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# JANE JACOBS IS STILL HERE

**Jane Jacobs 100**  
**Her legacy and relevance**  
**in the 21st Century**

**24 and 25 May 2016**

**Faculty of Architecture and the Built Environment**  
**TU Delft, The Netherlands**

**edited by Roberto Rocco**

## **Jane Jacobs is still here**

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# The materialisation of Jane Jacob's view “eyes on streets”

Quantitative tools to measure adjacency, permeability  
and inter-visibility between buildings and streets

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**Abstract**—One of Jane Jacob's key observations was that we need “eyes on the streets” from buildings to ensure safety. How can it be quantified? Research on urban environment by means of space syntax methods tend to focus on macro scale spatial conditions. However, micro scale conditions should not be neglected. In research on dispersal of burglaries in urban areas, spatial analyses methods as regards topological relationships between private and public space was developed and tested out. The following issues were taken into account: Degree of inter-visibility of windows and doors and their inter-relationship to street segments, the density of entrances of private houses connected to streets, the number of semi-private or semi-public spaces between various kinds of private and public space, the degree of constitutedness of streets and the degree of visibility from windows to parking lots. As these results show, measuring the private-public interface offers knowledge about the spatial conditions for vital street life, urban safety, social interactions and their interdependence. Quantifying a built environment's spatial layout can therefore provide understandings on how urban space shape possibilities for social integration and exclusion. All seems to depend on various degrees of adjacency, permeability and inter-visibility taken into account on different scale levels.

**Key words** – private and public space, analyses tools, crime, social integration

## Introduction: the public – private space relationship and urban living

During the last three decades, living in central urban areas has become popular in Europe. This

kind of “urban renaissance” has contributed to an increase of estate and property prices in inner city areas. Several people seek for urban areas with high social, cultural and spatial diversity, short distances from dwellings to work, leisure and cultural activities, and to use all the opportunities a city has to offer (Rogers 1999).

Many recent urban renewal

policy documents carry proposals to intensify existing city and town centres instead of creating new out of town settlements. The idea is that high diversity and density of various kinds of land use, functions and cultural activities will contribute to vital lively urban areas and economic growth. As stated in most policy documents, the density of the

built mass should be high without losing good living qualities (Nota Ruimte 2004, p. 71, Rogers 1999, p. 45). The compact city is used as a model for urban renewal and development for enhancing growth in compact existing settlements instead of sprawl and to promote a sustainable urban development. How this must be realised is, however, never demonstrated in recent policy documents.

The topological spatial relationship between private and public space and its impact on urban life is a forgotten aspect in contemporary urban design and planning disciplines. Architects tend to emphasise the feeling of privacy within the context of modern living in their design projects. Often an explanation can be found in the individualisation process of human beings during the last 60 years in the western society. There seems to be a need for high degree of privacy when living together with others. However, when the city itself offers high degree of anonymity, then one can ask whether it is necessary or not hiding one's dwelling entrance and windows away from public streets.

Urban project developers strive for high density or a high floor-space-index and propose large variations of urban functions in new areas. However, the degree of inter-connectivity and the topological shallow public-private interface is forgotten on the ground floor level. All these activities depend on how the spatial configuration is on the plinth or built up street sides. Therefore, there is a need to bring micro scale spatial relationships on the research, policy making as well as the design agenda in the urbanism discipline.

## Background

Already in the 1960s Jane Jacobs was advocating having 'eyes on the street' from buildings for ensuring safety on streets. Her book 'Life and death of great American cities' was a reaction on modern city planning and architecture taking place in the US in the 1950's and 60's. She was not alone for advocating inter-visibility between buildings and streets.

Likewise, Jan Gehl was conducting research on how people use and behave in public space. That resulted in his concepts of necessary, optional and social/resultant activities. These activities depend on the physical setting of a built environment, offering possibilities

for sitting, standing or to stay longer in public space. In particular optional activities are heavily dependent on the physical quality of the built environment. His research resulted in the Danish publication 'Livet mellem husene' from 1971, and the English translation 'Life between buildings' from 1987. One of his main messages was to have doors and windows oriented towards the public space.

During the last decades, several urban designers, urban planners and urban researchers are referring to Jacob and Gehl's writings. However, a quantitative research method has been missing during all these years. From an urban design practice, the more modern a housing project is, the more the entrances are turned away from public streets and the more an active frontage towards public streets is lacking.

A method describing micro scale spatial variables in urban studies aims at defining the inter-relationship of buildings or private spaces and adjacent street segments. Therefore, micro scale spatial analyses focus on how dwellings relate to the street network, the way buildings' entrances constitute

streets, the degree of topological depth from private space to public space, and inter-visibility of doors and houses across streets. As Jane Jacobs and Jan Gehl argue, many entrances and windows facing a street is one formula to ensure urban liveliness (Jacobs 2000, Gehl 1996). The challenge is to quantify these kinds of spatial relationships. Only then it will be possible to gain a genuine understanding on the spatial conditions for vital street life and urban safety.

## The components of the method

In a research project on space and crime in the Dutch towns Alkmaar and Gouda, an opportunity was provided to register various spatial relationships between private and public spaces (López & Van Nes 2010). In each city one local area was chosen and studied in detail. These areas are more or less comparable when it comes to their function, size and the large variation of their social composition of dwellers and architectural composition in terms of a large

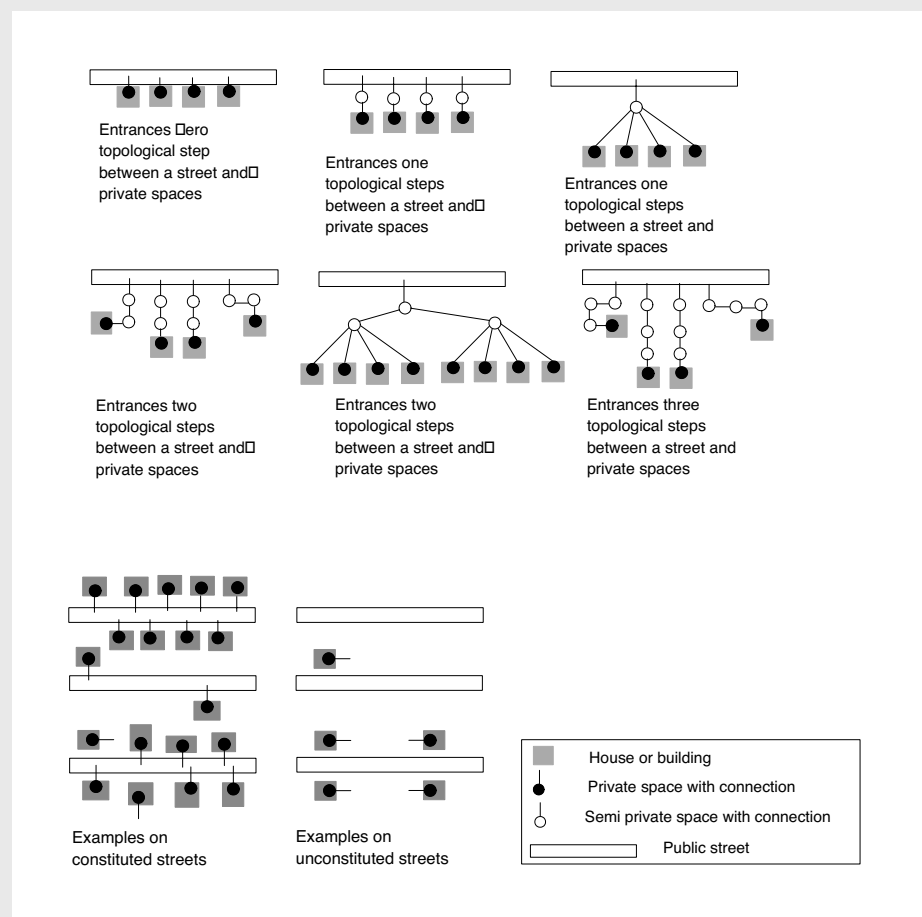


Figure 1: How the topological depth from entrances (top) and degree of constitutedness is calculated. Source: own illustration.



Figure 2: Example of a dwelling located to a traditional street (left) and a dwelling located on an upper walkway in a flat (right). In the traditional street there is a direct connection between the private home and the public street. A stranger passing through one's front door is perceived as a source of safety. Conversely, in the case of the upper walk-way, there are many semi public and semi private spaces between the home and the street. A stranger passing through one's front door is perceived as a source of danger. Source: own illustration.



Figure 3: Example on constituted streets (above) and un-constituted streets (below). Source: own illustration.



mixture of various housing types. The local areas contain boroughs with homogeneous building types as well as areas with a mixture of several types. In total 1.168 street segments were observed and 25 different spatial features registered for each segment. The results of the micro spatial registrations were put in a database together with various macro scale variables derived from the space syntax analyses of the street and road net and the number and characteristics of residential burglaries and thefts from cars for each street segment.

There are several ways of analysing spatial configurative relationships between building entrances and the street network. An easily way is to register the topological depth between private and public space. It consists in counting the number of semi-private and semi-public spaces between a private space and a public street. If an entrance is directly connected to a public street, it has no spaces between private and public space. Then the depth is equivalent to zero. If there is a small front garden between the entrance and the public street, the depth value is one since there is one space between the closed private space and the street. If the entrance is located on the side of the house and it has a front garden or it is covered behind hedges or fences then the topological depth of the entrance has a value of two. Entrances from back alleys covered behind a shed have a value of three. It is the topological steps between the street and the private spaces inside homes that are counted. (figure 1):

Entrances into flats can be represented in several ways. It all depends on the degree of permeability between the private space and the street. Some flats have upper walkways where the entrances to each apartment are connected, while others have a closed main entrance where visitors have to use a calling system. During registration the degree of permeability was used. Where a flat's front door or main entrance was permanently locked and provided with a doorbell or calling system, it was registered as a private space from thereon. When flats have open main entrances, the number of semi-private spaces was counted up to the apartments.

Each side of a street segment is registered separately. There are many streets where entrances are directly connected to the street on

the one side, while there is a flat with an upper walk gallery on the other side. If a street segment's side has several depth values between private and public spaces, the average value is used. The diagram in figure 2 (top) illustrates various types of relationship between private and public spaces. The black dots represent the private spaces, while the white dots represent semi-private spaces.

A street's degree of constitutedness depends on how building entrances are connected to a street. It is about the degree of adjacency and permeability from buildings to public space. When a building is directly accessible to a street, then it constitutes the street. Conversely, when all buildings are adjacent to a street, but the

entrances are not directly accessible, then the street is un-constituted. A street segment is constituted when only one entrance is directly connected to the street. If the entrance is hidden behind high fences or hedges, or has a large front garden, or located on the side of the buildings, then the street is defined to be un-constituted.

The diagram in figure 1 (below) illustrates the differences between constituted and un-constituted streets. It is thus a difference between a building located adjacent to a street and being permeable from a street. Spatial relationships of this kind can have impact on vital street life in urban areas.

The number and density of entrances are not at issue. The



Figure 4: A visualisation of the constituted and un-constituted streets in Gouda. Source: own illustration.

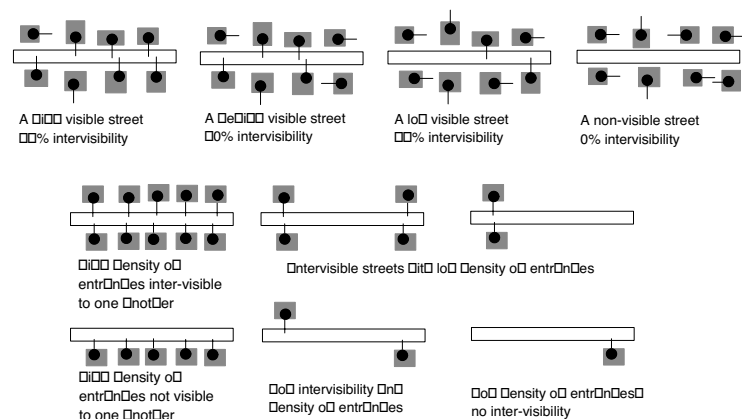


Figure 5: Diagrammatic principles on the relationship inter-visibility and density of entrances. Source: own illustration.



Figure 6: Examples on 0% inter-visible streets. When a burglar is inside these fences or hedges, he can operate without being noticed by neighbours or people in the street. Source: own illustration.

degree of constitutedness is about the number of entrances connected to a street divided by the number of buildings located along that street.

Figure 3 shows some examples on constituted and un-constituted streets. The two entrances on the top are constituted streets. In both cases the entrances are located only at one side of the street. The example on the left is a street dating from 1600 and the example on the right is a street from the 1970's. Both two streets below in figure 4 are un-constituted. No entrances are directly connected to these streets. The example on the left is a street located in a high-rise flat area from the 1960's. One has to go into the semi-public side streets to reach the flats' main entrances. Regards the example on the right, dating from the 1990's, all the apartments are located adjacent to the street. Even though the street is highly visible from all the apartments' windows, all entrances are located at the buildings' backsides and from the underground parking garages.

Figure 4 visualises the difference between constituted and un-constituted streets in Gouda. Un-constituted street segments are marked with a grey colour, while the constituted ones are in black. Most intruded homes (presented as dots) are entered from un-constituted street segments. The points of entry into dwellings are marked with a line from the street or back alley to the dot.

The more entrances connected to a street, the higher the probability that someone comes out from a private space into public

space. However, high density of entrances connected to a street does not always imply high inter-visibility. There is a distinction in the way entrances constitute streets and in the way they are inter-visible to each other. The way entrances and windows are positioned to each other influences the probabilities for social control. Figure 5 shows some diagrammatic principles on the relationship inter-visibility and density of entrances.

A registration of windows and doors inter-visible to one another and to the street segment were carried out. The number of inter-visible houses was divided by the total number of houses in each street segment. The percentage of inter-visibility from windows and doors from houses to streets and between houses was registered separately. The percentages were grouped in 100%, 80%, 60%, 40%, 20% and 0% inter-visibility for each registration. The density of houses and entrances were not taken into account. This was registered separately. Thus, two buildings with two entrances facing towards each other indicate 100% inter-visibility of doors. Conversely, a street segment with high density of entrances on only one side of the street segment and no entrances on the other side is defined to be 0% inter-visible. High density of entrances directly facing a street segment at only one side can be an indicator for street life, but is not necessarily a sufficient condition for crime prevention. A strong correlation was found between a street segment's inter-visibility and the risk on residential burglary (López & Van Nes 2010).

## The link to the macro scale analyses

A combination of various micro spatial measurements makes it possible to quantify the micro spatial features of neighbourhoods. These features are, however, not always present in studies focusing on the macro spatial analyses. For example, a street with few connections to its vicinity can still be full of social activities if a high density of entrances constitutes the street and when there is high visibility between public and private spaces. The reverse can be seen in, for example, distributed un-constituted streets with a low number of entrances and low inter-visibility. Independent of cultures and architectural styles, micro spatial measurements make it possible to describe the spatial set up of built environments on a local scale level. Thus, an urban area's degree of liveliness depends on the spatial conditions on a macro level as well as on a micro level. Therefore, both scale levels must be taken into account.

As the study of 1.168 street segments clearly shows, the micro spatial conditions of the street segment are inter-related to the macro spatial conditions of the cities street network (López & Van Nes 2010). Especially the topological depth of a street segment in relationship to its nearest main route gives a detailed description of the spatial set up of the area. Most micro spatial variables turn out to be related to the macro scale variable local angular choice with a high metrical radius. This variable is useful for measuring how well



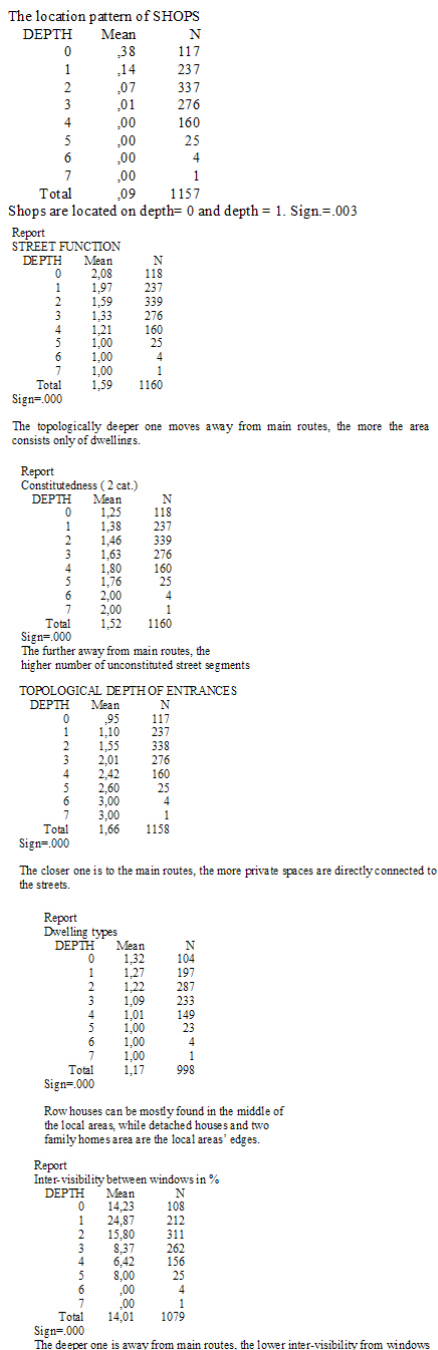


Figure 7: Statistical diagrams. Source: own illustration.

connected and spatially integrated each street segment is to all others in terms of direction changes and angular deviation. The spatially highest integrated streets are the most frequented ones. Various metrical radiuses can be used. The local angular choice with a high metrical radius identifies the main routes through cities and shows strong correlations with the micro-scale variables. The following results were obtained (figure 7).

The further away a street segment is from the main routes net, the greater the topological depth between private and public space. Along the main routes through

urban areas, most entrances are directly connected to the street. When changing direction two times from the main routes, the average topological depth for entrances is 2 while it is 3 in all street segments located more than six topological steps from the main routes.

Visitors usually frequent main routes, while only inhabitants frequent highly segregated streets in which gives neighbourhoods a desolated atmosphere. Dwellers inside these areas often prefer to protect their private life from insights from neighbours. When the streets are too much occupied by neighbours and there are almost no visitors around, the social control from neighbours can be too present. Therefore curtains and high hedges are used to prevent social control, and entrances are hidden away from streets and visible neighbours.

Urban areas located close or adjoining to main routes tend to have entrances directly connected to public streets. The streets are frequented by visitors as well as by inhabitants. The inhabitant wants to be a part of the urban street life. Often dwellers contribute to street life by sitting outside on a chair or the staircase in front of their homes. From their windows, dwellers keep an eye on what is going on outside. In many integrated areas, inhabitants like to contribute to the urban living by displaying their interiors to the view of passers by.

The more segregated a street segment is, the more mono-functional the adjacent buildings tend to be. Topological deeply located street segment usually only have a residential function, since offices, shops and public buildings tend to locate themselves along the main routes. The semi-private segments are among the topological deepest and segregated streets. Row houses and flats tend to be located along topological shallow street segments, while maisonettes, vertical separated dwellings and detached and semi-detached houses are located at the areas edges.

The further a street segment is away from the main routes, the lower the values of spatial integration and constitutedness. Homes located along un-constituted streets deeply located inside urban areas with low inter-visibility from windows tend to have a high risk of being burglarised. The un-constituted back alleys tend to be the most segregated street segments.

## Research results where the method has been applied

The first versions of the method were developed during the space and crime research project in Alkmaar and Gouda in 2005. Before Google Street view existed, registrations were done manually. Several researchers start to use this method in their research projects. So far known, it is applied on Dutch, Turkish, English, American and Indian built environments.

The micro scale spatial conditions were a main component in analysing the spatial parameters of the 40 problem neighbourhoods in the Netherlands. 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 was carried out on a dataset of 43 neighbourhoods in which various micro and macro scale variables was taken into account and related to social and crime data. The analyses shows 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.

The micro scale variables played a significant role in the classification of problem areas. In 75% of the neighbourhoods, the streets were lacking inter-visibility and had a high number of semi-private spaces between private and public space.

Various in-depth pilot studies were carried out in eight residential neighbourhoods located in Alkmaar, Deventer, Eindhoven, Maastricht and Utrecht. In this study, the findings from the national inquiry were evaluated in eight pilot neighbourhoods and tested on a lower scale level (the



Figure 8: The application of the micro scale tools in urban design practice. Example from a plan in Vroonermeer Noord in Gouda, the Netherlands, where the plan was to have no entrances on the main route running through the new housing area (left) and our suggestion to add buildings with active frontages and entrances towards the main route (right). Source: van Nes et. al 2013.

street segment). Besides variables providing insight into the spatial structure of the neighbourhood, the analysis also considered the urban micro-level - the relationship between buildings and streets. As it turned out, recorded anti-social behaviour from the police took place along unconstituted streets with low degree of inter-visibility (van Nes et al., 2013).

An inquiry was done to register how people use space in three different neighbourhoods in Rotterdam south from different time periods during a weekday. In one of the area interviews were made of the areas users and dwellers for identifying which streets and public spaces are perceived to be

unsafe and safe. As it turned out, high spatial integration of the street net contribute to a great variation of all types of people in streets. These areas consist of a highly inter-connected street net with shops located along it and with entrances directly connected to the street. These areas are conceived to be the safest to stay and move through by the interviewed users. Conversely, neighbourhoods with a labyrinth like street structure and lack of entrances and windows on the ground floor level contribute to few people in street and to a feeling of un-safety in the spaces between buildings. The degrees of spatial integration on various scale levels are low in these kinds of housing

areas. Therefore, the structure of the street network and the public-private relationship between buildings and streets plays a role for setting the physical framework to encourage street life and perceived safety (Rooij & van Nes, 2015).

Little knowledge exists on the relationship between urban space and the behaviour pattern of various ethnic groups. For this purpose four different neighbourhoods in Rotterdam north with a high number of various ethnic groups were investigated in different time periods during a weekday. A difference was made between Europeans, Turkish, Moroccans, and Surinamese/Antillean users in the static snapshots. As it turned out, the more spatially segregated the street net is in a local area, the more the various ethnic groups are separated from others. These areas consist of a labyrinth like street net, dead end and poorly inter-visible streets. A high spatial integration of the street net contributed to great variation of all types of people on streets. These areas consist of a highly inter-connected street net with shops located along it and with entrances directly connected to the street (Aghabeick & van Nes 2015).

A small inquiry on how women use space different from men is related to macro as well as micro scale variables. As soon as the street is spatially segregated or lacks active frontages towards streets, women tend to avoid urban areas with these spatial features (Nguyen & van Nes 2014).

The results shed some light on the current urban regeneration and urban design practice in the Netherlands. The spatial structure is hardly taken into account, in which contribute to a further socio-economic segregation of various ethnic groups. Seemingly, spatial segregation contributes to social as well as ethnic segregation among the users while spatial integration support socio-economic integration among various ethnic groups.

## Conclusions – challenges for urban design and planning practice

Micro spatial relationships play a crucial role in the socio-economic life of human beings. Often the concept “bringing back the human scale” is used in urban

policy making. It is referred to the metrical properties of space. Maybe a more genuine understanding on urban vital street life can be provided through a topological approach on urban micro scale level? In particular, urban renewal projects, modern housing areas and new large-scale urban development projects often tend to lack adjacency, permeability and inter-visibility between buildings and streets. This has negative effects both on street life and degree of safety of these areas.

High value on the floor-space-index is not always a condition for safe and lively streets. A “vertical city” like Hong Kong has several examples of new housing projects not well connected to the street. Even though the number of apartments is high, there is little street life at the street plinth. Often stacking apartments can contribute to vertical sprawl, but it seems to depend on how these flats’ entrances are connected to the street.

However, the degree of inter-connectivity and the topological shallow public-private interface is often forgotten. All these activities depend on how the spatial configuration is on the plinth or built up street sides. Therefore, there is a need to bring micro scale spatial relationships on the research, policy making as well as the design agenda

in the urbanism discipline.

When distinguishing the neighbour-hoods with relatively high and 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 social and optional activities and for the location of micro scale businesses inside an urban area.

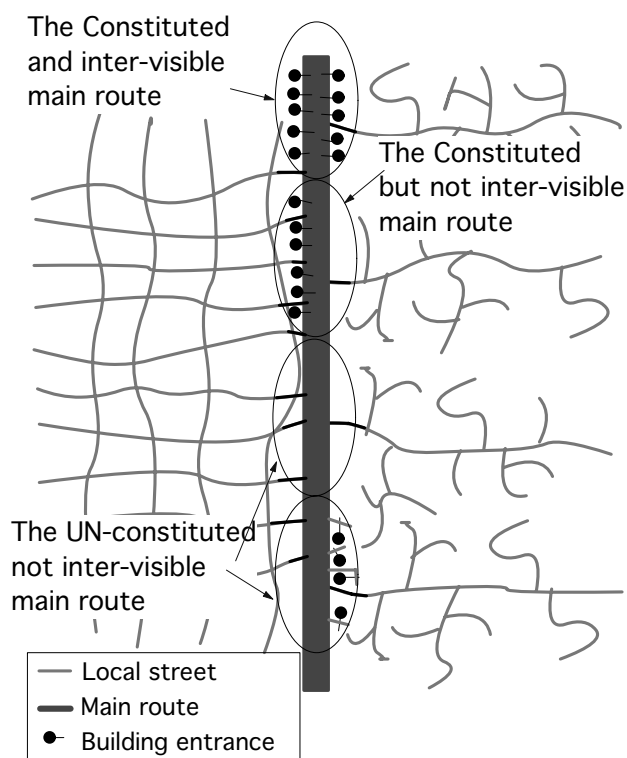


Figure 9: The role of the main route and the role of entrances.  
Source: own illustration.

## References

- JABOBS, J. 2000. *The Death and Life of Great American Cities*, London: Pimlico.
- GEHL, J. 2011. *Life between buildings*, Washington: Island Press.
- NEWMAN, O. 1972. *Defensible Space. Crime prevention through urban design*, New York: Macmillan Company.
- VAN NES, A. & AGHABEIK, L. 2015. "Ethnic groups and spatial behaviour in Rotterdam's neighbourhoods", in Karimi, K., Vaughan, L., Sailer, K., Palaiologou, G., Bolton, T. (eds.). *Proceedings of the 10th international space syntax symposium*, London: UCL.
- VAN NES, A. & LÓPEZ, M.J.J. 2010. "Macro and micro 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", in *Journal of Space Syntax*, no. 2, 296-314.
- VAN NES, A. & LÓPEZ, M.J.J. 2014. "A comprehensive spatial-socio classification of 40 deprived neighbourhoods in the Netherlands", in Cavallo, R., Komossa, N., Marzot, N., Berghauser Pont, M.J., Kuiper, J. (eds.). *New Urban Configurations*, Amsterdam: IOS Press, 559-566.
- VAN NES, A. & ROOIJ, L. 2015. "The perceived safety and spatial behaviour in three different neighbourhoods in Rotterdam", in Karimi, K., Vaughan, L., Sailer, K., Palaiologou, G., Bolton, T. (eds.). *Proceedings of the 10th international space syntax symposium*, London: UCL.
- VAN NES, A., LÓPEZ, M., DE BONTJ, L., VERHAGEN, D., & WAAYER, S. 2014. "How space syntax can be used in regenerating urban areas", in Kim, Y.O., Park, H.T., Seo, K.W. (eds.). *Proceedings of the 9th international space syntax symposium*, Seoul: Sejong University.
- NGUYEN, T.M. & VAN NES, A. 2014. "Identifying the spatial parameters for differences in gender behaviour in built environments. The flaneur and flaneuse of the 21st century", in *Che "genere" di città per il futuro*, Vol. 6, no. 10, Napoli: Univeersita degli studi di Napoli Federico II, Centro interdipartimentale.
- RUEB, L. & VAN NES, A. 2009. "Spatial behaviour in Dutch dwelling areas. How housing layouts affect sits users' behaviour", in Koch, D., Markus, L., Steen, J. (eds.). *Proceedings Space Syntax 7th International Symposium*, Stockholm: KTH.