Private and Public Space
Analysing Spatial Relationships Between Buildings and Streets

van Nes, A.; Yamu, Claudia

DOI
10.1007/978-3-030-59140-3_4

Publication date
2021

Document Version
Final published version

Published in
Introduction to Space Syntax in Urban Studies

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Abstract

In this chapter, we discuss and demonstrate how to analyse the urban micro-spatial relationships between private and public spaces. These methods allow one to analyse intervisibility between buildings and streets, entrance density from buildings towards streets, street constitutedness, and the topological depth between private and public spaces. These urban micro-scale analyses are a quantification of Jane Jacob's (1960) and Jan Gehl's (1996) presumptions about the interrelation between streets and building entrances and windows. Exercises are provided at the end of this chapter.

Keywords

Street life • Natural surveillance • Active frontages • Building–street interface • Public and private spaces • Intervisibility • Topological depth • Street constitutedness • Social control

Key concepts

Street–building permeability • Entrance intervisibility • Entrance density • Street constitutedness • Topological depth between public and private spaces

A. van Nes and C. Yamu, *Introduction to Space Syntax in Urban Studies*,
https://doi.org/10.1007/978-3-030-59140-3_4

Learning Objectives

After studying this chapter you will

- have knowledge about the concepts of social control, naturalsurveillance, and degree of street life;
- be able to conduct spatial analyses such as topological depth between private and public spaces; intervisibility, constitutedness, and entrance density; and
- be capable of critically reflecting on the analytical results connected to social control, natural surveillance, and degree of street life.

4.1 Introduction to Natural Surveillance and Urban Liveliness

Since the 1980s there has been an on-going debate about how streets can be made safe. Empirical research on crime and space is marked by the controversy between Jane Jacob's conception of lively, permeable urban environments and Newman's conception of closed, defensible spaces (Hillier and Shu 2000). In Jacob's view (1960), passers-by in streets, represented by, for example, strangers and inhabitants, function as a natural form of surveillance. In contrast, in Oscar Newman's opinion (1972), strangers are potential intruders, and the inhabitants' behaviours, their dwellings' spatial layouts, and the neighbourhood's spatial pattern are effective means of defence against them.

If we summarise the key elements of this debate, it is first about the spatial structure of the built environment's street network and second about the micro-scale spatial relationship between private and public spaces. In urban studies, the micro-scale spatial relationship is about the interrelation between buildings and adjacent street segments. More precisely, it is about how building openings are connected to the street network, in other words, the degree of topological depth from private space to public space and the intervisibility between doors and windows across streets. Thus, the challenge is how to quantify and calculate spatial parameters for the building–streetinterface and how to quantify degrees of so-called 'active' frontages.

The formula of Jacobs and Gehl for achieving urban liveliness is that many entrances and windows should face towards a street (Gehl 1996; Jacobs 1960). What both authors are missing in their writings on urban street life is a consistent spatial tool for measuring the spatial conditions needed for vital street life and for measuring the degree of urban safety. A first approach for measuring the building–street relationship was applied by Hillier and Hanson (1984) on a small scale for a neighbourhood in London, before and after modernisation in the 1950s. The purpose was to show how this modernisation affected the spatial relationship between private and public space. Their method was further developed by Shu (2000) in his Ph.D. thesis. This method is named 'street constitutedness'. Following this, van Nes and Lopéz (2010) added methods for analysing 'street intervisibility' and 'topological depth between private and public spaces'.

Figure 4.1 shows two examples of types of building–street interfaces that are not taken into account (left and middle) and one example of a building–street interface that is taken into account (right). The buildings in example (a) have doors but lack windows, whereas the buildings in example (b) have windows facing towards the street but lack doors. Both examples are considered to be cases where the buildings lack so-called 'active frontages' towards streets. Therefore, they are registered as 'disconnected' towards the street. Example (a) lacks visibility, whereas example (b) lacks accessibility. Therefore, the segment representation is coloured in blue, which means that the street segment is disconnected. Example (c) shows buildings that have both doors and windows facing towards the street. Here the street is both accessible and visible from the building and is considered as having an active frontage and is connected to the street, and thus the segment representation is coloured in red.

Fig. 4.1 The basic units for the micro-scale analyses

A method for visualising the degree of interface between buildings and streets is to register the number of building entrances with adjacent windows facing towards a public space. The image on the left in Fig. 4.2 illustrates how entrances from houses are connected to urban public spaces in the case of town X. Each entrance is represented as a black dot and the corresponding black line indicates to which street the entrance is facing, and therefore, connected to. Often the streets with the highest entrance density can easily be seen. However, this map does not clearly show the various degrees of entrance densities for each street segment. Therefore, the number of entrances per meter needs to be registered. One way to do this is to use colour codes. The map to the right in Fig. 4.2 shows entrance density added to the axial map. The main street has a very high entrance density, whereas the side streets have low entrance density.

There is an important rule for registering entrances when measuring and analysing the spatial properties of the building–street interface. Every entrance that is taken into account for the analysis must also have at least one window next to it. Entrances into parking garages and storage rooms are, therefore, not taken into account in the registrations because in most cases there are no windows adjacent to these types of entrances. A street with only entrances but with no windows along the facade facing a street on the ground floor level is not taken into account. The same accounts for streets with only windows facing the street on the ground floor level but with no entrances. Both visibility and accessibility properties from buildings towards streets need to be taken into account.

Measuring and visualising entrance density is easy. Figure 4.2 shows how entrance density can be visualised for town X. The degree of entrance density per meter can be quantified, and colour codes can be used to represent different degrees of entrance density. The purpose is to see in one glance the dispersal of entrance density in a neighbourhood.

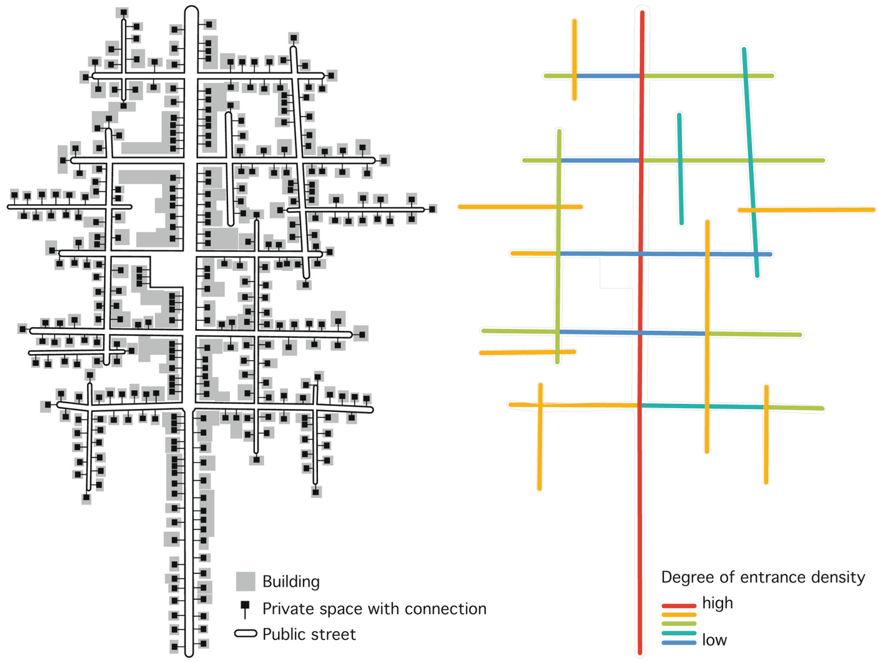

Fig. 4.2 Entrances with windows connected to the public realm (left) and the density of entrances with windows using an axial segment map of town X with colour coding (right)

In many ways, the density of entrances with windows next to them influences the degree of safety in urban areas. The higher the density of entrances with windows next to them per meter, the higher the probability that someone can leave or enter the house, as well as keep an eye on the street. However, a high density of entrances with windows next to them facing a street does not always imply high intervisibility. There is a distinction in the way entrances with windows next to them constitute streets and the way they are intervisible to each other. The way entrances and windows are positioned in façades and their relation to each other for both sides of a street influence the probabilities for social control, natural surveillance, perception of safety, and degrees of street life. In the next sections, we demonstrate some more refined spatial methods for analysing the public–private interface between buildings and streets.

4.2 Constitutedness and Unconstitutedness

Constitutedness is about the degree of adjacency and permeability from buildings to the public space (Hillier and Hanson 1984, p. 92). If and only if a building is directly accessible to a street does it constitute the street. Conversely, when all buildings are located adjacent to a street, but their entrances are not accessible directly from the street, the whole street is unconstituted. A street or street segment's degree of constitutedness or unconstitutedness depends on how buildings' entrances with adjacent windows establish their connection to the street, as well as the visibility to the street. Here again, buildings with only windows facing towards the street are registered as unconstituted. Likewise, buildings lacking windows and that have only doors connected to the street are also registered as unconstituted.

This spatial relationship between private and public space has an impact on the vitality of street life in urban areas (van Nes and López 2007). In unconstituted streets, the stationary activity of people is lower. Fewer people tend to sit and stand for a longer time in unconstituted streets, and rape and street robbery tend to take place more in unconstituted streets (Alford 1996).

Fig. 4.3 Urban examples of constituted (**a**, **b**) and unconstituted (**c**, **d**) streets in the Netherlands

If the entrances with adjacent windows are located on only one side of the street, the street is still constituted. The examples for constitutedness in Fig. 4.3 are streets dating from the seventeenth century (Fig. 4.3a) and streets dating from the 1970s (Fig. 4.3b). The unconstituted streets are examples of a high-rise flat area from the 1960s (Fig. 4.3c) and urban development from the 1990s (Fig. 4.3d). In the case of the modernistic high-rise building, no entrances are directly connecting the private space with the public space. People have to enter the building through a semi-public side street to further arrive at the building's front door. For the development from the 1990s, all apartments are located adjacent to the street. Even though the street is highly visible from all of the apartments' windows, all entrances are located at the buildings' backside and are accessible from underground parking garages.

Figure 4.4 illustrates schematically the difference between constituted and unconstituted streets. Thus, there is a difference between a building being located adjacent to a street and being permeable and visible from a street.

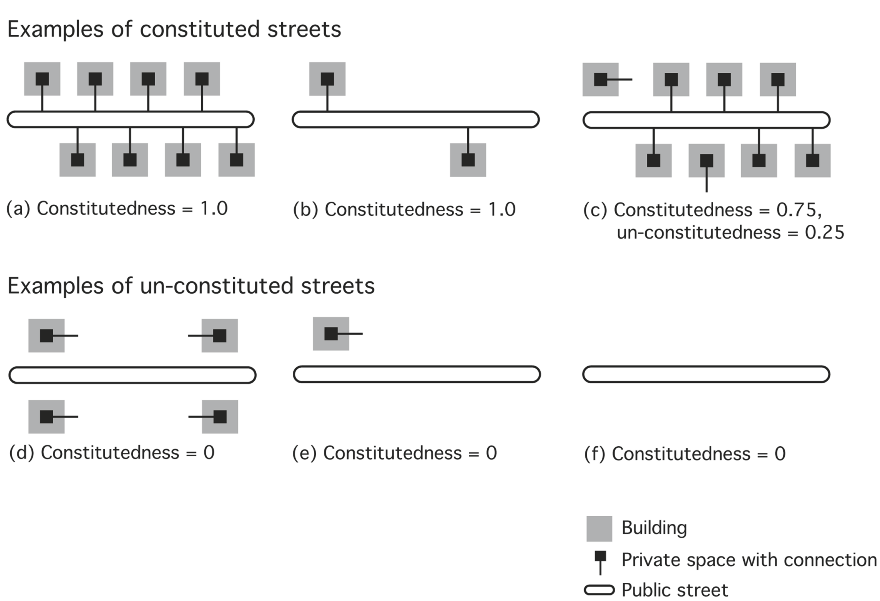

Fig. 4.4 Schemes of the spatial principle of constituted and unconstituted streets. Example (**a**) constitutedness = 1.0, (**b**) constitutedness = 1.0, (**c**) constitutedness = 0.75 and unconstitutedness = 0.25, (**d**–**f**) constitutedness = 0 and unconstitutedness = 1.0

In order to measure various degrees of constitutedness, the number of entrances directly facing a street in relation to the number of entrances not facing the street is registered and calculated. It is the percentage of the entrances that are connected to the street that determines the degree of street constitutedness (Fig. 4.4).

There are several ways of visualising the 'urban network–building permeability' relationship. Hillier and Hanson (1984, p. 104f) use the concept of an 'interface map' to illustrate the links between streets directly connected to adjacent buildings. All building entrances with adjacent windows that are both adjacent and directly connected to the street network are registered, and a colour code is applied to the street network to indicate constituted and unconstituted street segments. Also, a more differentiated map can be generated indicating for each street segment the topological depth between the street and building entrance (this will be explained below). In addition, Hillier and Hanson further applied a method generating a 'converse interface map' of the relationship between the street network and building permeability. The converse interface map highlights all street segments with no building entrances directly connected to a street segment. This kind of registration shows where there is a relation between adjacency and impermeability (Hillier and Hanson 1984, p. 105).

The analysis of constitutedness and unconstitutedness reveals the spatial conditions for the degree of street safety and social control between buildings and streets in urban areas. Some scholars define a street with a degree of constitutedness >0.75 as a 'completely' constituted street (Shu 2000, p. 119). This means that three out of four buildings have their entrances directly connected to a street segment. Buildings without entrances with adjacent windows connected to the street make the street unconstituted (Hillier and Hanson 1984, p. 92). Clear examples of unconstituted public spaces are highways and subways.

For the constitutedness analysis, the total number and density of entrances with adjacent windows is not of interest for revealing the spatial condition of constitutedness and unconstitutedness for a street. Instead, this analysis shows the ratio between the number of entrances with adjacent windows directly connected to the street and the number of entrances with adjacent windows not directly connected to a street (see Fig. 4.4).

The constitutedness analysis has been useful in studies dealing with crime and space because there is a correlation between the degree of constitutedness and the distribution of burglaries in neighbourhoods. Unconstituted streets are more affected by criminal activities than constituted ones. Moreover, entrances hidden behind high fences and hedges have little visibility from neighbours, and criminals seem to prefer to operate in spaces of this kind (Shu 2000, p. 445). In Fig. 4.5, using the example of the town of Gouda, the constituted versus unconstituted street network analysis is superimposed with data on burglary. Most intruded homes are entered from unconstituted streets.

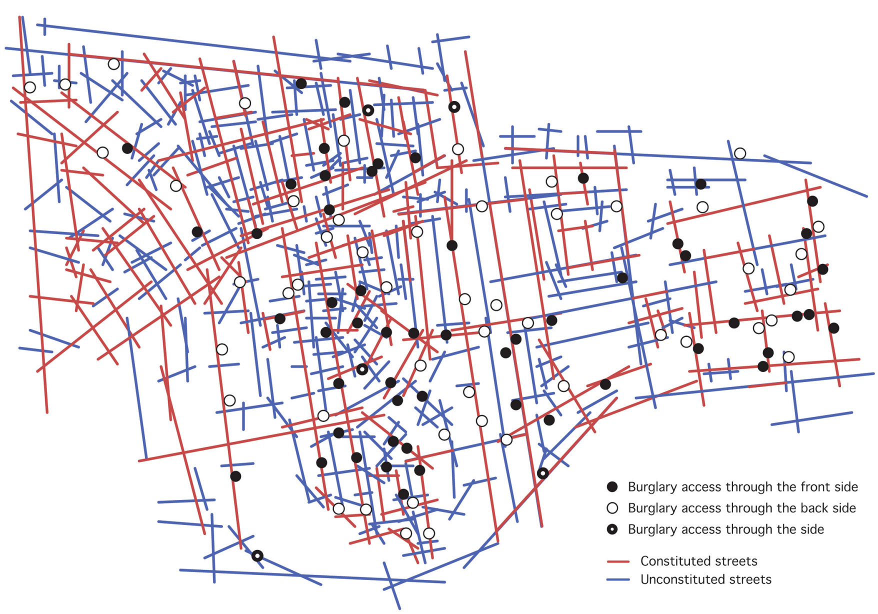

Fig. 4.5 Street network–building permeability relationship analysis superimposed with data for intruded homes for the town of Gouda (van Nes and López 2010). Points of entry into dwellings are marked as a line from the street or back path at issue to the data point (burglary) in different shades of grey

A constitutedness analysis does not show to what extent entrances are located on only one side or on both sides of a street segment. A more refined analysis is the street intervisibility analysis allowing for constituted street segments to reveal the spatial potentials for the natural surveillance mechanism between buildings and streets, as well as between buildings across streets. This method was developed by van Nes and López (2006, 2007).

4.3 Intervisibility and Density of Entrances and Windows to Streets

Intervisibility is defined as a 'point-to-point' visibility. The way entrances and windows (on the ground floor level) are positioned to each other influences the probabilities for social control and street life and for control between buildings across street segments. Entrance and window density can, to some extent, indicate the degree of liveliness in a street. As mentioned earlier, the more entrances that are connected to a street, the higher the probability that someone can come out from a private space into a public space. Streets constituted by many entrances with windows are often perceived to be safe to walk through at night (Tan and Klaasen 2007, p. 717).

There is a distinction in the way entrances with adjacent windows constitute streets and the way they are intervisible to each other from the street. Entrances and windows located opposite each other on both sides of a street give a high probability of natural surveillance, because people can keep an eye on each other, as well as access the buildings from a street. The natural surveillance mechanism can prevent homes from being burgled. Figure 4.6 shows some diagrammatic principles for the intervisibility–density relationship of entrances in a street.

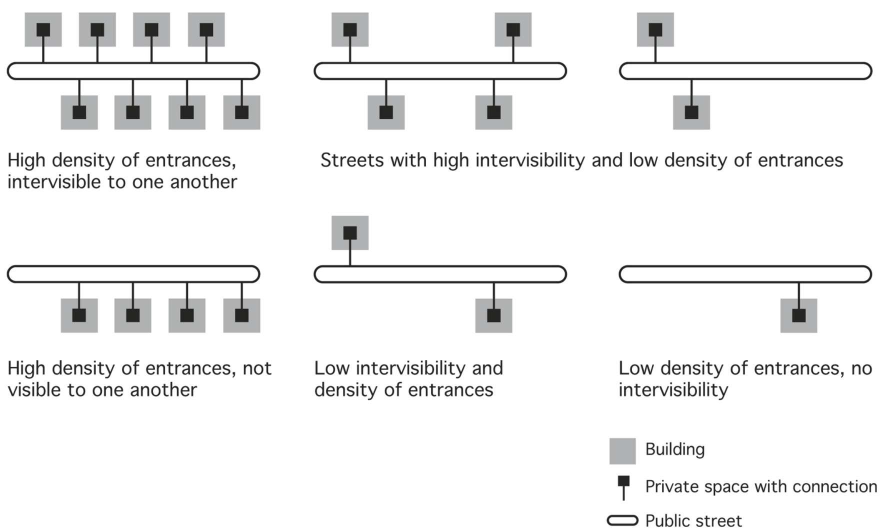

Fig. 4.6 Schemes of spatial conditions for the intervisibility–density relationship of entrances in streets

A convenient way to measure the intervisibility of, for example, entrances is to calculate the ratio between entrances that face each other across the streets to entrances that do not. Herein, Fig. 4.7 illustrates this simple calculation for four degrees of intervisibility related to entrance with adjacent windows density: (a) high = ≥ 0.75 (or 75%), (b) medium = ≤ 0.5–<0.75, (c) low = ≤ 0.25–<0.5, (d) very low = >0–<0.25, and (e) no intervisibility = 0. Entrances with adjacent windows hidden behind high hedges and fences are defined as non-visible.

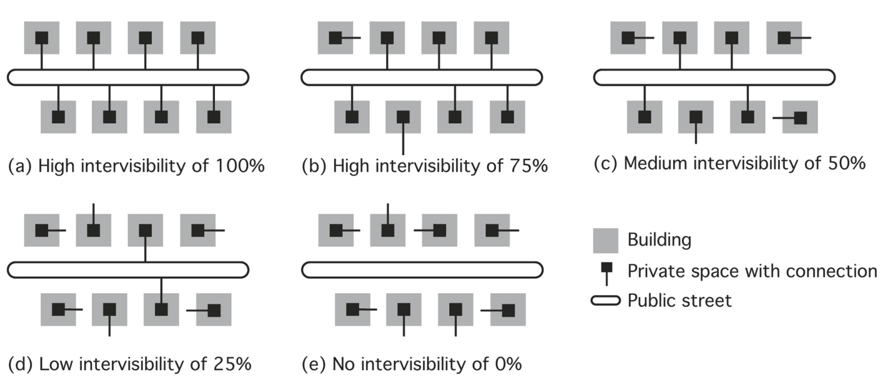

Fig. 4.7 Degrees of intervisibility of entrances with adjacent windows from high intervisibility to zero intervisibility

In traditional urban areas, the density of entrances with adjacent windows is in general quite high. This in contrast to suburban neighbourhoods with detached houses and modernistic post-war neighbourhoods with high-rise apartment buildings. For different cultures, we find different degrees of entrance densities. For example, Scandinavian cities have a low entrance density compared to continental European cities. In general, the degree of intervisibility is independent of the degree of entrance with adjacent windows density. However, enhancing window and entrance density on the ground floor level increases intervisibility and the potential for safe streets and neighbourhoods.

(a) (b)

Fig. 4.8 Examples of streets with high intervisibility (**a**) and low intervisibility (**b**) in a neighbourhood in the Dutch town of Haarlem

The example of high intervisibility (Fig. 4.8a) illustrates that all buildings have entrances and windows on the ground floor facing each other from *both* sides of the street. In contrast, the street with no intervisibility (Fig. 4.8b) has on the left side of the street entrances with no windows next to them. This is an example of a non-intervisible street because there are entrances with windows on only one side of the street. On the left side of this street, there are high fences leading to the back gardens of the buildings. Therefore, the intervisibility between the buildings in that street is lacking because there are buildings with doors and windows on the ground floor level on *only one* side of the street.

No windows on the ground floor imply no 'eyes on the street' from the ground floor level. Often buildings of this kind tend to have storage space on the ground floor level, and behind the entrances, there are corridors leading up to the dwellings starting from the first floor. One problem with these kinds of entrances is that a group of youngsters tend to gather together along the walls lacking windows, and the walls tend to be used for graffiti or other kinds of vandalism or anti-social behaviour (Rueb and van Nes 2009). Likewise, no doors on the ground floor level imply no direct accessibility to interfere with the street life. Even though there might be windows on the ground floor level, the lack of entrances creates a distance between the activities inside the buildings and the public street.

The street intervisibility analysis was applied to the Dutch town of Gouda and superimposed with burglary data (van Nes and López 2010; see Fig. 4.9). This study revealed that intervisible streets that have buildings with doors and windows connected to both sides of the street prevent homes from being burgled. To generate a relative range of visibility, the number of intervisible houses was divided by the total number of houses for each street segment and multiplied by one hundred. The intervisibility range was then grouped as follows: (a) high: 100–81%, (b) medium-high: 80–61%, (c) medium: 60–41%, (d) medium-low: 40–21%, (e) low: 20–1%, and (f) none: 0%.

The degree of density of houses and entrances with adjacent windows per street segment was not taken into account. As a reminder, a street with a high density of entrances with adjacent windows on only one side of the street segment has an intervisibility of zero. A high density of entrances with adjacent windows directly facing a street from only one side of a street segment can be an indicator of active street life, but not for the prevention of breaking and entering into buildings.

For Gouda, we can see that most burglaries from the front side occurred on streets with no intervisibility (Fig. 4.9). The homes intruded from the backside are located along streets with high intervisibility.

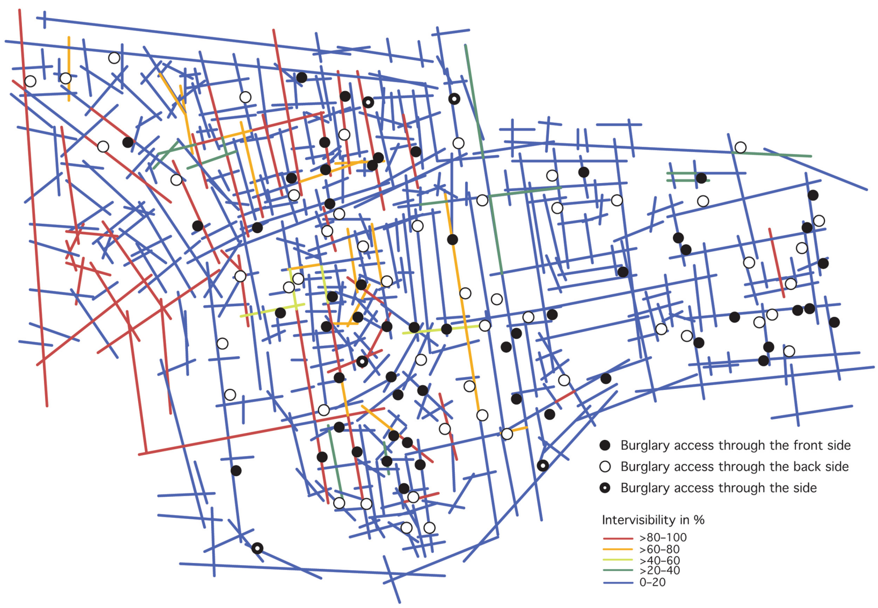

Fig. 4.9 Intervisibility analysis superimposed with burglary data for a neighbourhood in Gouda

The intervisibility analysis is also applicable in the field of archaeology. Our example of Pompeii depicts various degrees of intervisibility for the excavated parts of the town (Fig. 4.10). In addition, we also conducted an entrance density analysis (Fig. 4.11). Comparing both analyses, we can see that most shops, bakeries, and taverns are located along streets that are both intervisible and have a high density of entrances. The location of these functions was identified by archaeologists and recorded in detail by the German couple Liselotte and Hans Eschebach (Eschebach 1993).

Fig. 4.10 Analysis of various degrees of intervisibility for the town of Pompeii

Fig. 4.11 Analysis of entrance density for the town of Pompeii

4.4 The Topological Depth Between Private and Public Space

Often entrances to private spaces are not directly linked to the adjacent public street. In many cases, several semi-public or semi-private spaces are located between the private space inside a building and the public space represented by the street. Semi-public and semi-private spaces are hybrid spaces. They can be, for example, front gardens and front yards of houses or entrance halls and corridors in apartment buildings.

An easy way to reveal the relationship between private and public space is to register and map the topological depth between private and public space. This is done as follows: Count the number of semi-private and semi-public spaces between the private space and public space under scrutiny. If an entrance is directly connected to a public street, it has no hybrid spaces between the private and the public space. Its topological depth is one. If a small front garden is located between the house entrance and the public street, this front garden has a topological depth of two. The reasoning is that there is one space between the private space and the public space, and you take two steps from the public to the private space. Moreover, if the entrance is located at the side of the house adjacent to a front garden, the topological depth is three. Entrances accessible from back paths covered behind a shed have a value of four. For understanding the topological depth between private and public spaces, the topological steps between the public street and the private inside space are counted. Figure 4.12 illustrates various types of relationships between private and public spaces.

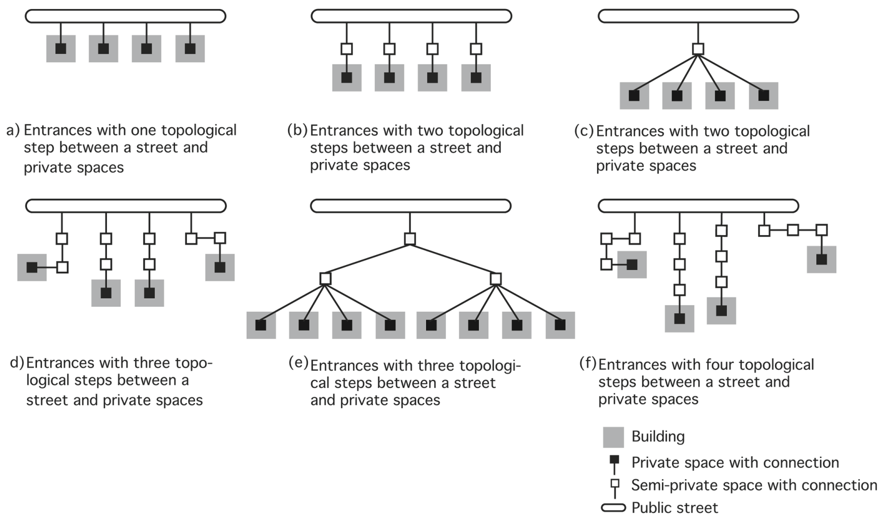

Fig. 4.12 Various topological depths between private and public spaces

Restrictions to the accessibility to entrances of flats can differ and depend on the degree of permeability between the private and the public space. Some multi-tenant buildings in the Netherlands have upper walkways that the entrance to an apartment is connected to (Fig. 4.13). Visitors can walk all the way to the intended apartment and ring the doorbell. This is different from what is seen, for example, in Manhattan, New York, where visitors have to use a calling system or are received by the concierge in the foyer who controls who enters the building.

The definition of semi-private and semi-public space depends on the accessibility of these spaces. For example, when carrying out a study and a multi-tenant apartment building's access is restricted by a calling system and the main entrance is permanently locked, the space is considered as a private space. When a visitor can walk all the way up to the flat's entrance door, the passed through spaces belonging to the apartment building are counted as semi-private or semi-public spaces.

In general, for collecting data it is important that the data for each side of a street segment are collected separately because the topological depth between public and private spaces often varies for each street segment for each side of the street. There can be individual houses with entrances connected directly to the street on one side, whereas an apartment complex with an upper walkway might be located on the other side of the street. Thus, one street segment can have different depth values for each side, and therefore, the average depth value is used for the street segment.

In most traditional urban areas, however, housing entrances are facing the street and therefore the topological depth is low. This is in comparison to most post-war urban areas where the topological depth between private and public spaces is often high. This means that people have to walk through several semi-private spaces before they can enter a private space.

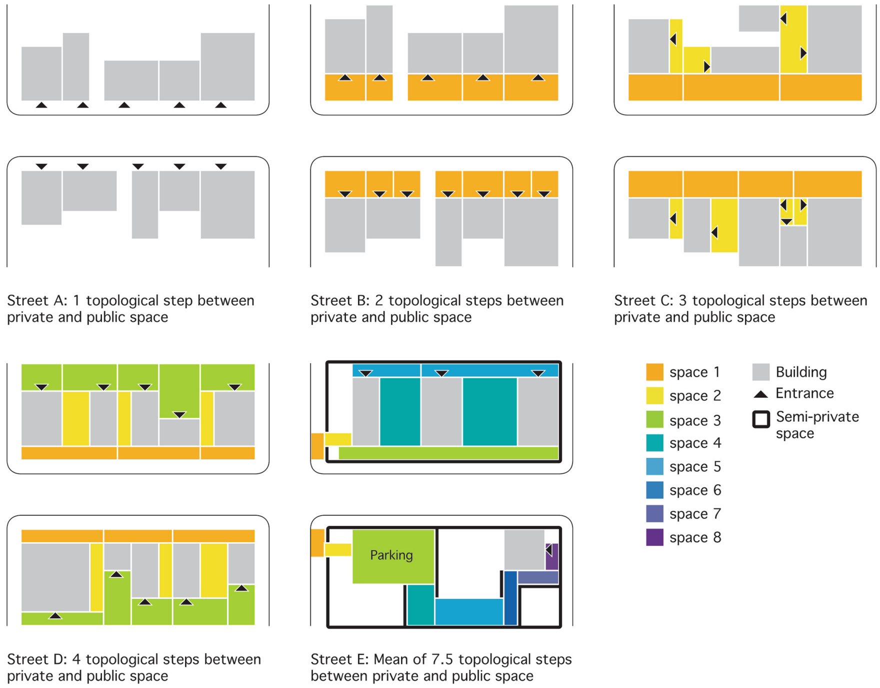

Fig. 4.13 Streets A–E: Five examples with different topological depths between private and public spaces

For streets A–D in Fig. 4.13, the semi-private and semi-public spaces can be easily identified, and thus the topological depth can be calculated. The average topological depth between private and public space is the same for all entrances for each street segment on both sides. Street E represents a gated community with several semi-public and semi-private spaces. The rule is to count the number of syntactic steps for the streetsegment at issue. Because the depth values differ for each side of the street segment, we calculate the mean topological depth for the street segment at issue. For our example E, the mean topological depth is 7.5 (syntactic steps).

Figure 4.14 illustrates two different entrance situations: (a) from a traditional street in the Netherlands and (b) from an upper walkway of a modernist housing area from the 1960s in the Netherlands. In the traditional street, the entrance to the private space is directly connected to the sidewalk. The sidewalk is a public space for everyone because it is part of the street's public realm and its profile. Everyone has access up until a dwelling's front door, and strangers are not considered as a threat. Nobody will approach a stranger and ask about his or her intentions. For the example of the modernist housing, in order to reach a flat's front doors, strangers have to pass through the semi-private spaces. Thus, they are often considered as a potential threat because they do not belong to the multi-tenant building's community. The stranger will with high probability be asked by passing tenants what he or she is doing there. Often, these spaces are additionally controlled with video surveillance. Hence, micro-spatial parameters matter for how people perceive, behave, and interact in urban spaces.

Fig. 4.14 A traditional street (left) and a modernist building (right) in the Netherlands, both with different entrance situations

The same logic can be found in the difference between traditional shopping areas compared to modern shopping centres. Shopping centres have only a few entrances for accessing all the various indoor shops. A feature of the mall's façade is, except for the entrance, that the building has no 'active frontage' oriented towards the street. In many cases, the shopping centres have large walls with 'blind' windows, or sometimes the wall is covered by advertisements. Conversely, a feature of traditional shopping areas is a high density of shops' entrances directly connected to the street with transparent frontages. Figure 4.15 shows an image of a traditional shopping street in Utrecht centre (left) and a modern shopping centre in Haarlem (right) in the Netherlands.

In general, transparent and semi-transparent frontages enhance the perception of safety and increase the 'natural surveillance' of an area and enable people inside and outside a building to see each other (van Nes et.al 2017; Rønneberg Nordhov et al. 2019).

Fig. 4.15 A traditional shopping street in Amsterdam with shopping windows and entrances facing the street (left) and a modern shopping centre in Haarlem with only one main entrance facing the street (right)

The topological depth between private spaces to public spaces seems to increase in highly segregated urban areas and in areas topologically far away from the main routes, which can be urban streets as well as roads (van Nes and López 2010). The higher the number of direction changes a street is located away from the main route network, the more the street is frequented by only inhabitants. As expected, the dwellers in these areas prefer to protect their private lives from the eyes of their neighbours. Often the social control among neighbours is higher in segregated urban areas due to the lack of random visitors. Therefore, views into private space are protected by curtains and high hedges in segregated streets.

Along highly segregated street segments, entrances are often hidden away from the street and are poorly visible from neighbouring buildings. In many ways, inhabitants in such areas provide a stronger watch over each other's lives than in topologically shallow urban areas. In urban areas located close to or adjacent to main routes with high pedestrian traffic, entrances with windows on the ground floor level tend to open directly to public streets. The streets are frequented by visitors as well as by inhabitants. Often, inhabitants want to be part of the vital urban street life or keep an eye on it. Urban homes are revealed to passers-by and are often not hidden behind opaque curtains.

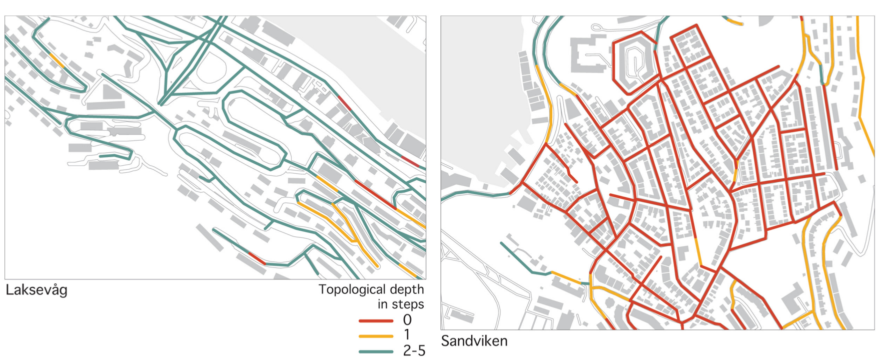

Fig. 4.16 Topological depth analysis between private and public spaces for the Laksevåg and Sandviken neighbourhoods of Bergen, Norway

Figure 4.16 shows the topological depths between private and public spaces in two different neighbourhoods in Bergen, Norway. Both neighbourhoods are located adjacent to Bergen city centre. The rental prices are high in Sandviken, whereas they are low in Laksevåg. Sandviken is a popular area to live in, whereas Laksevåg has a bad reputation. As can be seen from the figure, most streets in Laksevåg have 3 or more topological steps between the private and public spaces, whereas in Sandviken most streets have 1 topological steps between buildings and streets.

4.5 Combination of Micro and Macro-spatial Measurements

A combination of various micro-spatial measurements enables one to describe in a systematic and quantitative manner the local spatial features of neighbourhoods. These features are, however, not always present in studies focusing on macro or citywide spatial analyses. For example, a street with few street connections in its vicinity can still be full of social activities if a high density of entrances with adjacent windows constitute the street and if there is high intervisibility between public and private spaces. The reverse can be seen, for example, in highly integrated but distributed, unconstituted streets with a low number of entrances and low intervisibility.

Independent of cultures and architectural styles, micro-spatial measurements make it possible to describe the spatial set up of built environments at a local scale. Thus, an urban area's degree of liveliness depends on its spatial conditions on a macro as well as micro level. Therefore, analyses of both levels contribute to a thorough spatial configurative description of urban areas.

In this context, the study of crime in the towns of Alkmaar and Gouda by van Nes and López (2007) showed a set of statistical analyses between different spatial parameters that micro and macro-spatial variables are highly interdependent. In particular, the topological depth of a street segment in relationship to its nearest main route gives a detailed description of the spatial set-up of an area. In this way, most micro-spatial variables turn out to be related to the macro-scale variable of angular choice with a high metric radius. This variable identifies the main routes through cities and shows strong correlations with the micro-scale variables presented herein.

The study of Alkmaar and Gouda revealed that the farther a street segment is located away from the main routes, the lower the percentage of intervisibility of entrances and windows on the ground floor level. Seemingly, homes located on segregated streets tend to hide their entrances from the streets. Likewise, the farther a street segment is away from the main routes, the more the streets tend to be unconstituted. Homes located along unconstituted streets located in the heart of an urban area with low intervisibility from windows and entrances tend to have a high risk of being burglarised. The unconstituted back alleys tend to be the topologically deepest street segments.

4.6 Conclusion

Micro-scale analyses have been shown to be useful for an array of application themes in urban studies, for example, to understand the spatial logic of deprived neighbourhoods where van Nes and López (2013) and van Nes et al. (2017) showed that most of these neighbourhoods in the Netherlands have a high number of unconstituted streets with a low degree of intervisibility and a high number of topological steps between private and public spaces. Further applications include the relationship between behaviour patterns and ethnic groups (van Nes and Aghabeick 2015) or the safety perception of dwellers in their own neighbourhoods (de Rooij and van Nes 2015). For the latter, the results showed that people avoid staying in or passing through segregated and unconstituted streets with a low degree of intervisibility of entrances and windows because such streets are perceived as unsafe. Also, for the arena of gendered mobility, women tend to avoid frequenting unconstituted, segregated streets with low intervisibility of entrances (Nguyen and van Nes 2014).

For the protests during the Arab Spring in Egypt, in 2011, the degree of visibility of entrances in Tahir and Rabaa Al-Adawiya squares, in Cairo, played a role in the success of the protesters. Protesters seem to seek spaces with a high degree of accessibility on a local scale as well as on a citywide scale and with a high degree of symbolic value. The high visibility of entrances and windows helped the protesters to escape into buildings at Tahir Square when tanks and armed police forces tried to stop the demonstrations. At Rabaa Al-Adawiya Square, high fences with no entrances made it impossible for protesters to escape from the large military tanks (Mohammed et al. 2015a).

Furthermore, for understanding active land use, the application of the micro-scale method to the excavated town of Pompeii showed that shops were located in streets with a high density of entrances and a high degree of intervisibility (van Nes 2011). Likewise, the locations of shops in informal urban areas of the city of Cairo, in Egypt, are primarily along highly intervisible, locally integrated streets (Mohammed et al. 2015b).

In the case of the study of densification strategies in Bergen, Norway, it could be shown that the topological depth between private and public spaces influences the degree of walkability. The more entrances are directly connected to streets, the more people tend to choose to walk instead of using private vehicles (De Koning et al. 2017). In connection to this, the urban micro-scale analysis method has been used to study urban planning regulations and their impact on urban form in Recife, Brazil. The results showed that building types with parking garages on the ground level contribute to streets with no intervisibility and no natural surveillance (Carvalho Filho and van Nes 2017).

Işın Can (2012) showed in a study of three different neighbourhoods in the city of Izmir, in Turkey, that semi-private spaces that facilitate stationary activities such as sitting and standing are important for a neighbourhood's vital street life. Connecting the importance of micro and macro-spatial measurements, this study revealed that the street network must have high local integration values and the houses' entrances and windows must be oriented towards the street.

Micro-scale spatial relationships between buildings and streets play a significant role in the socio-economic life of people. The private–public interface influences the quantity and quality of street life, safety, and the risks of criminal victimisation. This is not only important for urban studies, but also for the design and planning of cities. However, micro-scale conditions are often neglected in the contemporary planning and design of urban areas. In particular, urban renewal projects, modern housing areas, and new large-scale urban development projects often lack adjacency, permeability, and intervisibility between buildings and streets. This has negative effects both on the quality and quantity of the street life and on the safety of these urban areas.

Fig. 4.17 A new housing estate contributes to unconstituted streets with a low degree of intervisibility and many topological steps between private and public space

Instead, present urban project developers tend to build with high density or high floor-space-index and propose large variations of urban functions in these areas. The degree of interconnectivity and the topologically shallow public–private interface is often forgotten. All of these activities depend on the spatial configuration along the plinth of built-up street sides. Micro-scale spatial relationships add value to the analysis, design, and policymaking in urban areas.

Figure 4.17 shows some images of a new housing complex built in 2009, in the municipality of Rijswijk. As shown in image 1, the western-oriented homes have an active frontage towards the canal. Image 2 shows an unconstituted street. Image 3 shows the back-garden part for the eastern-oriented homes. This design solution contributes to an unconstituted street with no 'eyes on the street' from the buildings. When moving to image 4, the short ends of the homes have no doors and few windows oriented towards this street segment. This is the main entrance into the housing complex, and this street segment is also unconstituted and not intervisible. Image 5 shows the entrance to the parking garage with stairs up to a semi-private space, and image 6 shows the 'parking' street for the houses. The topological depth between the semi-public parking street and the homes is two. The entrances are not directly connected to the street level. On the other side of the street, a wall can be seen. This street segment is unconstituted because there are only garages on the ground floor level.

Another challenge is the day and night difference of streets. Some streets have a high degree of intervisibility, connectivity, and a shallow public–private space relationship during the daytime. During the night, the inverse can be observed. Curtains, walls, and a lack of natural surveillance from windows due to the absence of people contributes to an unsafe feeling in these streets. Thus, the registration of day and night situations is useful for an appropriate analysis of the real situation. For

Fig. 4.18 Day and night situation of the shopping street Kalverstraat in Amsterdam

example, Amsterdam's main shopping street Kalverstraat represents an example where the day-versus-night aspect plays a role. During daytime, the shopping street is very lively. At night, several shops have dropped their iron curtains, contributing to an unconstituted street with no intervisibility. Figure 4.18 illustrates a day and night situation from the same location for Kalverstraat in Amsterdam.

When applying micro-scale analyses, there are some common errors to be aware of. When registering entrances in street segments, the functions of buildings must be active, such as offices, residential apartments, or shops. Passive functions, such as storage and parking spaces, contribute to a lack of natural surveillance. Likewise, entrances need to have adjacent windows on the ground floor level. When a building has several windows on the first floor and up, and only storage spaces on the ground floor level with no windows, it will contribute to unconstituted streets with low intervisibility.

However, the urban micro-scale methods need further testing for various cultures. For example, in cultures with a clear gender separation, the private–public relationship where the domestic space is predominantly for women and the public streets are for men has not yet been studied.

4.7 Exercises

All exercises can be carried out manually.

Exercise 1

Choose a shopping street and a dwelling street in two different neighbourhoods you are familiar with. We suggest choosing a traditional and a modernist neighbourhood. Conduct a topological depth analysis of the private–public space relationship for all four streets. Describe and explain the differences.

Exercise 2
Conduct a constitutedness and intervisibility analysis of the same streets you used in Exercise 1. Describe and explain the differences.

Exercise 3
If you have already computed a space syntax analysis (Integration and Choice) for a particular neighbourhood, conduct intervisibility, constitutedness, density, and topological private–public space depth analyses of all the streets. Compare the results from the micro-scale analysis with the results from Integration and Choice analysis. If you have not already computed a space syntax analysis, proceed with Exercise 4.

Exercise 4
Conduct intervisibility, constitutedness, density, and topological private–public space depth analyses of two different neighbourhoods you know. Choose a traditional and modernist neighbourhood. Generate a map for each analysis. Describe the differences and similarities between the two neighbourhoods.

Exercise 5
If you have a processed axial map of the same neighbourhood (see also Exercise 3), describe and explain the relationship between choice with both high and low metric radii and the results of the analysis from Exercise 3.

Exercise 6
Below are some addresses you can look up at street view level via www.google.com or www.baidu.com. Describe and reflect upon the results.

For those of you who can use Google, perform micro-scale analyses of the street segments where the addresses below are located:

(a) 176 Telok Kurau Road, Singapore
(b) 230 Orchard Road, Singapore
(c) 13 Admore Park, Singapore
(d) 18 Cuff Road, Singapore
(e) 19 Veerasamy Road, Singapore
(f) 12 Cross Street, Singapore
(g) 131 High Street, Mansfield Victoria, Australia
For those of you who can use www.baidu.com, perform micro-scale analyses of the street segments where the addresses below are located:
(h) No. 106 Huangpu Da Dao Xi, Tian He, Guangzhou, China
(i) No. 54 Wende South Road, Yuexiu District, Guangzhou, China
(j) No. 19 Xin Nong Street, Xicheng, Beijing, China
(k) No. 34 Xintaicang Hutong, Dongzhimen, Beijing, China
(l) No. 1, South Zhongguancun Street, Hai Dian, Beijing China .

4.8 Answers

Exercise 6

(a) low density of entrances, no intervisibility, street is constituted, topological depth between private and public space is 2–3 steps
(b) low density of entrances, no intervisibility, street is constituted, topological depth between private and public space is 2–3 steps
(c) low density of entrances, no intervisibility, street is unconstituted, topological depth between private and public space is more than 3 steps

(d) high density of entrances, high intervisibility, street is constituted, topological depth between private and public space is 1 steps
(e) high density of entrances, high intervisibility, street is constituted, topological depth between private and public space is 1 steps
(f) low density of entrances, no intervisibility, street is constituted, topological depth between private and public space is 2–3 steps
(g) low density of entrances, no intervisibility, street is constituted, topological depth between private and public space is 2–3 steps
(h) low density of entrances on one side, high density of entrances on the other side, no intervisibility, street is constituted, topological depth between private and public space is 1 steps on one side, more than 3 steps on the other side.
(i) low density of entrances, no intervisibility, street is unconstituted, topological depth between private and public space is more than 3 steps
(j) low density of entrances, no intervisibility, street is unconstituted, topological depth between private and public space is more than 3 steps
(k) low density of entrances, no intervisibility, street is unconstituted, topological depth between private and public space is more than 3 steps
(l) low density of entrances, no intervisibility, street is unconstituted, topological depth between private and public space is more than 3 steps

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