Is a railway station a 'central' urban place? Spatial configuration study of retail distribution pattern around railway stations

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1. Introduction

Stations have emerged as a new central place in metropolitan cities in Europe and have become hub of networks due to their high accessibility by different modes of transport in high scale level. Furthermore, they produce movements which offer sufficient opportunity for the development of commercial land use. It is often assumed that the internal functional dynamics of a centre is determined by the attractive power of concentration of large programmatic units (Dickinson, 1947; Lynch, 1960; Jacobs, 2000; Groenemeijer, 2001). This idea has been adopted to create a high number of different functions in and around station areas by mixing land use or increasing the population density.

Commercial activities seek growth and expansion in order to increase sales and profit. Since the retailer must decide both where future investment will be allocated and which strategies will be most effective at particular stores or location, retail strategies have an important spatial element. Whether selling goods or services, the choice of an optimal outlet location is perhaps the most important decision a retailer has to make. It is through the location that goods and services are made available to potential customers.

There have been a lot of studies on the location strategies on retails (Reilly, 1931; Applebaum, 1966; Ghosh and McLafferty, 1987; Sadahiro, 1998), and also on the relationship between the railway station and the retails location (Okabe and Miki, 1994; Bertolini, 1998; Bruil, 2004). Nevertheless the analysis of retail location has been mainly stayed in the abstract planning level. There is still a lack of knowledge on the 'street-level' distribution pattern of retail activities around the railway station.

This study therefore investigates spatial integration of railway stations in the existing urban fabric and analyses the influence of the railway station's location on the distribution pattern of retail and service firms. Station areas in the cities of Delft and Leiden in the Netherlands were analysed by the grid configuration analysis using Space Syntax techniques to uncover space-structural detail within urban fabric as a field of movement and activity. These different case studies are subsequently compared, to analyse how the different street configurations affect the economic activities around those stations. The findings demonstrate that the distribution of street-edge shopping, and the local qualities which support this function, appear to be determined very powerfully by spatial-configurational factors, which are the 'area-integration' and the integration between the "city-scale" structure in the local fine-grained fabric.

2. 'Central' urban place

The railway station area as a new central place in the city has similar necessity as a centre in the city. Recently, Khaisri Paksucharem (2003) argued that the key to the successful creation of an urban place out of a transport node is the same as that which prevails in

general, namely that spatial configuration is critical.

Bill Hillier and his colleagues at the Space Syntax laboratory propose that the live centrality is related to its spatial context; thus an urban centre is never stable, but consists in a process (Hillier, 1999). He also argues that while we may find movement and attractors (land-uses which benefit greatly from movement and are capable by themselves of generating movement, such as retail shops) highly related to each other, we can not assume that movement can be explained by attractors until we are sure that the configurational properties of the grid have not influenced both the presence of movement and the presence of attractors (Hillier, 1984).

Based on Space Syntax theory, Stephen Read studied the centrality issues on Dutch cities (Read, 1996). He argued that configurationally, cities consist of different scales of movement. These scales are layered, distinguished by the scales of mobility, and are designed to convey different scales of movement. The hierarchy or functional layering built into the shape of the urban grid of Dutch cities involves firstly the regional movement network which conveys movement at a scale which cities as points or destinations within it. Secondly, it involves the city-scale movement network, a set of spaces in the grid, which are suited by their geometry for carrying traffic over the medium and longer distance. And thirdly, it involves the grid at the neighbourhood or local scale. The regional scales appear locally most often in a nodal node - e.g. stations, metro stops or parking garages. The city scale is mostly linear and continuous, and is differentiated and 'formed' by its level of integration into the local scale. It is suggested that in order to produce that sort of real urban centrality, we need to integrate locations into the urban system at a variety of scale levels. The centrality is a product of layering of scales. This means that real urban centrality depends not only on the contribution of a regional context, but also on a context at a 'city' scale as well as at a local scale. In other words, the location needs to be systematically connected to the more traditional urban scales as well as to the new ones (Read, 2000).

At the local scale, Jane Jacobs has suggested the importance of small-blocks in generating diversity in the city (Jacobs, 1992). This idea has been further elaborated by Arnis Siksna (Siksna, 1997). He found that some block forms and sizes were better than others in making city centre layout more amenable to adoption, or more robust in meeting varied development needs over time. Small square blocks, 50-60 meters, perform better than larger blocks because they produce finer-mesh circulation patterns, more potential frontages, more coherent block fabrics and finer-grained, continuous urban fabrics and both low and high-rise buildings. Thus, he argued further, if certain block forms have worked well, or have produced particular effects in the past, there is a reasonable expectation that they will perform similarly in other cases in the future.

How about the centrality of railway station locations? Many railway station locations are attractive as retail location, due to their high accessibility on regional scale, but whether they have the 'real' effect on the distribution of retail location still needs to be investigated. This article concentrates therefore not on regional accessibility and centrality, but on the other scales required to provide an urban centrality around the station and to create an attractive location for street-edge shopping activities.

Figure 84: The map of shopping areas in Delft (source: Gemeente Delft, 2003)

3. Case one, Delft

Delft is a densely populated - medium sized town, with a population of 97,000 and an area of 26.31 km2, located 15 km from The Hague, the government capital of the Netherlands. The railroad marked the start of industrial times in Delft. In 1839, the "Hollandse Ijzeren Spoorwegmaatschappij" (Dutch Iron Railway Company) planned to extend its railroad line from Haarlem to Rotterdam, the upcoming harbour city, passing through The Hague and Delft. This plan brought a radical change in Delft's spatial lay out.

At present, the railway station in Delft plays an important role in the economic development of the city. Everyday more than 20,000 passengers stop at Delft railway station. Most of these passengers are students and employees at high education institutions, e.g. Delft University of Technology (with its 13,000 students and 3,000 employees) and knowledge based companies (approximately 4,650 employees) such as Netherlands Organisation for Applied Scientific Research (TNO) and Geodelft.

There are five important shopping centre areas in Delft (Gemeente Delft, 2003), three of them located in the historical inner city, and have a fun-tourist shopping character. The fourth one, "In de Hoven", is an urban indoor shopping centre, located in a post-war urban area where buildings are mostly high-rise and densely populated. The newest shopping area (built 1995) is "Leeuwenstein", a regional car-based shopping centre where one can get furniture, carpets, beds and kitchen appliances. It is easily accessible from highway A13 and its parking place is directly connected to the entrance doors. Due to its outstanding accessibility via the highway, this shopping centre serves not only the city of Delft, but also the other smaller cities around it.

Is it true that the railway station effects the distribution of retail shop?

In spite of the fact that this study focussed mainly on the spatial configuration around the railway station, it was necessary to include the whole urban grid in the analysis, to ensure that each line in the station area is embedded in the whole urban structure. Figure 84 gives an axial representation of the city of Delft, covering the area approximately between the highway A13 in the east and the natural city boundaries in the north, south and west, such as the farming lands and green houses.

Figure 85: Global integration map and b) Area integration map of Delft

Figure 85a is the global integration map and as such shows the most global structure of Delft, with a pattern centred on main street line axes (i.e. Westlandseweg-Zuidwal, Papsouwselaan-Voorhofdreef, Martinus Nijhoflaan, Buitenwatersloot-Binnenwatersloot and Westvest-Phoenixstraat). These are also the vehicular axes. As we can see, the location of the knowledge based institutes and companies are on these axes, partly because of its accessibility to the highway A13. It implies that those functions not only serve the city of Delft, but also a larger region. The same is the case with the railway station. It is located near the crossing of Westlandseweg-Zuidwal and Westvest-Phoenixstraat, one of the most central locations in Delft.

Figure 85b shows the area integration analysis (a measure designed to highlight areas in the city with a high general level of local integration). It further reveals the local potential of the fabric. In general one could say that local concentrations of high local integration reflects high integration and social interactivity. As can be seen in figure 85b, the market square area in the old city centre is highlighted (the darker patches in the area integration map) and it is the location where the most retail shopping streets in Delft clustered, with 192 retail shops of a total 612 in all of Delft (Gemeente Delft, 2003).

Let us focus on the spatial configuration around Delft central station. Since we deal mainly with streets configuration, the walkable radius is chosen as the research boundary. It means that the railway station area is identified as a circular area radiating from the railway station that is considered 'walkable' distance. In this case we adopt a walkable radius of 1 km (more or less equal to ten minutes walking time).

Figure 86a selects a one-kilometre area around Delft Central Station and assigns numbers of retail shops on each line segment on area integration map. It shows that retail shops mostly located themselves along the most integrated spaces (red lines) in this analysis.

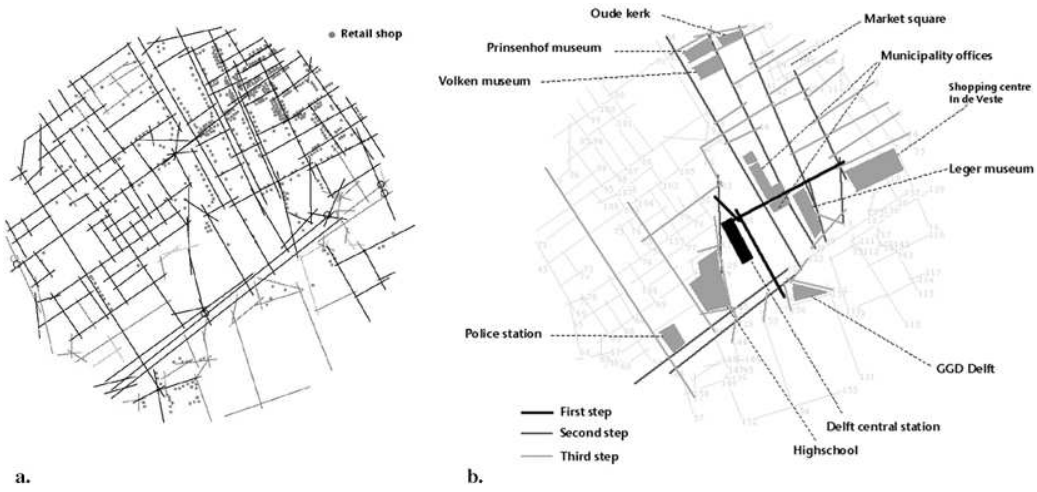

Figure 86: Area integration map plotted with the distribution of retail shops within one kilometer radius of Delft Central Station, b) Three-steps analysis from Delft Central Station

Furthermore, in the three-step analysis, shown in figure 86b, the metric area covered by the three-step grid is not compact and has low number of streets (49), which also implies that the size of the blocks are rather big, compare to the one in the market square.

It appears there is only small number of shops located in the vicinity of the station. Most of them are located in the most integrated space of 'area integration'. It suggests that the effect of the spatial configuration, in this case the 'area integration' measurement, is much more determining than the station one.

4. Case two, Leiden

The city of Leiden is located within the Rijnland region, between the bigger urban areas of Amsterdam in the North and the Hague-Rotterdam in the South. Rijnland itself consists of the Leiden urban area and a number of smaller towns from Katwijk on the coast to Alphen aan de Rijn 20 km to the East. The river Rhine, connecting the hinterland and the North Sea, is the back bone in this region. Many settlements were established along this river and Leiden is one of them. The name of Leiden derives from the regional denotation of Leithon (=lying on a water course), situated along the river Rhine and coinciding with the old territory of Leiderdorp. In early periods, Leiden grew along the Northern and Southern dikes of the river Rhine to the East-West direction. Only later, in the 19th century, when the city dismantled its fortification, the city started to expand along North-South axis. Nevertheless the original main structure of the city along the river dikes remain serving as the city-scale structure for centuries (see Figure 87). Furthermore, the two early city structures Haarlemmerstraat and Breestraat, which used to be the dikes along the river functioning as streets connecting other towns (such as Oegsgeest, Katwijk, Leiderdorp, etc), are the most important shopping streets nowadays.

Leiden Central Station, the main railway station in the Rijnland region, has a high accessibility by train and other public transport. It is only 10 minutes from the Hague, 15

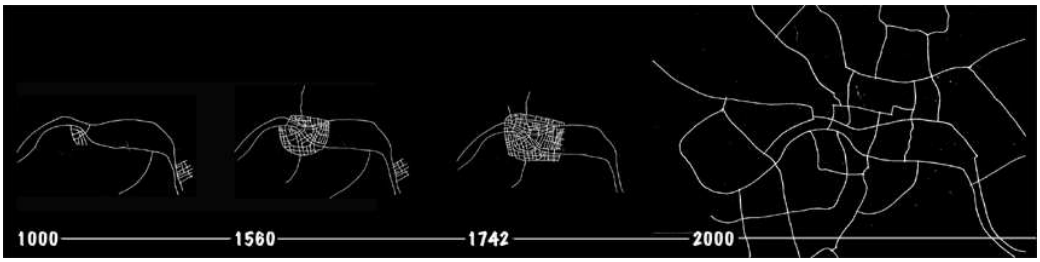

Figure 87: Spatial development of Leiden, the city-scale structure

minutes from the international Schiphol airport and 35 minutes from Amsterdam. Almost similar to the Central Station in Delft, many of the passengers have Bio-Science park (a cluster of hospital, education institutions, knowledge based companies, etc, in the field of life science) as their destination. Nevertheless, the retail activities that we would expect to flock in its immediate surrounding are not there, except for one street, the Stationsweg. Why? Does the station, due to its high accessibility, not have high capability in producing the pedestrian movement and attracting retail activities? Why then are the shops not more oriented to the station than to the main shopping street? What makes Haarlemmerstraat the main shopping street and not the area around the station?

As in Delft, first we analysed the whole urban structure of Leiden. Figure 88 shows the spatial configuration of the city-scale structure of Leiden. As we can see, the old dike structures, Haarlemmerstraat and Breestraat, are still part of the city-scale structure of the city. There are also more recent structures, such as Churchillaan, Vijfmeilaan, etc. The station is located just next to this main structure.

It has been suggested that to create an urban centrality and attractive place for retail activities, it is necessary to integrate the city-scale structure with the local-scale grid and to have a small block size in the local urban fabric. So, Figure 89a demonstrates the degree to which the city-scale structure is physically integrated with the local urban fabric. Furthermore, figure 89b shows the correlation between retail shops and the degree of integration of city-scale structure in the local urban fabric. These measurements clearly shown that each well-embedded city-scale section is characterized by street-edge shopping activities. In fact, the most important shopping streets (Haarlemmerstraat and Breestraat) are located at the most integrated city-scale.

Let us have a closer look to the station area. Figure 90 selects a one-kilometre radius around Leiden Central Station and assigns numbers of retail shops on each line segment. It shows that street-edge retail shops mostly located themselves along the Haarlemmerstraat and Stationsweg. Meanwhile in immediate surrounding of the station (both on East and West side) has almost no retail shop. In fact it is clearly shown that the effect of the station is only limited on the "Stationsweg", a street which connects the station with the main structure of the city. This implies that to be able to create a place for retail activities, the station is depending to the local retail structure of the city.

5. Conclusion

Our empirical analysis shows that the distribution of retail shops in Delft and Leiden is determined by spatial configuration to a considerable extent.

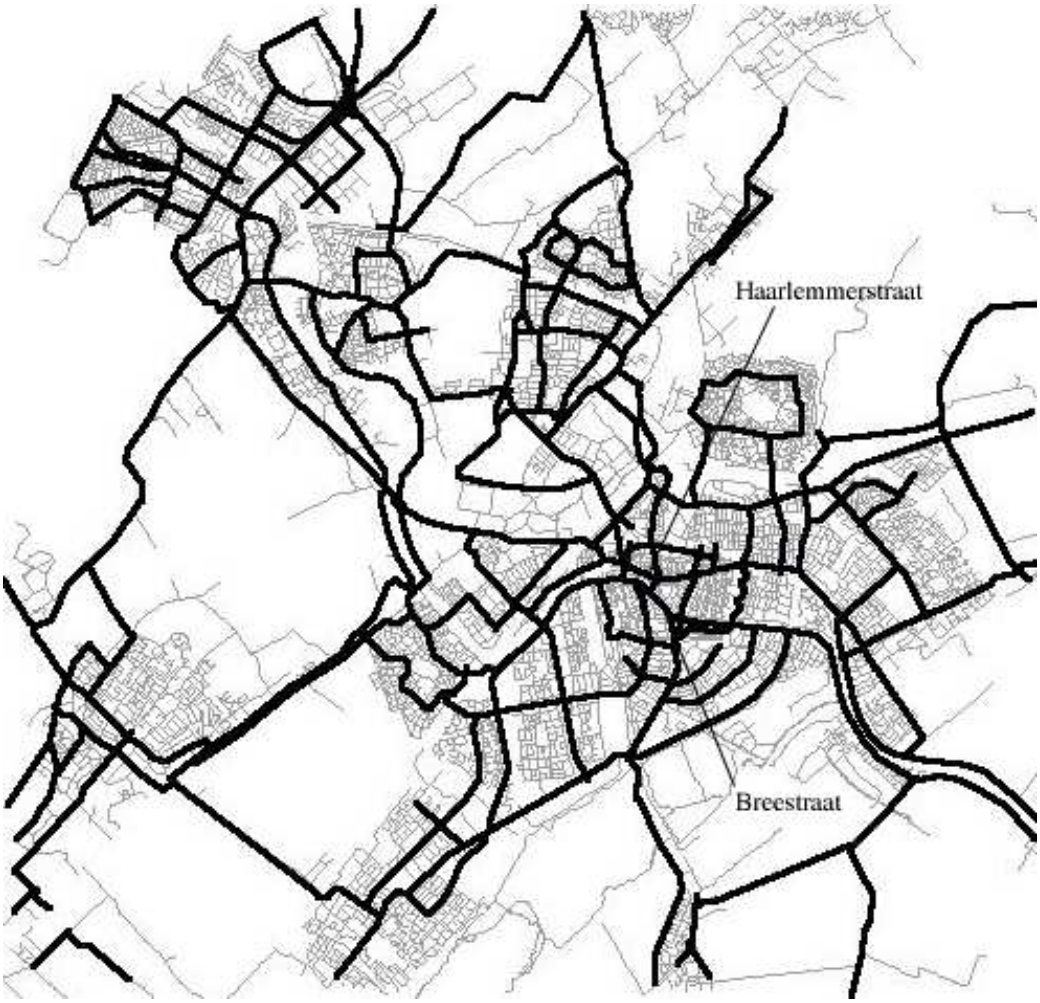

Figure 88: Spatial configuration of the city-scale structure of Leiden

Figure 89: a. Physical integration of the city-scale structure, b. Correlation between the embeddedness of the city-scale structure with distribution pattern of retails.

Figure 90: City-scale structure plotted with the distribution of retail shops within one kilometer radius of Leiden Central Station

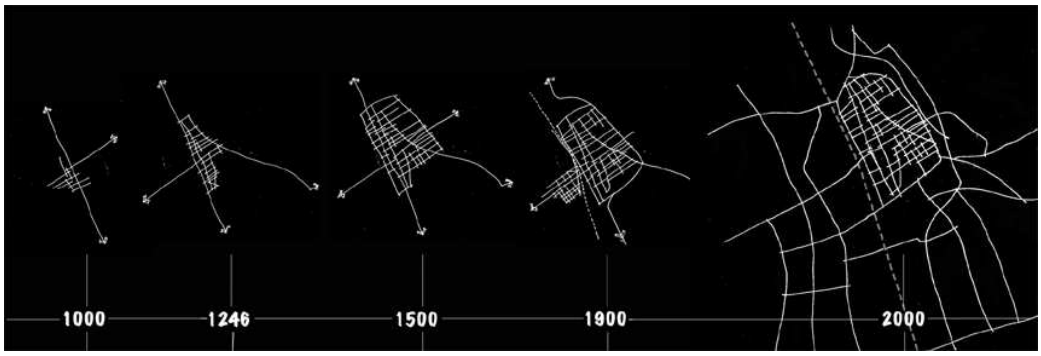

Figure 91: Spatial development of Delft, the city-scale structure

In the Delft case, the retail distribution pattern follows the "area integration" pattern. We suggest that this is because the natural emergence of "city-scale" structure was dismantled during the industrialization-modernization period of the 19th and 20th centuries. Its original main structure, which was the water structure connecting the Hague and Rotterdam via the city, was blocked and delineated in the end of 19th century. The city engineered other "city-scale" structure located outside the original city. This engineered structures poorly integrated in the local urban fabric. This lack of integration between the city and the local scale resulted in a strong integrated and transparent grid in the old city, which became the one and only attractive place for retail shops in the whole city.

In the Leiden case, the distribution pattern of street-edge shopping is more determined by the integration of the "city-scale" in the local urban fabric. It is clear that Leiden Central Station wouldn't be able to create an urban place for retails without plug-in itself (via Stationsweg) into the existing functional structure of the city (Haarlemmerstraat). This implies that the location of retail shops is much more determined by the city's spatial configuration than the presence of the railway station.

It is also evident that the distribution of retail shops around Delft Central Station and Leiden Central Station strongly depends on the structure of local urban fabric. Even though both stations have a high accessibility on the regional level, they have only little influence on the location's choice of the retailer.

These arguments suggest the importance of spatial configuration of a traditional urban fabric on the retail distribution pattern. If we wish to design a central location of economically dense and supportive environments around the railway station, then we must design with the knowledge that the main determining factor is not the station's regional accessibility, but its integration with the local urban structure.

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