

Chapter 2

The Elements of Urban Form

Abstract This chapter focuses on the different elements of urban form. The presentation of these different elements follows an order of increasing resolution of urban form. It starts with a description and explanation of the different urban tissues that we can find in our cities. It then increases the resolution and moves to the natural context and to the system of public spaces that constitutes each urban tissue, analysing both the spaces for circulation and for permanence. The chapter moves then to the urban plots which are, in our cities, the physical expression of individual property and, as such, distinct from the public or collective space. Once again increasing the level of resolution, the chapter moves to the buildings that constitute the urban tissue of a city including, not only exceptional buildings but also, current buildings.

Keywords Buildings • Elements of urban form • Natural context • Plots • Streets • Urban tissue

The different elements that constitute the physical form to our cities are the theme of this chapter. Each of the main elements of urban form is isolated from its context, enabling a more effective analysis and understanding. This analytical exercise is not ‘neutral’ and it somehow implies the previous existence of reading instruments to organize and structure these elements. Yet, we have tried to minimize the role of the ‘researcher’ and to focus on the ‘object’, the city. The role of the ‘researcher’, and of its instruments for description, explanation and even for prescription, will be discussed in Chap. 6, which will consider the different ways that different researchers use to deal with the same object, the city.

2.1 The Concept of Urban Tissue

Cities are, in morphological terms, extremely complex objects. In other words, cities are objects composed of different objects or of different parts. It is possible to identify a number of relationships between these objects ‘from the part to the

whole' and to recognize a hierarchy in these relations. To deal with the complexity of cities, urban morphology uses this hierarchical view of the city, structured according to a set of fundamental physical elements.

At a general level, the city is composed of urban tissues. Karl Kropf, in his paper 'Urban tissue and the character of towns', strongly influenced by the Italian tradition, defines urban tissue as an organic whole that can be seen according to different levels of resolution. These different levels correspond to different elements of urban form. The higher the level of resolution, the greater the detail of what is shown and the greater the specificity of morphological description (see also Fig. 7.4 in Chap. 7). At a very low level, the urban tissue includes only the streets and street blocks. At a high level of resolution the tissue might include a number of details such as the construction materials of an open space or building (Kropf 1996).

In general, all cities and their tissues are constituted by a set of elements of urban form—streets,¹ street blocks, plots and buildings. Yet, in each city these streets, street blocks, plots and buildings are combined in a specific way, originating different types of tissues. Some of these tissues are clearly identifiable and are able to offer their cities a unique character. Each of these urban phenomena is deepened by the 'time' factor, as a large number of our cities are indeed the result of a long process of construction, developed over centuries, and where different layers are continuously overlapping without erasing the previous layer. The notion of 'palimpsest' is often used in urban morphology to explain this continuous construction over time (we will get back to the notion of palimpsest in Chap. 6 when presenting the work of Gustavo Giovannoni).

Figure 2.1 presents, approximately at the same scale, eight cities in four different continents, with some urban tissues that are clearly recognizable: Brasilia, with a relation between (or a percentage of) open space and built form clearly favourable to the former; Djenné, in Mali, with a central and very compact urban occupation in clear contrast with the periphery left without buildings; Venice, with its exceptional geographical context marked by the strong presence of water and with an extremely compact urban tissue; New York, with an extremely regular pattern of streets and of buildings alignment and a wide range of buildings height (New York will be analysed in detail in Chap. 5); Barcelona, with its rigorous grid—forming octagonal open spaces in the street crossings—only broken by the large diagonal and with its homogeneous alignment of buildings; Paris, with the large radial streets conformed by a built form with uniform alignment and height; Rome, with a very dense layout of small street blocks interrupted by a number of monuments and squares that offer the city a high level of intelligibility; and finally, Sana'a, in Yemen, in clear contrast with the first urban tissue (Brasilia), with a relation between open space and built form that is clearly favourable to the latter.

¹In a broad sense, including the open spaces for circulation (streets, avenues, boulevards...) and the open spaces for permanence (squares).



Fig. 2.1 Urban tissues of eight different cities, approximately at the same scale: Brasilia, Djenné, Venice, New York, Barcelona, Paris, Rome and Sana'a (*Source* Google Earth)

The same way we can find different urban tissues in different cities, located in different continents, we can also find different urban tissues within the same city. Figure 2.2 shows—once again, at the same scale—four different tissues within the apparently homogeneous city (in morphological terms) of New York. These tissues are included in only one of the five boroughs of this American city—Manhattan.



Fig. 2.2 Different urban tissues in New York city, approximately at the same scale: Downtown, Soho, Harlem and Stuyvesant Town (*Source* Google Earth)

The first tissue is in the Downtown area around Wall Street. Wall Street takes its name from the seventeenth century wall located in this street. The fact that it hosts the centre of the global financial markets justifies its current importance. The area that surrounds it, with a very rich urban history, is characterized by a pattern of narrow streets, forming street blocks of irregular shape and of small size, including a reduced number of plots and buildings. These buildings correspond to very large volumes given by their large plans and heights.

The second urban tissue is the Soho area around one of its most notable streets, Greene Street. This area consists of more regular street blocks, with larger areas than in the previous tissue, with a reasonable number of plots and buildings. The buildings height is similar to the streets width. A fundamental factor for the high quality of the built environment of this area is the excellence of its iron buildings erected between 1869 and 1895. Another factor that should be noted is the great mixture of uses, which contributes, in an undeniable way, to the urbanity of this area.

The third urban tissue is the famous black neighbourhood of Harlem, in particular the area around the 125th Street (or Martin Luther King Boulevard). Unlike the previous area, this part of New York is clearly marked by the residential use, except for the 125th Street which is a truly commercial street. The street blocks of Harlem are larger than the ones in Soho, and include a higher number of plots and buildings. Yet, there are a significant number of vacant plots which, somehow, contributes to disqualify the urban environment of this neighbourhood.

Finally, the fourth urban tissue is Stuyvesant Town, a private residential development located east of Gramercy Park. Contrarily to the previous tissues, in

Stuy Town the open space prevails over the built space (although this dominance is on a much smaller proportion than the one in Brasília, mentioned above) and the area does not have a plot structure. The number of street blocks and the number of buildings are much reduced when compared with the previous areas. The building development, of large dimensions (comprised between the 14th and 20th streets), has a strong formal homogeneity.

2.2 The Natural Context

The natural context is the first condition for the establishment and organization of the different elements of urban form. The land relief, the quality and suitability of soil and subsoil, the climate, the solar and wind exposure, the type of natural landscape—all these factors influence how a settlement is established, from its foundation, from the first paths and streets (and, subsequently, from all the infrastructures that will be built in the streets) to the way land is subdivided into a number of different parts, to the various buildings that are built in these plots, and even to the materials that—at least, until the last century—will give expression and surface to all these forms.

In each initial intention of human settlement, in different historical periods, the land relief has its own configuration as well as a geometry that influences the location and the form of that settlement. In the master and doctoral theses that Rosália Guerreiro presented to the Instituto Universitário de Lisboa—‘O território e a edificação’ and ‘Urbanismo orgânico e a ordem implícita’ respectively—she synthesizes a number of key elements on this influence of land relief in human settlements, which we summarize, very briefly, in the two following paragraphs (Guerreiro 2001, 2011).

Generally, the land relief can be divided into two categories. In addition to the basic forms of land relief or of micro-relief (a hill, a promontory...) there are a number of composite forms, the macro-relief or the structural relief. The formation of these forms is associated with endogenous forces that originated the process of geomorphologic formation of the continents. The structuring lines of the territory are the ridge lines—corresponding to imaginary lines, more or less continuous, connecting the maximum elevation points and dividing the flow of water in opposite slopes—and the lines of thalweg—linking the lowest elevation points, promoting the natural drainage of water to downstream. The ridge lines, as well as the thalweg lines, are associated in branched hierarchical systems forming the orographic and hydrographic systems. The points where ridge lines and thalweg lines are ramified are the notable points of the territory, usually referred to as distribution centres and encounter centres. There is also a third system of territory lines—the contour curves, cutting perpendicularly the ridge and thalweg establishing the relationships between them.

In different human settlements, the definition of the first paths follows this natural structure of the territory strengthening its own configuration and geometry. Indeed, these lines that structure the territory—ridge, thalweg and contour curves—represent the lines where the effort to overcome the slope is smaller. As such, for

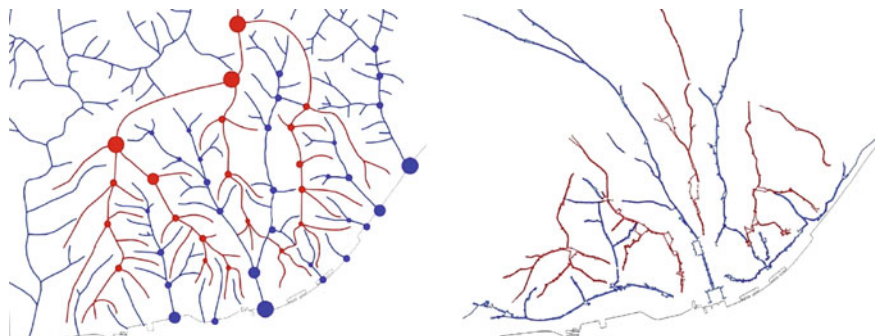


Fig. 2.3 Physiography of the physical support (ridges and thalwegs; distribution centres and encounter centres) and of the street system (ridge streets and thalweg streets) of Lisbon (*Source* Guerreiro 2011)

centuries, these were the lines of movement. The place where these lines of movement get together—the notable points of the territory—became the central places (Fig. 2.3).

Figures 2.4 and 2.5 illustrate the importance of land relief to human settlements. It is impossible to imagine the urban forms of Machu Picchu (Peru), Masada (Israel), Saint-Michel (France) or Lhasa (Tibet) without considering the land relief. The city of Machu Picchu, built in the fifteenth century (and abandoned in the following century after the Spanish conquest) by the Inca civilization in the Andes, at almost 2500 m above sea level, is one of the most remarkable examples of integration between human settlement and natural support. The city was structured in a set of terraces, ramps and stairs, around a central ‘square’ and included about 200 buildings distributed by religious, agricultural, industrial and residential areas. The second example is Masada, a fortified settlement built by the Jews in the Judean Desert near the Dead Sea at about 400 m altitude. Similar to Machu Picchu, Masada had a short period of occupation, being conquered by the Romans in the first century. A key element in the life of this settlement was a sophisticated water supply system.

The building development consisting of the *Potala* Palace, the *Jokhang* Temple and the *Norbulingka* built by the Tibetan monks from the seventh century onwards on the Red Mountain at 3700 m of altitude, is another notable example of the relationship between man and nature. Finally, the last example, linking Figs. 2.4 and 2.5, is Saint Michael. Saint Michael is a small settlement in Normandy, France, developed around a Benedictine abbey, in Gothic style, built between the eleventh and the sixteenth centuries. The uniqueness of this settlement is due not only to the dialogue with the land relief, as in the three previous cases, but also with water—when the water rises the settlement site becomes an island.

As in the previous cases we cannot imagine Varanasi or Venice without their relation to water (see Fig. 2.5). Indeed, the Italian city, founded in the fifth century, constituted by 120 small islands and a wide set of channels, is a singular case of

Fig. 2.4 Relationships between urban forms and natural context—land relief: Machu Picchu, Masada, Lhasa and Saint-Michel (Source Photographs by Filipa Neiva (a), Urszula Zdzieborska (b), Jan Reurink (c) and Cláudia Lira (d))



Fig. 2.5 Relationships between urban forms and natural context—water: Venice and Varanasi (*Source* Photographs by Sara Guedes (a) and Jorge Correia (b))



relationship between human occupation and the lagoon where it is settled. Also very intense is the relationship between the city of Varanasi and the Ganges River. While the urban forms of this Indian city seem to touch the river, the life of its inhabitants is inseparable from the Ganges, using it in numerous actions including bath, laundry and funeral services.

Depending on the concept of city (bounded, in a very simplistic way, between an organic model and a rational model) the influence of the natural context on the city can be more or less significant. This influence can also vary between different parts of the same city. Let us return to the example of Manhattan in New York. The establishment of a settlement on an island clearly influenced the way how, in the oldest part of town, faced with shortage of land, buildings started to be higher and higher. However, if we move to another part of the island, for instance, a northern area where in the early nineteenth century the regular grid, characteristic of the city, started to be implemented, we can see that the rugged relief was not an obstacle for the construction of that grid. Furthermore, if we continue to move north, we arrive at the magnificent Central Park, where the ‘apparently natural’ physical support was in fact built by man.

2.3 The Streets System

It is through the streets system (in the generic sense, including avenues, boulevards...) that we travel, and start to know, a city. Streets define the different street blocks that constitute a city and distinguish what is public, and is therefore accessible to all citizens, from what is private or semi-public. Streets are, in broad terms, the public and democratic space of the city, the place where we all met, with all our differences, and where we all interact in social terms.

All these possibilities of interaction are restricted when we move from the streets to the interior of buildings. Bill Hillier, the founder of Space Syntax, recently wrote, in a paper submitted to the International Space Syntax Symposium (ISSS), that social differences have no expression on streets. This British author argues that streets ‘do not reflect the society’ (or the most negative aspects of society), and that, on the contrary, streets can gather in space what society insists in dividing. In addition, Hillier argues that the livability of the streets is probably the most relevant indicator of the presence of a strong civil society (Hillier 2009).

In morphological terms, and in a temporal perspective, streets are the most stable element of urban form. While the physical process of city building is something that ‘takes time’ involving permanent transformation—it has a past, a present and a future—the streets system of a city is the one that offers greater resistance to this process of urban transformation, attaining a great temporal stability. The plots system has a lesser durability than the streets system, and the buildings system has a lower stability over time than the two first systems.

There is a wide variety of streets, with different shapes and sizes, with different ways of relating with the other streets in the surroundings, and also with different urban functions. The analysis of each of the main elements of urban form that we are developing in this chapter does not ignore that, for instance, the character of a street is influenced by other elements of urban form shaping it. This character is actually influenced by the plots on one or on both sides of the street; by the buildings—by their height and by the relation between their height and the width of the street; by the way buildings are located in plots, sometimes near to the plot frontage, offering the street a higher sense of enclosure, sometimes far from the plot frontage, offering greater openness to the street; or by the ‘doors’ that these buildings open to the street. Another important issue when analysing the streets system that will be developed in later chapters is how in each street the space for pedestrians and the space for vehicles—public or private, motorized or non-motorized—are distributed. Allan Jacobs’ ‘Great streets’ is an example of a notable book on the streets of our cities (Jacobs 1993).

Figure 2.6 presents a diverse set of streets in four different cities. The first images refer to the intersection of two of the most important streets of New York: the Broadway, which crosses the whole island of Manhattan in the north–south direction, being the only street with an irregular pattern on the orthogonal grid of the city designed in the early nineteenth century; and the 5th Avenue (with 10 km

Fig. 2.6 Different streets in different cities, approximately at the same scale: Broadway, intersection with the 5th Avenue, in New York; the *Champs Elysées* in Paris; the *Via Rinaldini* in Siena and the *Reguliersgracht* in Amsterdam (Source Aerial views—Google Earth; Photographs by the author)



long and 30 m wide) which is perhaps the most famous of the eleven avenues that structure New York in the north–south direction.

The two following images refer to the *Avenue des Champs Elysées* in Paris, one of the most important symbols of the Baron Haussmann's intervention in the French capital in the second half of the nineteenth century (see Chap. 3). This is an axe of 2 km long and 70 m wide (in its western part which is clearly more urban), conformed by a fairly homogeneous set of buildings. The buildings height is clearly inferior to the street width, which gives the *Champs Elysées* a strong sense of openness. It has a strong presence of trees and with very different functions including shops, cafes and cinemas. This avenue is part of a longer axe with a fundamental importance in the city, linking *La Defense* and the *Louvre* Museum.

The third set of images refers to a small medieval street in Siena, the *Via Rinaldini*. This street is directly linked with the famous square of the city (that will be analysed in the following paragraphs). *Via Rinaldini* is less than 50 m length and is 5 m width. Despite the clear differences in relation to the two previous streets, we should highlight that the cross-section of this street is somehow close to the cross-section of the 5th Avenue where the buildings height is clearly higher than the street width.

Finally, the fourth set of images refers to the *Reguliersgracht*, one of the streets of Amsterdam, within the so-called 'ring of canals', an area that started to be built in the early seventeenth century. The built environment of Amsterdam—as well as of other Dutch cities—is marked by a sound presence of water. As such, the cross-section of the street (the street is about 30 m wide and 600 m long) is clearly different from the previous examples, as it includes the canal and, on each side of it, a street with three different spaces: one for pedestrians, one for vehicular traffic (distinguishing it from the urban environment in Venice where there is no vehicular traffic in the historical city) and one for car parking.

The public spaces system of a city includes not only the open spaces for movement, which we designate, in a simplified way, as streets, but also the open spaces for permanence, which we designate as squares and gardens. All this diversity of streets that we have described in the previous paragraphs can also be found in the case of squares.

Figure 2.7 presents four squares in three different continents. The first of these is Times Square, in New York, located at the intersection of Broadway with the 7th Avenue. While in morphological terms the square is no more than the intersection of the two streets with no particular conditions inviting for staying in the square (somehow similar to what happens in Picadilly Circus, in London), the truth is that at any time of day or night, Times Square is full of people (as we can see in this photograph taken at night). In terms of urban functions, the square is located in the heart of the Theater District and it includes a number of cultural and commercial activities contributing not only to the dynamics of this space, but also to the consolidation of the image of the square through a significant number of attractive neon lights. Our collective imaginary of this New York square is undoubtedly informed by the traditional party in the New Year's Eve, when a crystal ball falls from the top of the number 1 of Times Square.

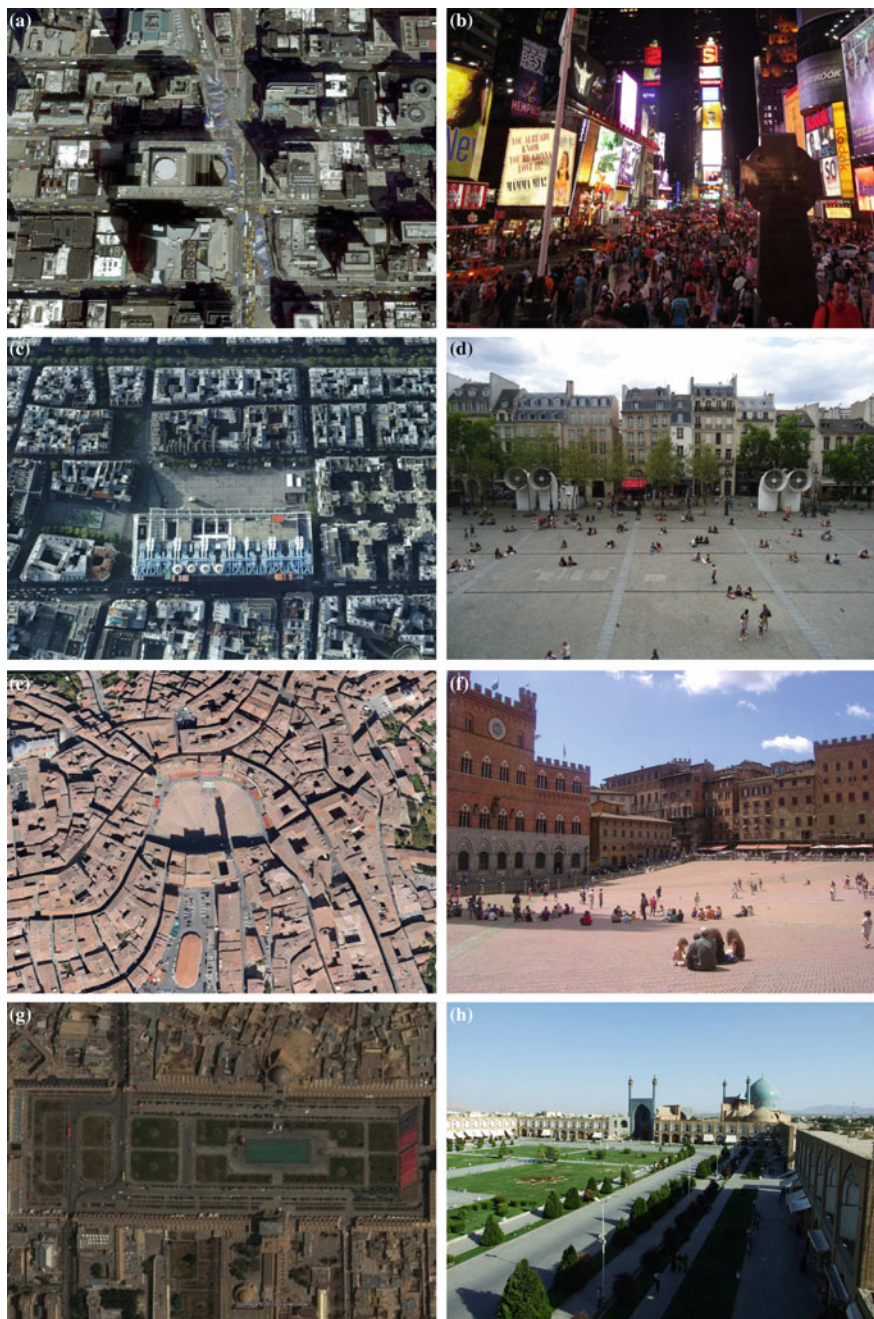


Fig. 2.7 Different squares in different cities, approximately at the same scale: Times Square in New York, *Place Georges Pompidou* in Paris, *Piazza del Campo* in Siena and *Meidan Emam* in Isfahan (Source Aerial views—Google Earth; Photographs **b**, **d** and **f** by the author, Photograph **h** by Jorge Correia)

The second square included in Fig. 2.7 is the *Place Georges Pompidou*, in Paris, near the former market of *Les Halles*. This square is clearly different from the previous, both in morphological terms and in functional terms. Indeed, the *Place Georges Pompidou* has a clearly defined shape, a rectangle of about 175 m long and 70 m wide, and a slope upwards from the entrance in the *Centre Georges Pompidou*, that establishes its eastern limit, up to the buildings of the *Rue Saint-Martin* that constitute its western boundary. This immense sloping surface is one of the fundamental characteristics of the square and is the key element that invites people to different activities, from the simple lay down to different artistic performances. In terms of function, this square is clearly distinguishable from the first because it has a strong artistic dimension, due to the presence of the remarkable *Centre Georges Pompidou*, built in the late 1970s. As a complement, the *Place Igor Stravinsky* (at south of *George Pompidou*, in Fig. 2.7) including a set of modern sculptures and the Stravinsky Fountain with 16 mobile sculptures, should also be referred.

One of the most famous squares in the world, particularly among those studying the physical form of cities, is the *Piazza del Campo* in Siena. This Italian square, from the twelfth century, has the shape of a shell and it is delimited by a number of notable buildings (*palazzi*) with different heights, from five to seven storeys. Similarly to the *Place Georges Pompidou*, this square is constituted by a wide sloping surface—following the topography of the city—which has the lowest point in the northern part, in the entrance to the town hall, the *Palazzo Pubblico*. One of the most famous events that takes place in the square is the *Palio*, a horse race which dates back to Roman military exercises.

The last example included in Fig. 2.7 is the *Meidan Emam* in Isfahan, Iran. This square of great dimensions, 520 m long and 160 m wide, has a rectangular shape (as the *Place Georges Pompidou*) and it is delimited by a continuous building volume of two storeys high with a double colonnade. A number of exceptional buildings stand out in this set—two notable mosques, classified by the United Nations Educational, Scientific and Cultural Organization (UNESCO), and a palace. The northern part of the square gives access to the *Bazaar* of Isfahan. In addition to accommodating some exceptional functions, the square is intensively lived by the local people for many different activities. Contrarily to the three previous cases there is not a strong presence of foreign tourists in Isfahan.

As we can find substantially different urban tissues or streets in the same city (as we have seen in the example of New York), we can also find different squares with clearly distinct forms and functions in different parts of the same city. The following paragraphs, and Fig. 2.8, illustrate this phenomenon in Paris.

The first example included in Fig. 2.8 is the *Place Vendome*, located in the *Tuileries* area. This square was built in the early eighteenth century (it is the latest example of this set). It has a rectangular shape (octagonal cut in the corners) with 140 m long and 120 m wide, it is crossed by one street only—the *Rue de la Paix*, and it is composed of a group of buildings with a great homogeneity in terms of architectural language and of the number of storeys. In terms of urban functions, *Place Vendome* is the home of a number of fashionable shops.



Fig. 2.8 Different squares in Paris, approximately at the same scale: *Place Vendôme*, *Place des Vosges*, *Place des Victoires* and *Place Dauphine* (Source Aerial views—Google Earth; Photographs by the author)

The *Place des Vosges*, built in the early seventeenth century in the *Marais* area, is the second example. With a dimension that is slightly higher than *Place Vendome*, *Place des Vosges* is a square of 140 m, and it is configured by an extremely homogenous group of buildings comprising 36 houses (nine in each of the four sides) containing an arcade around the whole perimeter of the square. The centre of *Place des Vosges* is a green space. The access to the square from the *Rue de Birague* is made through the arcade. As such, the square is delimited by one important street only, the *Rue du Pas de la Mule*, at north.

The third example is the *Place des Victoires*, located in the *Tuileries* area, nearby *Place Vendome*. This square, with a circular shape, has smaller dimensions than the previous two (approximately 75 m diameter) and, as in these two cases, it is defined by a set of buildings, of four and five storeys, with great homogeneity in terms of architectural style. The square was built in the seventeenth century in order to frame the statue of Louis XIV. Although it is a very interesting example in terms of urban form hosting a number of important fashion shops, the square is not much more than a roundabout.

The *Place Dauphine* is located in the oldest part of the French capital, the *Ile de la Cité*. This last example of our set is clearly different from the previous three cases: the square has a triangular shape (with an area that is larger than the *Place des Victoires* and smaller than the other two cases); and the buildings shaping it have a higher diversity than the previous ones, both in terms of numbers of floors and of architectural language.

The following paragraphs and Fig. 2.9, illustrate the same phenomenon in Rome. As mentioned above, Rome is a city of a very dense layout made of small street blocks interrupted by a number of notable squares. Let us focus on four of those squares, *S. Pietro*, *Campidoglio*, *Navona* and *Rotonda*. The *Piazza S. Pietro*, with a dominant religious nature, is located east of the *Tevere* River, within the Vatican territory. The square, the *basilica* and the colonnade (four columns deep) shaping it, were built in the sixteenth and seventeenth centuries. The square has a complex shape, made of two different shapes, an ellipse (of 200 m long and 150 m wide) and a trapezoid (where the parallel sides have approximately 100 and 115 m long and are distanced 100 m).² The square is part of a wider composition, being the western limit of a strong axe defined by the *Via della Conciliazione*, which is bounded at east by the *Castel Sant'Angelo*. While the exact centre of the square is marked by an obelisk, two different fountains appear to be the two centres of the ellipse.

The second example included in Fig. 2.9 has a rather different nature, shape and size. The *Piazza del Campidoglio* is located in the historical kernel of Rome. The square and the three surrounding *palazzo* were built or restored in the sixteenth century, constituting then a new civic centre for the city. It now gathers civic and museologic functions. The *Piazza del Campidoglio* has a trapezoidal shape; the bases of the trapezoid have approximately 55 and 40 m and are distanced about

²A third shape, linked with the *Via della Conciliazione*, could also be considered.

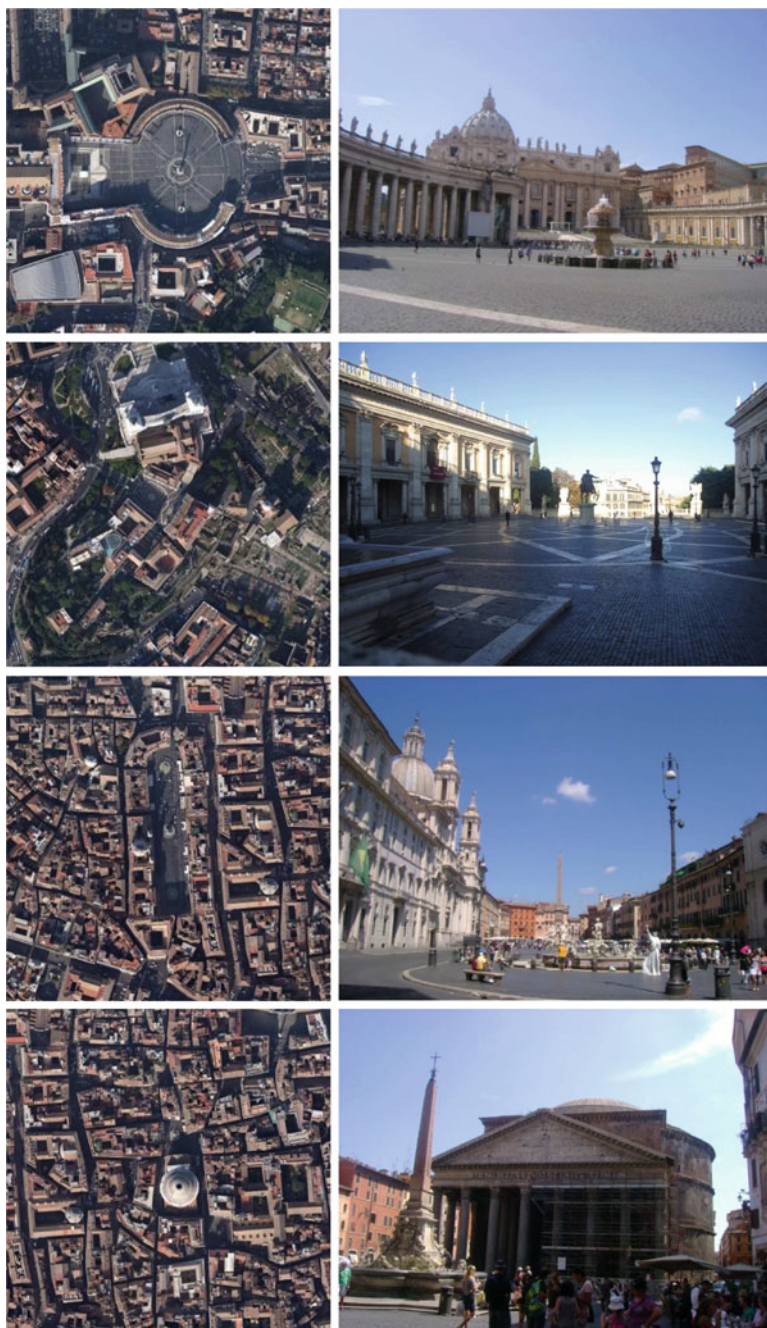


Fig. 2.9 Different squares in Rome, approximately at the same scale: *Piazza S. Pietro*, *Piazza del Campidoglio*, *Piazza Navona* and *Piazza della Rotonda* (Source Aerial views—Google Earth; Photographs by the author)

75 m (it is substantially smaller than *Piazza S. Pietro*). The square has a notable pavement with an oval geometric layout and, in the centre, an equestrian statue. Limited at east by the *Pallazo Senatorio*, the axial composition of this set includes, at west, a wide-ramped stair (the *cordonata*) connecting the square to the *Via del Teatro di Marcello*.

Contrarily to the four Parisian squares presented above, the four Roman examples have a strong touristic dimension. That is the case of *Piazza Navona*, located north of *Corso Vittorio Emanuele II*, which has an intense social life. The square as we know it was established in the seventeenth century. Its peculiar shape, a long rectangle of about 250×50 m with round ends (a proportion of about 5:1, where the largest dimension is higher than the largest dimension of *S. Pietro*), draws on the ruins of a stadium erected in the first century. Three notable fountains (*Nettuno*, *Quatro Fiumi* and *Moro*, from north to south) have a central role in this remarkable baroque set. Besides the numerous caf  s, restaurants and shops, the building set of *Navona* includes the church of *Sant'Agnese in Agone*.

The last example is *Piazza della Rotonda*, located 250 m east of *Navona*. The square was defined in the fifteenth century. Yet, the surrounding building fabric dates from earlier periods. That is the case of its main building, the Pantheon (the church of *Santa Maria Rotonda*, giving the name to the square), dating from the first century. As we can see in Fig. 2.9 the square is considerably smaller than the other three examples. It has an irregular shape near to a trapezoid; the bases of the trapezoid have approximately 45 and 35 m and are distanced about 60 m. It has a fountain with an obelisk in the centre. The square has a large number of caf  s and restaurants.

2.4 The Plots System

As mentioned above, the plots system of a city is one of the most important elements of urban form, separating the public domain and the private domain (or the different private domains). Nevertheless, the role of this fundamental system is often neglected by the main agents and stakeholders in the process of city building, largely because of the, apparently, reduced urban visibility of plots.

The definition of the plots system in a given territory is an essential element of its urbanization process and has a considerable stability over time. The decision on what would be the new structure of private ownership in a particular territory might involve the subdivision of a set of large plots—for instance, plots of former rural use—or the proposal of a new land division. The subsequent stage of this urbanization process usually involves the precise definition of the different plots: (i) how is each plot related with the street? (what is the dimension of the plot frontage? what is the orientation of the plot in relation to the orientation of the street?); (ii) what is the position of each plot within the plots system? (is it in the middle or in the edge of the street block? is it located in a long side or in a short side of the street block?); (iii) what is the shape of the plot, and what are its dimensions and proportions?

It is essential that we acknowledge that these definitions, taken when each plot is laid down, will condition the future options in terms of the building types that can effectively be built within these plots and, as such, it will have a significant impact on the urban landscape.

Although there are considerable differences between each specific context, in many cities the processes of plot subdivision and of plot amalgamation are not very common. This means that the choices that we make, as agents, in very early stages of the urbanization process will condition, for long periods of time, the urban forms that in the future will be built in the city. It is also important to say that, although the city suffers many kinds of disturbances over its ‘life’—such as wars, fires, earthquakes, tsunamis, to name just a few—that could be used as a pretext to erase the pre-existing plots system (or parts of the plots system) and to create a new plot structure, the truth is that, in most of the cases, this does not happen and the pre-existing plots system is maintained.

An important element in the description and explanation of the physical form of the city is the dimension of its street blocks and, within these, of its plots. In general, the dimension of street blocks and of plots increases as we move from the historical centre to the peripheral parts of the city. Yet, there are some exceptions. These exceptions are not negligible and they contribute to the identity of each city—in this regard, the concept of fringe belt will be presented later in Chap. 6. Another important element is the number of plots per street block, as it somehow expresses the greater or lesser diversity of agents and stakeholders—and of urban strategies—that are present in the street block. Contrarily to the dimension of the street blocks, in general, the number of plots per street block decreases as we move away from the historical centre to the peripheral parts of the city.

Figure 2.10 illustrates the plots system of a whole city, central Pingyao. This plan is included in the paper ‘Extending the compass of plan analysis: a Chinese exploration’ by Jeremy Whitehand and Kai Gu (2007). Located nearly 500 km south-west of Beijing, Pingyao is a city that is notable for the survival of its traditional form. It is roughly a square-shaped walled city, with a significant number of planned streets and plots. Figure 2.10 presents the complex plots system of the city. In central Pingyao, regular patterns of plots seem to be associated with regular patterns of streets. In contrast, access to subdivisions of plots (more irregular) created in the interiors of street blocks has been achieved by the development of a labyrinth of alleys, including many cul-de-sacs.

Let us now take a smaller part of a city. *Rua do Almada* is a fundamental street in the urban history of my city, Porto. The construction of this street in the second half of the eighteenth century was promoted by the so-called *Junta das Obras Públicas*, a public agency responsible for urban planning and management. The *Junta* was responsible for the opening of new streets and for the regularization of existing paths, designing a street network that has structured the process of urban development of the city until the end of the nineteenth century. The *Rua do Almada* is 800 m long and 10 m wide. It links two different squares, the *Largo dos Loios*, in the south, and the *Praça da República*, in the north. The street consists of ten street blocks and 214 plots. The largest street block of this set is the section contained

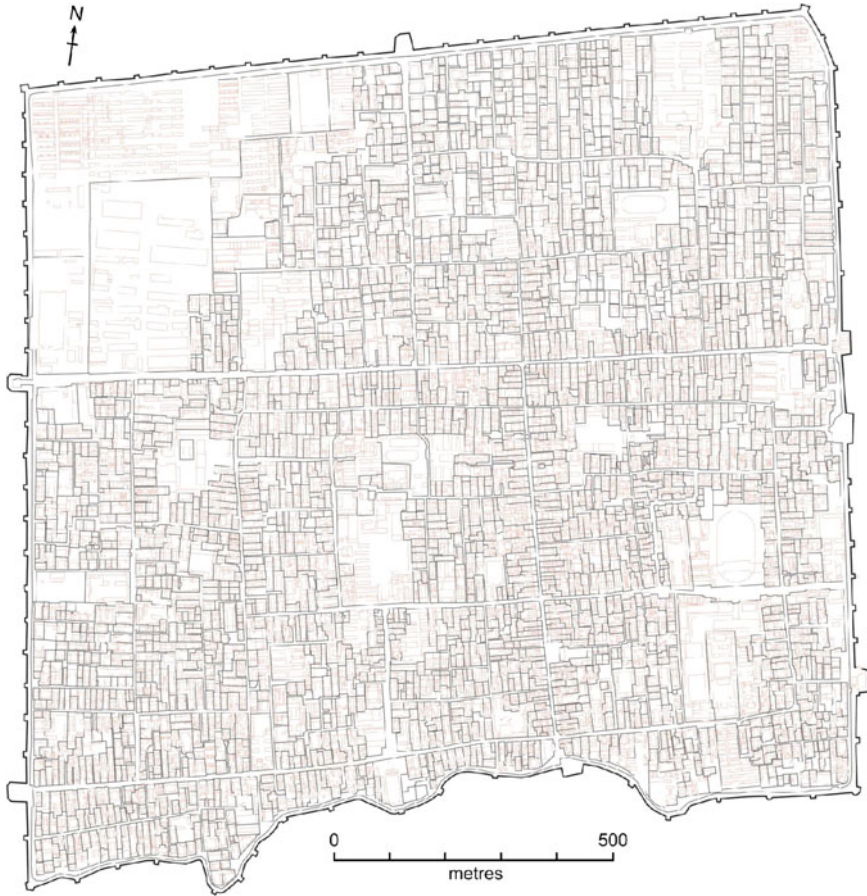


Fig. 2.10 Plot boundaries in central Pingyao, in 2000 (Source Whitehand and Gu 2007)

between the *Praça da República* and the *Rua Dr. Ricardo Jorge* including 58 plots. In a significant part of these 58 plots, plot frontage is about 5 m and plot depth ranges between 20 and 90 m. Over more than two centuries in the ‘life’ of these plots, buildings were conserved recurring to small maintenance works. Yet, eight buildings erected in the last decades of the twentieth century can be found in these 58 plots. However, even in this set of eight buildings, seven were built in the original plots of the eighteenth century, and only one building was erected on a plot resulting from plot amalgamation (of two different plots). In *Rua do Almada* the establishment of a particular type of plot, long and narrow, led to the emergence of a particular type of building. Due to the reduced dimension of the plot frontage, the building type had to adopt an in-depth organization, usually with more than 15 m depth. This in-depth organization of the building has lead to the location, in each

storey, of one (or two) room (s) near the two facades and of a staircase, and of one (or more) rooms in the interior of the building.

The German geographer MRG Conzen, whose work will be analysed in detail in Chap. 6, was one of the main promoters of the study of the plot as a way to describe and explain the physical form of a city. One of the concepts proposed by Conzen was the *burgage cycle*. The *burgage cycle* is the progressive built occupation of the back of the plot culminating in a significant reduction of the open space, resulting in the need to release this space and in a period of urban fallow, preceding a new development cycle. The proposal of this concept was based on the study of the town of Alnwick, in particular on the analysis of the plot belonging to Mr. Teasdale in six different periods of time between 1774 and 1956. Although this phenomenon was recognized in Alnwick, the truth is that it occurs in many different contexts, including the plots of Porto. In the city of Porto, the *burgage cycle* conceptualizes a process of plot occupation and construction of working-class housing in the back of the *bourgeois* building facing the street, without changing the plot structure—the so-called *ilhas*, built in the nineteenth and twentieth centuries.

2.5 The Buildings System

Although buildings do not have the stability in time that streets and plots have, they are one of the most important elements of urban form and, perhaps, the most visible of these elements. In general, the city is made of two different types of buildings, ordinary buildings and exceptional buildings. The main characteristics that distinguish these two types are related to the building form but also to the building utilization. The former type includes most of the buildings constituting the city. The similarities between buildings, within this type, are stronger than the differences between them. This type includes mostly buildings of residential utilization but also commerce and services buildings. The second type includes only a few buildings of the city: those buildings that by their shape—and eventually by their utilization—are clearly distinguishable in the urban landscape. Within this second type there is a smaller set, a very special set of exceptional buildings whose form becomes indistinguishable from the form of the city they are part of. This is the case, for instance, of the Opera House in Sydney.

The position of each building within its plot is of fundamental importance for the character of the urban landscape. In most cities, until the end of the nineteenth century, the continuous alignment of different buildings defined, in a very clear way, the street form. Yet, a number of city theories, developed over the twentieth century, have questioned this traditional alignment of buildings and have led to the introduction of an increasing variation in the position of buildings within plots, questioning the traditional definition of the ‘street’ and of the ‘street block’.

Another important characteristic of buildings is their height and particularly the relationship between their height and the width of street where they are located. The variation of these two measures can introduce significant changes in the urban

landscape. If the height of buildings is much less than the street width we will have little sense of enclosure. Yet, if the height of buildings is greater than the street width, the sense of enclosure will increase. Other important characteristics of buildings are the façade design (important for the urban landscape), the position of the staircase in the interior of the building and the organization of dwellings.

Although in last decades there has been a powerful trend towards an increasing uniformity of buildings at the global scale, we can still find a great diversity of buildings across different countries and different continents. Figure 2.11 includes five photographs of different buildings in different cities and villages, in five different continents. The first is a photograph of Chicago taken from the Lake Michigan. This part of the city, around Lake Shore Drive, has a regular street system with a great diversity of buildings with very different heights. In the middle of the photograph, some skyscrapers seem to emerge within the set of tall buildings. It is the case of the John Hancock Centre of 100 storeys. Although there is also a great diversity in terms of building materials, the urban landscape is marked by the presence of steel and glass. The second photograph is in a rather different geographic and cultural context: Djenné, one of the oldest towns of sub-Saharan Africa, inhabited since 250 B.C. This area includes almost 2000 traditional buildings that were built using earth as the main material. The architecture of Djenné, of its ordinary buildings and of its exceptional buildings (such as the Mosque, in the photograph) is characterized by its homogeneity of materials and colours and by a strong sense of verticality. The third photograph shows a traditional building of the *Batak Toba* people, located in *Samosir* in the middle of Lake *Toba*, in Sumatra (Indonesia). This house, very different from the buildings in the upper photographs, has a boat-shape and it is elevated from the ground. It is mainly built in wood and it has intricately carved gables and upsweeping roof ridges. The fourth photograph presents a set of buildings in the *Stortorget*, a small public square in the *Gamla Stan*, the historical centre of Stockholm. Despite the similar height and alignment of buildings, there are some subtle differences between them such as the use of different colours and the design of the upper storeys and roofs. Finally, a traditional building of the Māori people located in Taumaranui, in New Zealand is included in the last photograph of Fig. 2.11. The design of the roof and of the central column in the main façade (usually two other columns are located in the interior of these buildings), and the sound presence of sculpture distinguishes this building from the buildings of the previous photographs, contributing for the identity of the Māori architecture.

As we have seen when analysing other elements of urban form, we can also find very different buildings within the same city. In addition, it is possible to identify a kind of evolutionary path or a typological process, corresponding to a succession of building types in the same cultural area. Focusing on a particular part of my city, the *Rua de Costa Cabral*, Fig. 2.12 identifies the main residential types of the area and offers a reading of how these building types have evolved over time. The first column of photographs displays the transformation of single-family houses: from the terraced houses built in narrow frontage plots (a), in medium frontage plots (b) and in large frontage plots (d) to the semi-detached houses (f) and the detached

Fig. 2.11 Different buildings in different cities and villages, in five continents: Chicago, Djenné, Samosir, Stockholm and Taumaranui (Source Photographs by the author (a, d), Elisa Dainese (b), Janto Marzuki (c) and Bryan Woodhead (e))



Fig. 2.12 Succession of building types in the same cultural area, Porto (Source Oliveira et al. 2015)



houses (h). The second column of photographs presents the transformation of multifamily buildings: from terraced buildings erected on narrow and large plots (c) and (e) to semi-detached buildings (g) and detached buildings (i)—this will be developed in the last section of Chap. 6.

References

- Guerreiro R (2001) O território e a edificação: o papel do suporte físico natural na génese e formação da cidade Portuguesa. Unpublished MSc thesis, Instituto Universitário de Lisboa, Portugal
- Guerreiro R (2011) Urbanismo orgânico e a ordem implícita: uma leitura através das geometrias da natureza. Unpublished PhD thesis, Instituto Universitário de Lisboa, Portugal
- Hillier B (2009) Spatial sustainability in cities: organic patterns and sustainable forms. In: Koch D, Marcus L, Steen J (eds) Proceedings of the 7th international space syntax symposium, KTH, Stockholm, p 16–35
- Jacobs A (1993) Great streets. MIT Press, Cambridge
- Kropf K (1996) Urban tissue and the character of towns. *Urban Des Int* 1:247–263
- Oliveira V, Monteiro C, Partanen J (2015) A comparative study of urban form. *Urban Morphol* 19:73–92
- Whitehand JWR, Gu K (2007) Extending the compass of plan analysis: a Chinese exploration. *Urban Morphol* 11:91–109

Urban Morphology

An Introduction to the Study of the Physical Form of
Cities

Oliveira, V.

2016, XXIII, 192 p. 65 illus., 19 illus. in color., Hardcover

ISBN: 978-3-319-32081-6