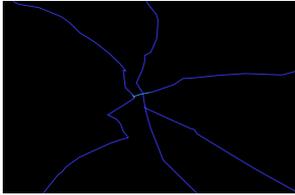
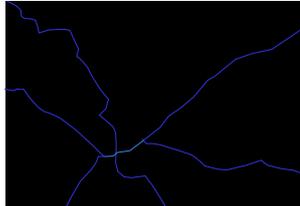
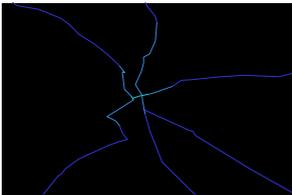
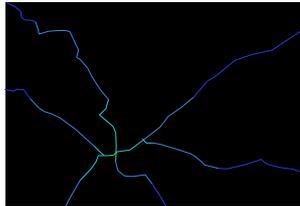
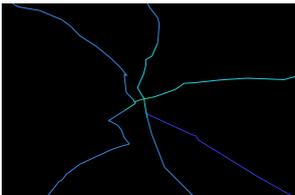
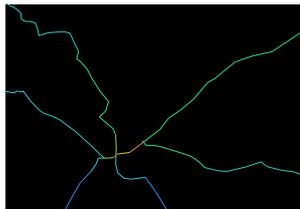
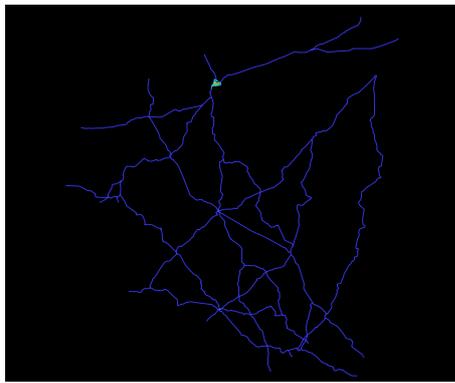
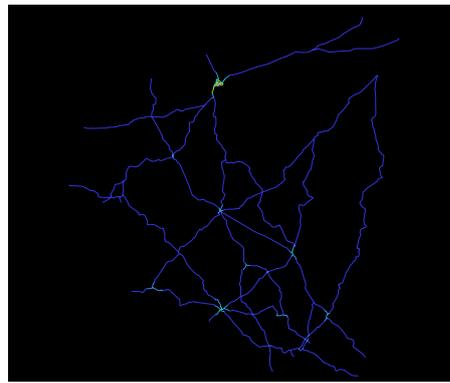
Metric Radius	's-Hertogenbosch	Oirschot	Eersel
50m	 Very high	 Low	 Very Low
100m	 Very high	 Medium	 Medium
400m	 High	 Medium	 High
800m	 High	 High	 High
2000m	 High	 Very high	 Low

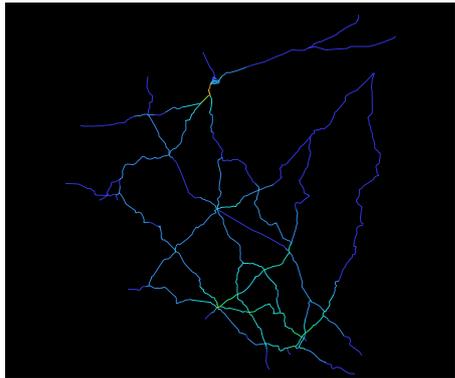
Table 3
Comparing Topological Choice values



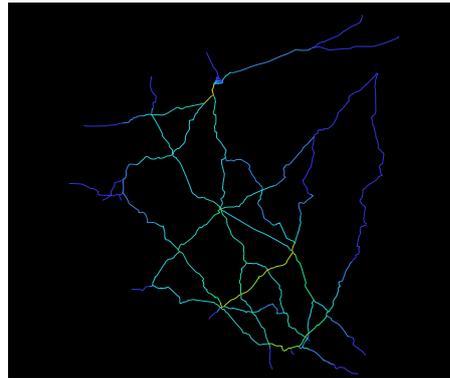
Radius 50 metric



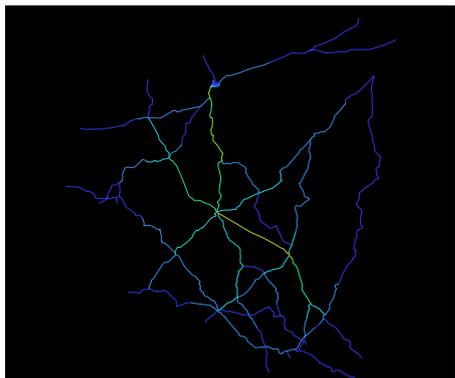
Radius 100 metric



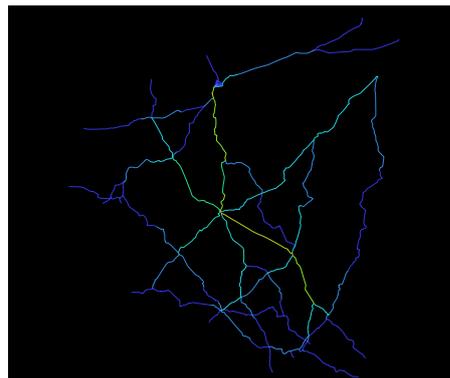
Radius 400 metric



Radius 800 metric



Radius 2000 metric



Radius n metric

Figure 7

Topological Choice Radius 50, 100, 400, 800, 2000 and n metric of the Bailiwick of 's-Hertogenbosch in 1550.

Conclusion

This paper is of course only a stepping stone in the continuing development and research into the medieval economy and the symbiosis between town and countryside and has only shown some preliminary space syntax results. However, it has provided an indication that already in the medieval period some sort of conurbation was in existence. It has demonstrated the need for a more formal analysis of urban networks and has introduced a suitable methodology, which has enabled the visualisation of this conurbation. This methodology, a combination of space syntax and Conzenian morphology, has been tested on the Bailiwick of 's-Hertogenbosch and yielded very promising results.

However, since this is the first case-study which has used space syntax in historical urban network analysis, it is important to test it on several other regions in the future and to create a wider corpus of data and to discover whether there are any limitations, for instance in the choice of region, and

particular urban network. Moreover, waterways are important means of transport and it should be investigated whether and how waterways can be included in the spatial analysis.

I do hope that this paper has raised some interesting points for discussion either at the conference or in future and has created some interest for the use of space syntax in a medieval context.

Notes

Notes

- 1 Demographic, economic and institutional causes have been discussed in the regional chapter of my PhD thesis, and have only had limited impact upon the establishment of markets and fairs.
- 2 Depthmap is a Space Syntax software package developed by Alasdair Turner at UCL <http://www.vr.ucl.ac.uk/depthmap/>

Abbreviations

BHIC	Brabant Historisch Informatie Centrum (Brabant Historic Information Centre)
ONB	Oorkondeboek Noord-Brabant (Camps et al. 1979) (Chartulary Noord-Brabant)
RHCE	Regionaal Historisch Centrum Eindhoven (Regional Historic Information Centre Eindhoven)
RHCT	Regionaal Historisch Centrum Tilburg (Regional Historic Information Centre Tilburg)
SAH	Stadsarchief 's-Hertogenbosch (Municipal Archives 's-Hertogenbosch)
UvT	Universiteit van Tilburg (+library code) (Tilburg University Library)

References

- van Asseldonk, M M P. 2002. *De Meierij van 's-Hertogenbosch; De Evolutie van Plaatselijk Bestuur, Bestuurlijke Indeling en Dorpsgrenzen, circa 1200-1832*. PhD thesis, Katholieke Universiteit Brabant, Tilburg
- Berry, B J L. 1967. *Geography of Market Centers and Retail Distribution*. Englewood Cliffs, NJ: Prentice-Hall.
- Britnell, R H. 1996. *The Commercialisation of English Society 1000-1500*. Manchester: Manchester University Press.
- Camps, H P H, Dillo, M, van Synghele, G and van Der Vlist, E T. 1979. *Oorkondeboek Noord-Brabant*, <http://www.inghist.nl/Onderzoek/Projecten/OorkondenVanNoord-brabant694-1312> (Page Consulted: 14/10/2008).
- Christaller, W. 1935. *Central Places in Southern Germany*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. Edition used from 1966
- Craane, M L. 2007. Analysing Medieval Urban Space; a Methodology. *Internet Archaeology*, 21, http://intarch.ac.uk/journal/issue21/craane_index.html (Page consulted: 14/08/07)).
- Farmer, D L. 1991. Marketing the Produce of the Countryside. In E Miller (Ed.) *The Agrarian History of England and Wales Volume III 1348-1500*, 324-430. Cambridge: Cambridge University Press.
- Frenken, A M. 1975. *Helmond in het Verleden*, Schiedam: Interbook International.
- Hillier, B. 2005. Space/Spatial Behaviour. *Hillier-workshop on Space*. Leiden, Unpublished. (30 May 2005).
- Horsten, F H. 2005. *Doorgaande Wegen in Nederland, 16e tot 19e eeuw: een Historische Wegenatlas*. Amsterdam: Aksant.
- Lijten, J P J. 1991. Kermis en Markt. In H J M Mijland, L M van Hout and J P J Lijten (Eds.) *Oog op Oirschot, 190-199*. Oirschot: Stichting Gerard Goossens Fonds.
- Lilley, K D. 2000. Mapping the Medieval City: Plan Analysis and Urban History. *Urban History*, 27(1), 5-30.
- van Nes, A. 2008. 'Randstad'.
- van Oudenhoven, J. 1670. *Een Nieuwe ende Vermeerderde Beschryvinge van de Meyerye van 's-Hertogenbossche, Behelsende alle de Baronijen, Heerlijkheden, Steden, Casteelen, Vlecken, Dorpen, Gehuchten*. 'sHertogenbossche: gedrukt by Ian Scheffers, ende Iacomina van Oudenhoven, weduwe van Isaac van Dockum. UvT TRE 004 D 10
- Stabel, P. 1997. *Dwarfs among Giants; the Flemish Urban Network in the Late Middle Ages*. Leuven: Garant.

- von Thünen, J H. 1863. *von Thünen's Isolated State*. Oxford: Pergamon Press. Edition used from 1966
- Turner, A. 2007. From Axial to Road-centre Lines: a New Representation for Space Syntax and a New Model of Route Choice for Transport Network Analysis. *Environment and Planning B: Planning and Design*, 34(3), 539-555.
- Unwin, T. 1981. Rural Marketing in Medieval Nottinghamshire. *Journal of Historical Geography*, 7(3), 231-251.
- Woodbine, G E. Bracton De Legibus et Consuetudinibus Anglie.
<http://hls15.law.harvard.edu/bracton/> (Page consulted: 14/05/08)