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SPATIAL-SOCIO CLASSIFICATION OF DEPRIVED NEIGHBOURHOODS IN THE NETHERLANDS:

Strategies for neighbourhood revitalisation

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Abstract

Since 2007 various strategies were developed for improving the worst deprived neighbourhoods in the Netherlands. The majority of the measures directed to the revitalisation of these neighbourhoods were social programs aiming to strengthen the economic position and social skills of the inhabitants.

Spatial interventions have been largely overlooked because an adequate diagnosis tool is missing. To fill this gap, space syntax and statistical analyses is carried out on a dataset of 43 neighbourhoods in which various micro and macro scale variables is taken into account and related to social and crime data. The analyses show that the deprived neighbourhoods can be classified in four groups based on their spatial properties and three groups based on their socio-spatial characteristics. These groups provide an adequate classification of the different social and spatial properties of the neighbourhoods, and point out which spatial measures making sense in the revitalisation of these areas.

Keywords: *Deprived neighbourhoods, network configuration, social composition, revitalisation, classification systems*

Theme: *Urban Space and Social, Economic and Cultural Phenomena*

Introduction

In 2007 Dutch minister Ella Vogelaar from the Ministry of Housing, Communities and Integration appointed 40 neighbourhoods in the Netherlands on a priority list for revitalisation. These neighbourhoods were labelled 'priority neighbourhood': area's in which various problems in relation to unemployment, liveability and safety accumulate in combination with an ageing and one-sided housing stock (Priemus 2005).

Since then, various action plans and policies have been developed by the national and local governments and local partners. Local residents were included in these plans and treated as 'field experts'. The most common measures were replacement of rented homes by owner-occupier dwellings, selling off social housing, improving the public spaces, creating broad-based schools or multifunctional neighbourhood centres, involving residents in the management of the neighbourhood, and providing help and support to households with problems (VROM/WWI 2010). These interventions had a total cost of 750 million euro, but the overall effects were very disappointing (Permentier et all 2013). Restructuring was the only intervention for which significant positive effects were found, especially large-scale restructuring. All other interventions produced no significant positive outcomes.

The results of the evaluation suggest that spatial measures are probably a more effective way to deal with neighbourhood problems related to unemployment, safety and liveability than social or (other) physical interventions. The question, however, is what kinds of spatial improvements are needed? How does the social composition of dwellers play a role to the need and the kind of spatial improvements inside a neighbourhood? The aim of this paper is to take a first step in answering these questions. To do so, two classification systems are presented which can be used as a starting point for spatial and social diagnoses of deprived areas and as indicators of which improvements are needed. In this paper, the spatial and social classifications are related to each other as well as to crime data. This to reveal the extent in which the social composition of dwellers, in combination with the spatial characteristics of neighbourhoods, affect each other and crime rates. In conclusion, some general spatial principles on how to plan and design vital and safe neighbourhoods are presented.

Macro and micro scale analyses of all neighbourhoods

In this study, all cities with one or more neighbourhoods on the Vogelaar list were analysed both with the help of statistical analyses (SPSS) and the Space Syntax method (Depthmap software). This makes it possible to reveal the spatial configuration of the street network in a neighbourhood and to correlate spatial characteristics with data on social composition and criminal dispersal. In addition, 8 reference neighbourhoods were added. These reference neighbourhoods have the same social profile as the neighbourhoods on Vogelaar's list. The three organizations providing data for this study (the Central Bureau of Statistics, the municipalities and the various police offices) sometimes use different boundaries or even different names for the same areas. Because of this not all neighbourhoods or boroughs could be included in this study. The result was a database of 43 neighbourhoods in 21 Dutch cities with a corresponding list of social, crime and spatial data.

The following macro spatial values were used in the comparison of the 43 neighbourhoods:

- *Global integration* – shows how spatially integrated the neighbourhood is in relationship to the whole city/town.

- *Local angular integration with topological radius 3* – shows how spatially integrated the neighbourhood is in relationship to its surroundings.

- *Angular analyses with a high metrical* radius – shows how the area is connected to the location of the main routes in the city/town.

- *Angular analyses with a low metrical radius* – shows the spatial potentials for the vitality of a local centre inside the neighbourhood.

- *Correlation metric high-low* – shows the degree of correlation between the angular analyses with a metric high and low radius. The higher the correlation, the more spatial potentials for local small businesses and street life.

- *Main routes in relation to the local streets* – shows the degree of adjacency and connectivity between main routes and local streets. If there are too many direction changes from the main routes, the area scores low. If the local streets are directly connected to the main routes, the area scores high.

- *The angular step depth taken from the main* routes – This variable is similar to 'main routes vs local', but also takes the angular weighting between the street segments into account. If the number of direction changes to all streets from the main routes is low, the area scores high. The area scores low if the average step depth taken from the main routes is high.

Micro scale spatial relationships between private and public space influence the extent in which individual life styles can interfere with street life and visa versa. The various degrees of interfaces or spatial inter-connections between these two kinds of spaces influence human behaviour in cities (van Nes and López 2010). The following micro scale variables were used in the analyses and comparison of the 43 neighbourhoods:

- *Inter-visibility between entrances and windows and streets* – shows how inter-visible the streets are. A street is considered inter-visible only when the entrances with windows are connected directly to the street, when there is a dwelling, office, cafe or shopping function on the ground floor level, and when these two aspects are located on both sides of the street. If the dwellings are located a half floor higher than the street, the street is not considered inter-visible.

- *Inter-visibility main* routes – shows how much of the main routes inside the area are inter-visible from adjacent buildings.

- *Correlation between visibility and degree of spatial integration.* If the area has inter-visible streets, but located only in the segregated streets and the main routes are not inter-visible, the area scores low. If the area has inter-visible main routes, but poorly inter-visible segregated residential streets, the area scores medium. If the area has inter-visible streets and a high degree of spatial integration, the area scores high.

All spatial values are grouped in five classes. If the area has high average values on their spatial analyses, the value 5 is given. The middle values are 3 and the lowest values are 1.

Social, economic and demographic data was obtained from the Central Bureau of Statistics. These data included: total population, number of private households, number of dwellings, percentage of inhabitants 15-25 year, percentage of households without children, percentage of households with children, average household size, percentage of non-western households,

property-stock value, percentage of rental homes, number of private cars, average income per recipient, average income per household, percentage of persons with low income, percentage of households with low income and economic non-actives.

Data on total numbers of recorded crime was obtained from the AH Misdaadmeter and included the total numbers of recorded incidents of theft from/out of cars, violence and vandalism. Each of these crime numbers were related to 10.000 residents.

A spatial classification of the neighbourhoods

Based on the distinction between the macro and micro scale, it is possible to classify neighbourhoods into 4 groups:

Group 1. High values on the macro as well as the micro scale levels

Group 2. High values on the macro level, low values on the micro level

Group 3. Low values on the macro level, high values on the micro level

Group 4. Low values on the macro as well as the micro scale levels

The results from the spatial analyses show that the four groups of neighbourhoods are clearly distinctive from one another. Priority neighbourhoods belonging to group one tend to be areas with high gentrification potentials. These areas are located adjacent to town and city centres. Problems in these neighbourhoods are often related to the low technical quality of the buildings. The neighbourhoods tend to have many apartments that are too small and lack a sufficient number of luxury dwellings. Some of the neighbourhoods belonging to this group show signs of gentrification processes. Students and the creative class are moving into these areas, and some of the historic buildings are restored and reused. Examples on these kinds of neighbourhoods are Amsterdam-Oost in Amsterdam and Transvaal in The Hague. These kinds of neighbourhoods tend to have buildings with a strong place identity, but they need technical improvements. The spatial drivers for a gentrification process are present in these neighbourhoods. They have a highly integrated street network and a high degree of inter-visibility between buildings and streets.

Figure 1 Transvaal, The Hague (Source images: Google Earth)

Figure 1 shows the local angular analyses with high and low metrical radii and a photo of a local dwelling street (right) and a main route (left) in Transvaal, The Hague. The neighbourhood is built at the end of 19th century as a working class neighbourhood. In the local dwelling street the buildings are connected directly to the street on both sides and the entrances and windows are inter-visible. There is an active dwelling function on the ground floor level. Also the main route has entrances and windows directly connected to the street on both sides. Various shops, small firms and dwellings are located on ground floor level. The main route functions as a local shopping street for the area. Shopping streets are located along streets with high values in the angular analyses with both high and low metrical radii.

Neighbourhoods belonging to the second group also have large potentials for gentrification. The main routes are located inside the neighbourhood and well connected to most local streets. The most notable difference with group one is the fact that neighbourhoods in group 2 have several streets with blind walls or buildings with entrances turned away from the streets. Examples are Nieuw West in Amsterdam, and Malburgen, Persikhaaf and Het Broek in Arnhem. In this group, there are also some neighbourhoods with well integrated and inter-visible main routes through the area, but the inter-visibility between buildings and streets is poor in the side streets. Examples of these kinds of neighbourhoods are Maastricht Noord-oost, Kruiskamp in Amersfoort, Bos en Lommer in Amsterdam, Schilderswijk and Stationwijk in The Hague, and Feyenoord, Vreewijk, Oude Noorden, Crooswijk, Bergpolder and Charlois in Rotterdam.

Figure 2 Transvaal, The Hague (Source images: Google Earth)

Figure 2 shows the local angular analyses with high and low metrical radii and photo's of a local dwelling street (right) and a main route (left) in Amsterdam Nieuw West. The neighbourhood is built in the 1950's for accommodating the population growth and tackling the housing shortage in Amsterdam after World War II. In the local dwelling street on the photo, the buildings are not directly connected to the street. There are storage spaces on the ground floor level and the walls are inactive and without any windows. Therefore the street inter-visibility is low. The main route also lacks entrances and windows connected to the street. The buildings are turned away from the main route and the main route functions as a traffic distributor for mostly vehicles and bicycles. Car based shopping centres are located along streets or roads with high values in the angular analyses with both high and low metrical radii.

Neighbourhoods belonging to group three consist of low-rise buildings with small gardens and a segregated street network. The streets are inter-visible with entrances connected directly to the streets. Several of these neighbourhoods lack, however, an integrated main street or main route or a connection to a main route on their edges. Examples of these neighbourhoods are Klarendal in Arnhem, Rivierenwijk in Deventer, Meezenbroek in Heerlen, and Woensel West, Bennekel and Doornakker in Eindhoven. Some areas have gentrification potentials due to adjacency to an integrated street net. Examples of these kinds of neighbourhoods are Velve-Lindenhof in Enschede, Nieuw West in Rotterdam, Hoog and Korrel in Groningen, and Ondiep and Zuilen Oost in Utrecht. The challenge in these neighbourhoods is to make new connections in the street network that will increase the low spatial integration.

Figure 3 Doornakker, Eindhoven (Source images: Google Earth)

Figure 3 shows the local angular analyses with high and low metrical radii and a photo of a local dwelling street and a main route in Doornakkers, Eindhoven. The neighbourhood is built in the 1930's as a working class neighbourhood. In the local dwelling street on the photo, the buildings are connected directly to the street on both sides and the entrances and windows are inter-visible. There is an active dwelling function on the ground floor level. The main route is located outside the area and has few entrances and windows connected to the street. Some buildings are turned away from the main route while others are directly connected to it. Due to its low integration values from the macro scale analyses, the main routes in this group of neighbourhoods lack the spatial potential to function as local shopping streets. In the angular analyses with metrical radii, there is no overlap between streets with high values in the low and high metrical radii. Therefore the area lacks shops and micro scale businesses.

Figure 5 Poelenburg, Zaanstad (Source images: Google Earth)

The neighbourhoods belonging to the last group tend to be located on the edge of a town or city. Most of them consist of high rise buildings or flats with poor connections between private and public space. Others consist of low-rise buildings, positioned in such a way that there is no inter-visibility between the buildings' entrances. Some areas have a mix of both cases. What they all have in common is a poorly integrated street and road network and poor inter-visibility between buildings and streets. Examples of neighbourhoods of this kind are Overdie in Alkmaar, Buitenhof in Delft, Meezenbroek in Heerlen, Hechterp Schie in Leeuwarden, Hatert in Nijmegen, Steenvorde Zuid in Rijswijk, Nieuwland in Schiedam, Poelenburg in Zaanstad, Zuid Oost and Amsterdam Noord in Amsterdam, Wielwijk and Crabbenhof in Dordrecht, Kanaleneiland and Overvecht in Utrecht, Overschie and Zuidelijke Tuinsteden in Rotterdam and the area's Bouwlust, Vredesrust, Morgenstond and Moerwijk in The Hague. More than half of the 43 neighbourhoods belong to group four.

Figure 5 shows the local angular analyses with high and low metrical radii and a photo of a local dwelling street and a main route in Poelenburg, Zaanstad. The neighbourhood is built in the 1950's to deal with the housing shortages and population growth after World War II. In the local dwelling street, the buildings are positioned in such a way that entrances are only connected to one side of the street. Therefore the entrances and windows are not inter-visible. There is an active dwelling function on the ground floor level. The main route is located on the area's edge and has no entrances or windows oriented to the road. It does not function as a local shopping street. The street network integration is low in the local angular analyses with a high as well as low metrical radius. The area consists of only dwellings.

In order to compare all the spatial variables with one another, a grade system is made based on the scores of the spatial analyses. Table 1 shows the comparison of the various spatial analyses of all the neighbourhoods. When a neighbourhood scores very high in the spatial analyses, it gets value 5. When it scores very low, it gets value 1.

Table 1 Spatial comparison of all 43 neighbourhoods

Neighbourhood	Construction Year	Global int n	Ang int 3	Metr high	Metr low	Corr scat	Mainrou t vs local	Visib-ility	Visbl main r
Alkmaar, Overdie	1960	2	2	1	3	2	1	1	1
Amersfoort, Kruiskamp	1920, 30, 50, 80	5	4	4	5	4	4	3	2
Amsterdam, ZuidOost	1970, 90	2	2	2	2	2	1	2	1
Amsterdam, Bos en Lom	1920, 30, 50	3	3	1	4	2	3	3	5
Amsterdam, NieuwWest	1960-90	4	4	3	4	4	4	1	1
Amsterdam Noord	1960-90	3	1	1	2	1	1	1	1
Amsterdam Oost	1900-40	4	4	2	3	3	4	5	5
Arnhem, Het broek	1930	5	3	5	3	4	4	4	2
Arnhem, Klarendal	1880, 1970-90	3	2	1	4	4	3	4	5
Arnhem, Malburgen	1930-1960	5	2	3	3	3	3	2	1
Arnhem, Persikhaaf	1950-1970	3	4	4	4	4	4	1	1
Delft, Buitenhof	1950, 1960	3	3	4	2	3	1	1	1
DenHaag Schild+Station	1850-90, 1980	5	4	5	5	5	5	4	4
Den Haag Z bouwVredr.	1950, 1960	4	3	2	1	2	1	1	1
Den Haag Z moerMorg.	1950	5	3	4	2	2	2	1	1
Den Haag Transvaal	1900-35, 90	5	5	4	3	4	5	4	4
Deventer, Rivierenwijk	1930, 50, 60	4	3	2	2	2	1	2	1
Doordrecht, wielwijk, cr	1960	3	2	2	4	3	2	1	1
Eindhoven WoenselW	1930	5	2	2	3	2	1	4	2
Eindhoven Bennekel	1940, 1950	2	2	1	4	1	2	4	1
Eindhoven Doornakker	1930-50	2	1	1	2	1	1	4	1
Enschede, Velve-Linden	1890-1950	2	2	2	2	1	2	4	4
Groningen, hoog+Korrel	1900-50, 90	4	4	3	3	4	4	4	5
Heerlen, Meezenbroek	1930-60	3	2	1	4	1	1	3	1
Leeuwarden, hecht.Sch	1950,60	4	2	2	1	2	1	1	1
Maastricht, noordoost	1900-60	5	3	4	4	5	4	4	2

Nijmegen, Hatert	1950, 60, 90	4	2	1	1	1	1	1	1
Rijswijk, Steenvorde Z	1950,60, 80	3	1	1	1	1	1	1	1
Schiedam, Nieuwland	1950,60	3	2	1	2	2	1	1	1
Zaanstad, Poelenburg	1960	2	1	1	1	1	1	1	1
Rdam, Oude Westen	1890, 1970, 80	3	4	1	3	3	4	3	5
Rdam, Nieuw West	1900-30, 90	3	3	3	3	5	4	4	5
Rdam Oude Noorden	1880-30, 70-90	4	4	5	4	5	5	4	5
Rdam Croosw	1900-30, 70-90	3	2	3	2	3	3	1	2
Rdam Bergpolder	1930, 60, 70	4	4	2	3	2	4	3	5
Rdam Overschie	1930-60	2	1	1	1	1	1	1	2
Rdam Zuidelijke Tuinst	1960	4	2	1	3	2	1	1	2
Rdam zuid Charlois	1900, 40, 50	3	3	2	4	3	3	3	5
Rdam zuid Fey,Wreew	1900, 40, 90	4	4	3	5	4	4	5	5
Utrecht Kanaleneiland	1960	4	1	1	1	1	1	1	1
Utrecht Ondiep	1900	3	3	1	2	1	3	4	4
Utrecht Overvecht	1960	2	2	2	2	2	1	1	1
Utrecht Zuilen Oost	1920-50, 90	3	4	3	2	3	4	4	5
Enschede, Depbr, mekkel		1	1	1	2	2	2	2	2

Based on these four spatial classifications, strategic plans for spatial improvement can be proposed by focusing on the weak spatial parameters. How and in which way depends on where the spatial weaknesses are located and what they consist of. In the first group of neighbourhoods (macro high, micro high), a large potential for gentrification is present. Here, often an improvement of the technical standard of the dwellings is needed. In other cases, there is a need to implement a variation of types and size of dwellings.

In neighbourhoods belonging to the second group (macro high, micro low), buildings with active frontages towards streets need to be enhanced to aggregate street life. In particular blind walls need to be removed. Storage rooms located on the flats ground floor level need to be replaced with an active function, such as a dwelling, office or shop directly connected to the streets. In line with Jane Jacobs (1960), “eyes on the streets” need to be enhanced on ground floor level in these kinds of neighbourhoods.

A socio-economic classification of the neighbourhoods

A typology focusing on the degree in which spatial macro and micro scale variables are distributed in neighbourhoods is a good way to come to a spatial classification and to get a first idea of the direction in which improvements can be found. It is also possible to create a

socio-economic classification. For this, a statistical technique called cluster analysis is used.

K-means clustering is a cluster analysis technique that aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. It assigns cases to a fixed number of groups (clusters) whose characteristics are not yet known but are based on a set of specified variables. When performing such an analysis on the socio-economic data of the 43 neighbourhoods, the variables 'average house value', 'percentage non-western residents', 'percentage rental houses' and 'percentage households without children' provide the most meaningful clusters (table 2). These clusters do not only provide a robust socio-economic typology. They also correlate well with the crime data and spatial characteristics of the neighbourhoods.

Table 2 The definition of the three socio- economic clusters

Final Cluster Centres

	Cluster		
	1	2	3
Average house value x € 1.000,--	124	202	159
% Non-western residents	48	31	36
% rental houses	78	66	70
% households without children	20	25	22

The clusters can be described as: poor multicultural neighbourhoods, multicultural gentrification areas, and modernist neighbourhoods. The first one consists of a high number of non-western immigrants with low level of income, low housing prices and high unemployment. The multicultural gentrification areas house a large variation of the population, and the housing prices are average. The modernistic housing areas consist of a high number of retired people and housing prices are very affordable.

Cluster 1: Poor multicultural neighbourhoods

The first cluster consists of priority neighbourhoods with relative low average house prices (124.000 euro) and relatively few households without children (20% average). About half of the residents in these neighbourhoods are of non-western decent; 78% of the houses are rentals. The areas themselves often show a broad mix of building periods and building styles. Examples on these kinds of neighbourhoods are Amsterdam Bijlmer-Centrum, all the priority neighbourhoods in The Hague, Rivierenbuurt in Deventer, and Kanaleneiland-Noord in Utrecht.

Cluster 2 Multicultural gentrification areas

The second cluster consists of neighbourhoods with relatively high average house prices (202.000 euro). These neighbourhoods are built in the 1920's – 1950's and consist of a relatively high number of households without children (25% average). Two-third of the houses in these neighbourhoods are rental homes and 31% of the population in these neighbourhoods are non-western immigrants. These neighbourhoods are on the list of 'priority neighbourhoods', but the inhabitants are certainly not 'poor'. The neighbourhoods are relatively small in size and located in proximity to the city centre. They consist mainly of low-rise buildings. Examples on these kinds of neighbourhoods are Amsterdam Bos en Lommer, Maastricht Buitenwijk Noordoost, and Utrecht Zuilen Oost.

Cluster 3 *Modernist neighbourhoods*

The third cluster consists of neighbourhoods that are social-economically and demographically in between the other two clusters. The average house price in these neighbourhoods is around 159.000 euro. 22% of the households are without children, 36% of the residents are of non-western decent and 70% of the houses are rentals. The majority of these neighbourhoods are built in the 1960's. They are located further away from the city centre and built in line with the principles of Modernism with flats of 4 or 9 stores with large open spaces between the buildings. Examples on these kinds of neighbourhoods are Alkmaar Overdie, Amsterdam Bijlmer-Oost, and Utrecht Kanaleneiland-Zuid.

Correlations between the spatial, socio-economic and crime data

The spatial and socio-economical clusters themselves provide useful insights in how deprived areas such as the ones listed on the Vogelaar list of priority neighbourhoods can be improved. But things get more interesting when also crime data is brought into the equation and when patterns are discovered between the spatial, social and crime data.

Table 3 Correlations between spatial variables, criminal incidents and typologies

2a. Socio-demographic clusters versus spatial characteristics

	Global integration	Local Angular integration	Metric High	Metric low	Correlation between metric high and low	Main routes in relation to the local streets	Intervisibility between entrances and streets	Visible main routes	Correlation between visibility and degree of spatial integration	Degree of connectivity local streets versus main routes
Multicultural poor areas	3,46	2,46	2,08	2,92	2,69	2,69	2,15	2,31	1,92	1,69
Multicultural gentrification areas	3,78	3,11	2,89	2,89	3,11	3,33	3,33	3,11	3,56	2,44
Modernist areas	3,29	2,41	2,65	3,12	3,06	2,65	2,18	2,12	1,88	1,65
Total	3,46	2,59	2,51	3,00	2,95	2,82	2,44	2,41	2,28	1,85

2b. Socio-demographic clusters versus number of incidents per 10.000 inhabitants

	Vandalism	Thefts from cars	Violence	TOTAL
Multicultural poor areas	140,82	91,92	67,59	300,33
Multicultural gentrification areas	114,63	132,34	59,31	306,29
Modernist areas	104,71	95,06	49,21	248,97
Total	119,04	102,62	57,67	279,32

Table 3 shows that the multicultural gentrification areas are not as deprived as their status of 'priority neighbourhood' may suggest. They are in fact relatively well-off both in their social-economic as spatial performances. These areas are well integrated in the city and have enough spatial potentials for local businesses and an active street life. The multicultural gentrification areas are typically closer to the city centre than the neighbourhoods belonging to the other two clusters and that results in higher global integration values. The main routes often go through these neighbourhoods (and not around) thus creating good spatial conditions for a natural mixing of residents and visitors. The visibility in these neighbourhoods is often much better than in the neighbourhoods in the other two clusters. The level of vandalism and public

violence is average for priority neighbourhoods. It is however remarkable to see that the level of theft out of cars is relatively high. This can most probably be explained by the proximity of these neighbourhoods to the city centres and that visitors of the city centre intensively use the parking lots of these neighbourhoods.

Table 4 Correlations between spatial typologies, criminal incidents and socio-economic data

	Vandalism	Violence	Average value of houses	Average income per inhabitant
macro high / micro high	99,67	44,73	172,00	16,48
macro high / micro low	137,98	68,27	153,60	16,21
macro low / micro high	322,26	136,21	95,00	15,10
macro low / micro low	97,78	52,74	144,75	15,67
Total	117,89	57,95	153,63	16,05

The correlations between the spatial typologies and criminal incidents (table 4) show that priority neighbourhoods with either both high or low values on the macro as well as micro scale spatial variables have the lowest number of criminal incidents. When looking at the types of crime, theft out of cars differs from the amount of vandalism and violence as it is highest in the neighbourhoods with a highly integrated street net.

The spatial clusters also show significant relationships with the average values of the houses. There is a positive correlation between the degree of spatial integration of the street network combined with the degree of street inter-visibility on the one hand and the average income and house prices on the other hand.

Challenges for renewal practice

The results of this study provide only a first small step in determining which spatial measures are needed in the revitalisation of which neighbourhoods, their relation with social factors and their possible effects on liveability and safety. The values used above are based on average spatial as well as social variables on neighbourhood level. A next step – currently undertaken – is to correlate the spatial properties of several 'pilot neighbourhoods' with the dispersal of crime and anti-social behaviour on the level of the street segment and to translate the results in recommendations and interventions that may improve the vitality, safety and economic potential of these areas (van Nes et al 2013).

Although limited in its methodological setup, this inquiry can at least give some suggestions on how to improve the spatial setup from neighbourhoods making them safer, livelier and economically vibrant. Not all neighbourhoods on the priority list have high crime rates. When distinguishing the neighbourhoods with relatively high and neighbourhoods with relatively low crime rates, high crime rate areas generally have their main routes outside the neighbourhood while safer areas more often have main routes running through its local centres. A well-integrated and well-connected main route going through local centres encourages the natural development of a local lively centre inside the neighbourhood. It functions as an armature for the whole neighbourhood and generates a natural mixture of visitors and people living inside the neighbourhood. Such a main route encourages the establishment of micro businesses inside the neighbourhood hence shaping job opportunities for the inhabitants. Previous research has shown that neighbourhoods with main routes through its centres are generally safer especially when most local residential streets can be reached within 1-2 direction changes from the main route network (van Nes and López 2010).

On a micro scale level, the positions of buildings and entrances along a main route or a residential street contribute to the degree of social control and eyes on the street. The more buildings located along a street, combined with entrances directly connected to streets, the higher the potentials for natural social control. When entrances and buildings are turned away from a well-connected street, opportunities are created for youngsters to group together and commit incivilities outside the natural control of adults (Rueb and van Nes 2009).

The social composition of the dwellers, their lifestyles and wishes are also important factors in choosing the priority of improvements. Spatial parameters play a role in the socio-economic performance of a neighbourhood. It is about how the spatial layout contributes to generate a reduction of criminal opportunities, shape a natural social control mechanism between inhabitants and visitors, and shape opportunities for meeting and the location of micro scale businesses inside the area.

References

Permentier, Matthieu, Jeanet Kullberg, and Lonneke van Noije. 2013. *Werk aan de wijk. Een quasi-experimentele evaluatie van het krachtwijkenbeleid.* Sociaal en Cultureel Planbureau.

Priemus, Hugo. 2005. *Regeneration of Dutch Urban Districts: the Role of Housing Associations Theme Session: Regeneration of Urban Districts.* ESRA 2005; 45th Congress of the European Regional Science Association. Amsterdam 23-27 August.

Rueb, Lisette, and van Nes, Akkelies. 2009. "Spatial behaviour in Dutch dwelling areas. how housing layouts affects its users' behaviour." In *Proceedings* of 7th *International Space Syntax Symposium*, edited by Daniel Koch, Lars Marcus and Jesper Steen, Stockholm, Sweden: KTH.

van Nes, Akkelies, and Manuel López. 2010. "Macro and micro scale spatial variables and the distribution of residential burglaries and theft from cars: an investigation of space and crime in the Dutch cities of Alkmaar and Gouda." *Journal of Space Syntax* 2.

van Nes, Akkelies, Manuel López, Laura de Bonth, Dirk Verhagen, and Simone Waayer. 2013. "How space syntax can be applied in regenerating urban areas. Applying macro and micro spatial analyses tools in strategic improvements of 8 Dutch neighbourhoods." In *Proceedings of 9th International Space Syntax Symposium*, Seoul, South Korea.

VROM/WWI. 2010. *Achter de voordeur bij de G31.* Den Haag: Ministerie van Volkshuisvesting, Ruimtelijke. Ordening en Milieubeheer / Ministerie van Wonen, Wijken en Integratie.