CONCEPTUAL AND INSTRUMENTAL INFLUENCES IN THE GRAPHIC REPRESENTATION OF URBAN PLANNING: FROM ANCIENT TIMES TO THE BAROQUE

Jordi GOMIS [1], Carlos TURÓN [1]

ABSTRACT:
The graphic representation of a town or city has always been studied in different disciplines. Geographers, Civil Engineers, Architects and Urban Planners have established different graphic points of view regarding the representation of settlements and their planning. The graphic criteria used in representing the town have changed due to the logical evolution of instrumental techniques. However, it is not just the improved drawing tools or graphic media that have enhanced the representation of the planning and of the town but also the appearance of historical circumstances that have changed various cultural concepts directly affecting the shape of towns as well as their representation. This article analyses and reflects as to the different instrumental and conceptual historical events that have significantly altered the graphic representation of a town from ancient times to the Baroque.

Key-words: *Drawing, Graphic representation, Urbanism, Urban planning.*

1. INTRODUCTION

One Cities, one of the most complex problems faced by humanity, have existed for millennia. And they have always been "the expression of a desire shown through mathematical, geometrical, philosophical, ideological and symbolic drawings no one ever having been able to reduce them to a simplifying utopia" (Delfante 2006: p.11). Because, of course, they are a reflection of the extreme complexity of everyday life. According to Santamera (2007), "it cannot be forgotten that the city is the most complete, comprehensive and complex work of man" (Santamera 2007: p. 341). Indeed, cities are genuinely cultural creations, in the broadest sense of the term. However, they have a very important feature that sets them apart from other cultural manifestations of society. This feature is their persistence over time and space. So, the city can be seen as a physical compendium of the cultural evolution of a certain society. In fact, it is clear that the cities that exist today "are the result of continuous construction and reconstruction from their initial moments" (Peris Sánchez 2009: p.174) that in some cases date back several millennia.

Throughout the history of humankind, just as in every period there has been a more or less characteristic model of a city corresponding to cultural models, "theoretical models of cities that responded to the theoretical ideal of a specific planner" have also existed (Benevolo 1994: p. 39). These ideal models have almost never become a reality, but their study is also a valuable source of knowledge in many ways, especially in their graphics, since the author has wished to show, through drawing, the whole conception of the planned city, like the drawing of the new gridiron for the Barcelona Eixample district proposed by Ildefons Cerdà, for example (**Fig. 1).**

[1] *Universitat Rovira i Virgili, 43003 Tarragona, Spain, jordi.gomis@urv.cat; carlos.turon@urv.cat.*

The planning of cities is often conditioned by a scheme limited by the technical, economic and cultural circumstances of the time. This scheme, which should define the functions that must be guaranteed, takes into account the natural location (geographical location, climatology, available materials, etc.), and the sociocultural conditioning factors (social and economic organization, the way of life of individuals and groups, religion, politics, etc.).

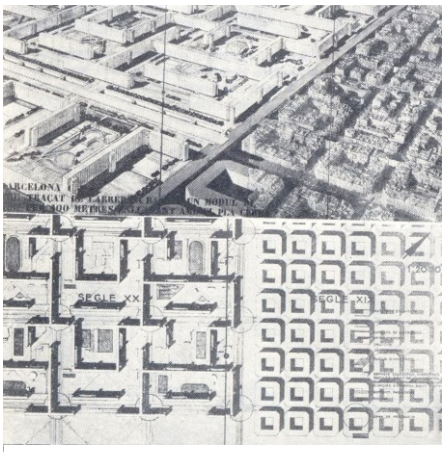

Fig. 1 Photo montage comparing the grid of Barcelona in the nineteenth century designed by Cerdà with the new gridiron proposed in the 1930s by Josep Lluís Sert (Freixa, 1992: p. 40).

Thus, the scheme must specify the purposes and dimensions of the project, which, as an expression of the imagination, translates into a design that integrates the requirements of the scheme. Charles Delfante in his book "Grande histoire de la ville" says that "one might think that even in the most remote times, cities were drawn before being built" (Delfante 2006: p.12). It should be emphasized, however, that not all scholars of the history of urbanism agree. It is common for some of them establish a fundamental division that distinguishes between "spontaneous cities and ordered or planned cities" (Santamera 2007: p. 342). The former are those whose genesis and evolution and subsequent growth do not respond to previous models of planning. The latter are those implemented according to a strict, programmed framework of planning.

Thus, the composition and planning of cities, prior to becoming a reality, are not a manifestly temporal feature. It seems clear that planned cities, though not a majority, also existed in ancient times. However, planning itself and its composition appears in cities, in an evident manner, in the Baroque period and especially in the late eighteenth century. However, we must also consider that town planning as a comprehensive discipline that involves urban design and compositional rules of buildings and spaces appears at the beginning of the nineteenth century as a direct result of the industrial revolution.

This notion of urban composition seems to arise when an ideology, of whatever kind, guides the principles that should govern the "urban development project". It is not a law, but it must be stated that throughout history, political, religious or military powers have involved applying two fundamental principles in planning:

** Order, which is necessary because it allows attributing roles in a hierarchy of relationships of dependency, of complementarity or of any other kind.*

** And symbolism, which allows emphasising the greatness of the power established.*

2. METHOD

In order to carry out a study such as this it is absolutely necessary to establish the trends that have existed in the graphic representation of planning and the main factors that have been involved, changing and transforming the drawing of urban planning throughout history. The look back at this historical process must be rigorous indeed. But, when looking back from a purely graphic point of view, one must keep a sufficient distance to achieve a comprehensive assessment of the matter, allowing oneself not to be especially picky in each

and every one of the small, though significant changes, as they might detain us on graphically over-superfluous issues that are rather more typical of the historical development of cities and urban planning than their representation.

The intention is not to provide a meticulous observation of "the history" of the city and of its image, but of the evolution of the model of the graphic representation of its planning. Now, nothing is absolute, and it should be mentioned that this borderline between "representation of the city" and "representation of planning" is often ambiguous. A more global, not so detailed view of the specific historical circumstances that have come into play in the transformation of cities and their planning enables quite easily establishing a process of sufficiently indicative and noteworthy graphic incidents thus ascertaining which are the mechanisms and resources that must be used to represent them, and what was the origin and the reason for their implementation.

This graphic evolution can be dealt with by observing the representations of the planning of cities, considering only their graphic features and trying not to confuse it with the obvious transformation of the city as an object and the factors that have been involved in and have forced this process. These factors, however, have not always been sufficiently relevant with regard to the drawing and representation of urban planning, generating, parallel with urban history, an independent graphic evolution of the representation of their planning. This "independent" evolution of graphic representation has not been influenced only by circumstantial or random factors, but has been affected by a variety of circumstances. Conceptual, disciplinary and technical issues have had different influences on the graphic process of the representation of planning, leading to several notable qualitative leaps. And these varied influences have been manifested very differently, both in order of importance, and in the effects that these issues have had finally on the drawing of town planning, thus creating a whole process of transformation of graphic representation in which the origin and timing of the changes is as irregular as exciting.

An important aspect must also be clarified. We have seen that there are different views regarding the existence of planning per se and its origin. There is also a variety of opinions concerning the reality of planning prior to the construction of cities. One need only recall the claims of Charles Delfante (Delfante, 2006), or of Juan A. Santamera (Santamera, 2007). So, one can always question whether the available representations of cities, prior to the commonly accepted emergence of urban planning as a discipline, located in time on the borderline between the Renaissance and the Baroque, are actual planning or are rather to do with cartography or even with illustration or painting. They likely breathe a bit of everything, of course. However, it is understood that accurately determining this point is not too important. An act of abstracting and creating as occurs when materializing any graphic representation, must be influenced by pre-existences, and whatever their purpose and origin, their importance cannot be played down.

3. ANCIENT TIMES

Complexity has since early times been one of the components of urban composition. The layouts that can be distinguished in the sparse data available on Hittite cities or on Mesopotamian town planning are proof of this. Data are also meagre referring to the Nile Valley, of which only the "City of Gods" and the "City of the Dead" are conserved due to their greater consideration and respect over the "City of Men", in which the materials used for its construction were of poor quality. Of the former two, however, there are remains of their surprising and spectacular renderings that demonstrate their mastery of geometry and

monumental composition using esplanades and avenues. Contemporaneously, in the valley of the Indus river, cities are built that show great refinement in the urban planning procedures that were quite unusual at the time: water piped to dwellings, a complex sewer system beneath the main streets, etc.

Egyptian cities are organized around a central avenue, while the Mesopotamian ones are fortified and built on raised areas. Their plan tends towards geometric regularity, with rectangular "apples" or blocks and straight, narrow streets that intersect at right angles. The cities of Mesopotamia are organized around a fortified castle, which is the highest point in the city. Their military function is always present. The rest of the city is quite uneven, with houses made of mud and wood. Despite their irregularity, they do not lack a processional avenue that connects the main gate with the palace, which gives it a monumental air. The cities of Crete are precursors of the Greek ones. They are not fortified, since their insularity provides sufficient protection. However, Peloponnesian cities do have walls. These cities feature a central square where public life takes place. The classic city, however, is most diverse. We refer to Greek and Roman cities. As in all cities, their form and structure depend on the conception that the culture that creates them has of the urban environment. Despite everything, they tend towards geometric regularity, often orthogonal, which appears previously in Harappa and Mohenjo-Daro -cities of an ancient civilization of the Indus Valley (2000 BC).

But it is in the Greek cities that the city reaches its maximum development in classical times. The Greek city-state, the polis, usually has an orthogonal plan that is more regular the more organized it is. It had buildings and public places where people gathered and where democracy was organized and philosophy arose. These places are the temples, the agora and the market. It was also necessary to build administrative and recreational buildings, such as theatres and stadiums. The typical plan is that applied by Hippodamus of Miletus, with whom Aristotle credited the legacy of the doctrine of the logical distribution of the city, and he is generally recognized as the "father" of urban planning and the inventor of the grid. Hippodamus introduced urban planning based on wide streets that intersected at right angles. He proposed the organization of the polis according to numerical relationships in search of symmetry. Logic, clarity and simplicity prevailed in his designs. It is impossible not to relate Hippodamus' concept of architecture with the thinking of his time: the plan in the form of a chessboard reflects the logical and mathematical divisions with which the philosophers/architects of the fifth century BC sought to reflect the ideal society. See **Fig. 2**, the map of the city of Miletus, produced by B. F. Weber and A. Von Gerkan. In this case, the aforementioned map is useful to observe the planning designed by Hippodamus, however, it should be pointed out that it has no special scientific relevance as a plan of a certain era.

The Greeks built colonies in different parts of the Mediterranean, and for the newly built constructions of a city such plans were very helpful. Cities such as Miletus, Athens, Sparta, etc. are of this type, modified only by the topography. Whenever possible, the plan is oriented north-south, so that all dwellings have a south-facing façade.

Roman cities were the centre of culture, politics and economics of the time, where the judicial, administrative and fiscal systems were based. It is important to note that the Roman Empire was, unlike others, a fundamentally urban empire. Roman cities were connected by wide roads that allowed the rapid movement of armies, merchants' caravans and post.

New cities were founded always starting from a basic structure of an orthogonal network with two main streets, the "cardo" and the "decumano", that intersected in the economic and social centre of the city, the forum, around which temples, monuments and public buildings are erected. It also housed most of the shops and commercial sites, turning the forum into an obligatory stop-off point for anyone visiting the city. Interestingly, this strict urban planning, an example Roman order, was never applied in Rome itself, a city that arose long before the empire and whose structure was already somewhat messy. The splendour of imperial power led to its rapid growth with the arrival of many new immigrants to the city in search of their fortune.

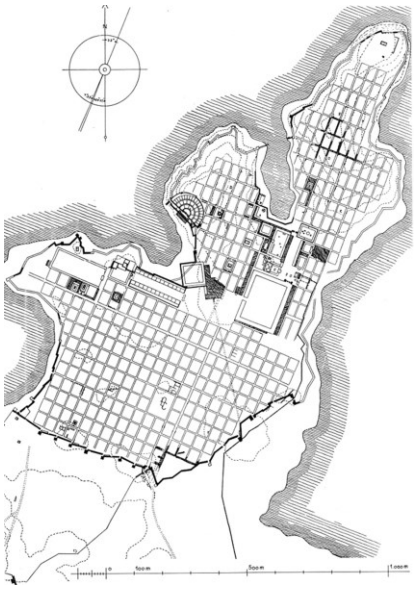

Fig. 2 Reproduction of the urban plan of the city of Miletus, designed by Hippodamus. Drawing by B. F. Weber of 1989 on sketches by A. Von Gerkan of1922 (Galantay, 1997: p.17).

Rome was never able properly to digest its greatness, accentuating yet further the chaos and disorganization. Fortune, however, brought about the burning down of the imperial capital in 64 AD, during the reign of Nero. The reconstruction of the different districts was conducted in accordance with a master plan designed on the basis of straight, wide streets and large parks, which allowed greatly increasing the city's conditions of hygiene. The ancient Romans were excellent engineers and architects, of this there is no doubt, and they were also well aware of the importance of good urban planning. Naturally, to achieve proper control of Rome they required plans and maps. Most of them have been lost, mainly because they were made on perishable materials, but here you have a marvel in the form of a stone puzzle that can be regarded as a gigantic plan of ancient Rome. This plan is fragmented into a multitude of pieces of stone, which complicates its reconstruction, small pieces of a plan showing all of the city's streets and houses in detail.

Around the sixteenth century the remains of the gigantic plan appeared, called "Forma Urbis Romae", composed of more than a thousand pieces that once made up an enormous map. Originally its size was 13 metres by 18 metres, cut in 150 marble slabs that were placed on a wall of the Temple of Peace. The scale of the map is approximately 1:240, with north facing downwards, showing in great detail each storey of each temple, spas, "insulae", etc. of the city of Rome in the third century AD. Many of the buildings also bear their name engraved, making the map an exceptional document (**Fig. 3**).

For centuries cities were represented based on drawings and prints used as artistic presentations and geographic studies without any special pretension involving the discipline of planning as we understand it today. Instead, the "Forma Urbis Romae" map now suggests, without a doubt, a certain urban and architectural conception when realizing the representation of the city. The plan, however, was destroyed during the Middle Ages, and the marble slabs of which it consisted were reused as building materials and to make lime, so that today, only small pieces of the map are conserved -around 10 percent of the total-, broken into more than a thousand pieces that have been recovered from the area since 1562.

It is probably one of the first graphic references we have of a floor plan of a city, represented with urban planning and graphic criteria that remain in force today.

Fig. 3 Fragment of marble from the "Forma Urbis Romae" map (Stanford University, 2013).

4. THE MIDDLE AGES

If With the advent of the crisis of the third century, and particularly in the late Christian empire, the security enjoyed by Roman cities for some time had disappeared. Many of them, especially those closest to the borders harassed by Germanic peoples, were forced to wall themselves in and shut themselves off in fortifications, sacrificing quality of life in exchange for security. It was a step backwards that would result in the demise of the western empire, ruralization, the end of trade activities, and the birth of medieval castles.

The walls can be considered to have constituted the foundational element of the medieval city. In addition to providing the defence of the town, they marked its territorial and jurisdictional boundaries. They also established the boundaries of the taxation system, both the commercial and the municipal. The walls could accomplish a mission as an element of social or ethnic division within the town. Thus, as can be seen in **fig. 4**, most of the representations of cities of that era give preferential value to their walls.

Fig. 4 Konstanz (Germany) in 1493, engraving by the German Hartmann Schedel (1440-1514). The Hebrew University of Jerusalem & The Jewish National & University Library.

The intention of the medieval cities is not to be irregular, so we can find various types of basic plans: circular, linear, orthogonal, etc., and generally adapted to the topography around a castle. With the passage of time and urban clogging, the servitude of the inner roads and the different initial structure and organization of each nucleus form an irregular city. The walls establish the limits of the town, but do not prevent its growth.

The new fortifications slowly incorporated the neighbourhoods and streets that were previously outside their boundaries. The nuclei that surpassed the walls forced the construction of other larger and more extensive walls to include them. Moreover, in many cases the old walls were destroyed, raising streets with a curious and distinctive layout in their place. Christian cities were not too big, with some 15,000 inhabitants, and they were not greatly cut off from the country, as many of their inhabitants were engaged in farming activities. With the walls appeared the extramural suburbs, at some distance so as not to hinder the defence of the city.

In any case, to this day there are no sufficiently significant drawings of cities that date from medieval times. Naturally, there are sufficient references of what cities were like in the early Middle Ages thanks mainly to the drawings and engravings of the fifteenth and sixteenth centuries, i.e. the Renaissance period. Now, during the Middle Ages, graphic and artistic concerns were heading in other directions, and they were not precisely to represent the towns and cities. In any case, buildings and cities appear as complementary elements of historical or mythical motifs that are represented graphically using various techniques and media. Examples of such representations can naturally be seen in samples of Romanesque and Gothic art.

5. FROM RENAISSANCE TO BAROQUE

Giambattista Nolli's map of Rome and the plan of Imola by Leonardo da Vinci are good examples of drawings of spatial representation rendered in graphic and conceptual terms that are common to our times, but that were quite innovative at the time of their realization. In those times, few people were accustomed to relating the information from a floor plan with the information they knew existed in the real world. And even today many people are not entirely comfortable with the graphic convention of maps or plan views. People were accustomed to images of the city showing squares, churches, obelisks, columns and other relevant references to orient them without difficulty.

It is clear that the plans of cities must always simplify the reality and are not intended to show all the available information. However, they must contain the minimum information unambiguously. This allows the observer to precisely and properly read the reality the plan seeks to express. The public at that time was accustomed to bird's eye images (**Fig. 5**) that showed the significant buildings and the most important structures.

In this regard, the map of Imola by Leonardo (**Fig. 6**) is a new addition to the graphic representation of the urban world. Leonardo created a map of Cesare Borgia's fortress, a town plan of Imola in order to win his patronage. When he presented it to Cesare, the latter was greatly surprised. People at that time were beginning to hear about maps and very few had seen one. In those days, "no one, but God, could see a city from above, thus a floor plan of a city could not in any way correspond to the human experience of the time" (Bosselmann, 1998). It proved to be a fascinating idea and a clear demonstration of Renaissance thought, the ability to think abstractly, and reasoning. It should be emphasized, however, that his work was conceived as a tool to evaluate and plan the fortifications of the city. It was a plan intended for expert readers and not for the general public. So, few of Leonardo's contemporaries came to understand his plan of Imola. This new convention to represent the city was scarcely used.

Fig. 5 "Pianta di Roma", a work by Alessandro Strozzi. Map from 1474 -quill on parchment. Medicea Laurenziana Library – Florence- (Masetti, 2010: p.31-34).

Fig. 6 Plan of Imola by Leonardo da Vinci in 1502, commissioned by Cesare Borgia. Watercolour and pencil on paper. Royal Library, Windsor Castle. (University of Seville, 2013).

In fact, during the sixteenth century, the increasingly accurate bird's eye representations of cities by the French and German schools of geographers were imposed (**Fig. 7**). These drawings had a key advantage. The representations were understood by both specialists and the general public. Now, it should also be considered that their dissemination was particularly restricted due to the difficulties and costs of printing, and also their especially limited demand. We should add, however, that this model of representation was implemented until well into the nineteenth century, although, as of the seventeenth century, sharing space with other representations more closely related to the discipline of urban planning.

Fig. 7 Aachen (Germany) in 1572. Illustration belonging to the first volume of the atlas "Civitates Orbis Terrarum" published in Cologne (Germany) in the same year, by Georg Braun (1541-1622) and Franz Hogenberg (1535-1590). The Hebrew University of Jerusalem & The Jewish National & University Library.

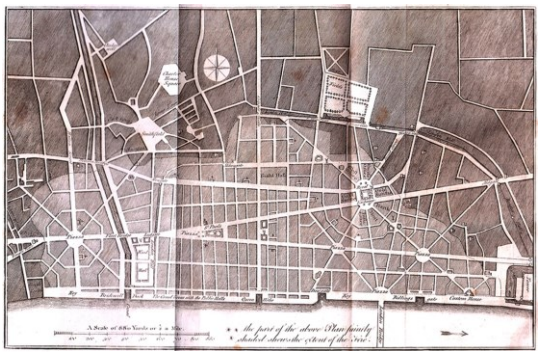

Fig. 8 London Plan of 1666, designed by English architect Christopher Wren. Royal Library, Windsor Castle (Reams, 2013).

Among other examples would also be the urban design of the London Plan (1666) by the English architect Christopher Wren (**Fig. 8**) and the streets of Mannheim and Karlsruhe, in Germany. The ideal London plan, designed by Christopher Wren (1632-1723), sought to influence the open nature, articulating the city around large transversal roads. The main one linked St. Paul's Cathedral, a religious centre, with the Royal Exchange, the economic centre. Radial systems and a grid were created linking the centre with the commercial sector located beside the river. Its practical nature did not impede the realization of great outlooks and the individuality of the nodes of the streets with the construction of 51 churches, veritable "monumental architectures".

These designs of Renaissance urban planning were used in the Spanish and British cities established in the New World in the sixteenth and seventeenth centuries, as can be seen in Savannah (Georgia), Williamsburg (Virginia), Caracas (**Fig. 9**), in Venezuela, and Lima (**Fig. 10**), in Peru. The almost immediate arrival of the first viceroy of New Spain, Don Antonio de Mendoza in 1535, was crucial for urban planning in the Americas. Mendoza, who had studied the urban planning doctrines of Leon Battista Alberti, Italian Renaissance architect, applied them radically both in Mexico and in Peru, to where he moved in 1550. "The ideal city" during the Renaissance, an open grid that, in the Spanish case opened around a central space or Plaza Mayor (main square), was the model that was applied in Hispanic domains.

Fig. 9 First plan of Caracas made by Governor Don Juan de Pimentel in 1577 and anonymous plan of Caracas of 1775 (Gasparini, 1969: p.38-58).

Fig. 10 Plan of the city of Lima -Peru-. Plan of the year 1750, made by Bellin (Morse, 1971: p. 45)

The Baroque is characterized, therefore, by its eagerness to integrate spaces in a single unit, whether urban or landscape. This period sees the emergence of regulatory plans of what has been called the "capital city". Rome is the prototype capital city. Its urban development had begun, effectively, in times of Julius II, but its greatest organizer was Sixtus V (1585-1590), aided by the architect Doménico Fontana. Its regulation is based on a network of major roads that are articulated around important centres, both buildings and squares. The map of Rome, of the aforementioned Giambattista Nolli, is precisely from the late Baroque. Nolli dedicated his life to documenting the city's architecture and urbanism, where he lived until his death. The result of this work between 1736 until its publication in 1748 was "La Pianta Grande di Roma" (the Great Map of Rome), one of the best designed and most revealing iconographic plans of all times, a true work of art (**Fig. 11**).

Fig. 11 Map of Rome of 1748, by Giambattista Nolli (1701-1756) (Tice and Steiner, 2013).

However, Nolli's map of Rome was a terrible failure economically speaking because he only managed to sell 340 copies of the 1874 that were printed. The general public preferred a more figurative image rather than "spending money on a plan whose main merit was to show the exact dimensions of all parts of the city" (Bosselmann 1998: p. 21). This task that Pope Benedict XIV commissioned to Nolli, aimed to help define accurately the exact boundaries of the 14 traditional "Rioni" or districts of the city. This new, extremely precise representation of the city contrasted conceptually with the old bird's-eye plans. The Nolli map is an iconographic plan of the city, an opposite vision to the perspective bird's eye view, which had until then been the kind of mapping that was done. Giambattista Nolli not only became the first to make an iconographic map, but his map became the model to copy and a benchmark for the maps of cities produced later. The map reproduces the city in impressive detail. Nolli achieved this thanks to new topographical and scientific techniques, meticulous work sketches and engravings done with great thoroughness and rigour that reflect all the data. The Nolli map is the most accurate plan of Rome since ancient times and presents the city, at the peak of the Baroque, with all the cultural and artistic realizations of the papacy.

The historical centre of Rome has changed little in the last 250 years, which makes the Nolli map one of the best sources for understanding and gaining knowledge of the contemporary city. The second half of the twentieth century saw a renewed interest in the map by architects and urban planners, arousing new urban theories that presented a unique model for the study of all cities and their urban patterns. The great importance of the Nolli map lies both in its huge historical significance and in the analysis it performs of the urban form. The map represents some two thousand hectares of densely built city and the surrounding territory. It also identifies nearly two thousand places of cultural importance.

The Nolli map is an extraordinary technical achievement that represents a milestone in the art and science of cartography. Both topographical surveys in the late twentieth century and the most sophisticated satellite images have confirmed the exactitude and accuracy of the Nolli map, with only the slightest margin of error. The Nolli map, on a scale of 1:2900, surpasses most plans made at a later date as regards accuracy, as is the case of the Topographical Map of Rome published by the "Direzione Generale del Censo" in 1866. The plan not only documents the streets, squares and urban spaces of Rome, but Nolli also draws in detail hundreds of interiors of buildings by means of their ground floors. The highly detailed representation of the map guarantees the continuity of its value as a unique

historical document, and gives the observer a glimpse of the former metropolitan centre during one of its most illustrious periods.

This clear representation highlights the public open spaces, representing about one third of the surface area of the city, and the routes between churches, baths and markets. It is a model of a compact Mediterranean city that superimposes the various uses and confirms the close relationship between them. The technique of the Nolli map comes straight from Baroque chalcographic engraving, which perfected the criteria for the use of texture. One of the most precious examples of the use of graphic drawing variables is found in Guarino Guarini's architectural treatise, "Architettura civile" (Guarini, 1737) which appeared in 1734, and of which Nolli must have been aware. Guarini's plans always use unidirectional patterns to fill in walls, and dashes and dots for the projection of vaults. This conventional method is the one used by Nolli in his map: he shades in the areas corresponding to blocks that are built upon, except the interiors of public buildings, for which he uses a darker filling for the floor plan. In this way, he manages to show a volumetric-spatial structure of the city showing a continuing Baroque public space that extends to public and monumental buildings and is not limited to streets and squares.

In fact, it can be seen that during the Baroque and especially in Giambattista Nolli's map, the floor plan representation initiated by Leonardo at Imola is reproduced. Through the power of abstraction, urban planning now starts to be drawn clearly and become a reality. The map of the city can be taken to a workshop or to another city, spread out on a table or hung on a wall, and it can be looked at with other professionals commenting on possible modifications in order to begin to understand and treat the city as a global system. During the Baroque, the city begins to have centres, axes and limits. The streets link up major public spaces, the main roads cross the city connecting gateways, bridges and squares. One can begin to see clearly in the floor plan the hierarchy of spaces of interaction that articulate the city.

6. CONCEPTUAL INFLUENCES

Probably, of all the factors that may have been involved in the transformation of the graphic representation of planning, the ones that have brought about major qualitative leaps forward have been caused by deep conceptual changes in two quite substantially different respects. On the one hand, the transformation that the actual evolution of man and his conception of the city has caused on its planning. And, on the other, the changes and mechanism that the progress of spatial conception and of its systems of representation have caused to graphic representation in many of its fields. The map of Rome on pieces of marble, "Forma Urbis Romae", or some clay slabs with the representation of maps of the ancient city of Nippur in Mesopotamia (1500 AD) are among the oldest pieces available to us that represent the floor plan of a city. This type of representation, conceptually closer to the projection and representation mechanisms used nowadays, was completely obliterated during the Middle Ages.

Romanesque and Gothic art concentrates its efforts on representing far more transcendent matters, and cities, such an earthly object, are not among them. Thus, it is likely that the "darkness" in which man was immersed during the Middle Ages once again brought about this leap backwards, in this case, with regard to the representation of medieval towns and cities. As mentioned above, no significant drawings of cities dating from that period have survived to our age. Of course, we have also seen that there are enough references of what towns and cities were like in the early Middle Ages, thanks

mainly to the drawings and engravings of the fifteenth and sixteenth centuries, i.e. the Renaissance period. Bird's eye view drawings and engravings that showed the significant buildings and the most important structures. These drawings had a key advantage, their representations were understood by both specialists and by the general public.

The map of Imola by Leonardo da Vinci, Giambattista Nolli's map of Rome, and in between, the urban design of the London Plan drafted by English architect Christopher Wren, are the representations that again cause a qualitative leap that reproduce the floor plans of ancient times. However, these plans are a clear example of the thought, the ability to think abstractly, and reasoning of the Renaissance and later, of the Baroque period. The map of Leonardo did not have such a specific character in reference to urban representation, as it showed, in a particularly unusual way at the time, a project to fortify the city. The Nolli map, rendered in the late Baroque, already incorporates the precision of mapping developed especially during the fifteenth and sixteenth centuries; it reinterprets Leonardo's map and develops a complete floor plan of the city of Rome, some 250 years later. In between, Wren's map follows the same patterns of representation, but without causing the sudden conceptual change in the point of view and projection of Leonardo's map, nor achieving the degree of cartographic precision of the Nolli map.

However, Wren's map is genuinely the most urban of all, as it proposes a new arrangement for a portion of the City of London, while Leonardo's plan draws a project of fortifications and Nolli's draws the city of Rome as it is at that time. That is to say, in contrast to Wren's plan, neither Leonardo nor Nolli perform the task of planning the city. In spite of everything, graphically all three represent the first important conceptual leap in the representation of the city, replacing the usual bird's-eye views in perspective and recovering the floor plan.

Someone may consider that this is not so much a conceptual change as a change in method, since the concept itself of the city or of its planning does not change, but the method or system of representation does. However, at the time and in the circumstances in which it occurred, it cannot be considered in any case a simple change in method, and the new vision proposed in the representation of the city is so deep and innovative that we are forced to consider an especially momentous change in the conception of the representation of the city.

7. INSTRUMENTAL INFLUENCES

The influence of what could generically be called instrumental techniques, which include both drafting and drawing techniques -including materials (ink and media) and tools-, and printing and/or reproduction techniques are also especially transcendent in the evolution of the model of representation of planning. The expression "and/or" has been used on purpose in the case of printing and reproduction techniques because in time they have often been so separated as in others so deeply related that in some cases they are the same. If we dispense of the representations in marble or clay that have survived from ancient times, which are indeed historically interesting but of relatively little relevance to the study at hand, we can establish that the first documents that show specific representations of cities and their structure can be found in the engravings of the fifteenth and sixteenth centuries.

As we have seen, they are bird's eye view drawings made with ink or ink and gouache on paper. We know that around the year 1400 paper was beginning to be commonly used in Europe and the graphite pencil did not appear until the mid-sixteenth century, its

manufacture and use not becoming generalized until the mid-eighteenth century. So, ink on paper is the main delineation technique used for drawing cities. If the desire is to add colour, mainly watercolour or gouache are used. However, as we have seen, colour crept into graphic representations purely for figurative and pictorial reasons. During this period, copies or reproductions of drawings were made by simply copying or using various printing techniques.

Advances in paper making and quality and the invention of drawing instruments improved the characteristics of the drawings without altering the basic technique of "paper and ink". Quills of different thicknesses, drawing boards, parallel rules, set squares and brackets, pencils and erasers and different types of compasses were invented or substantially improved during the eighteenth century.

Thus, the improvement of the tools, materials, drawing techniques -projective and descriptive geometry- and cartographic techniques, led to graphic refinement in the representation of the city and its planning that progressed until the mid-nineteenth century. This refinement, however, continues to use paper and ink as the fundamental technique. Copying and reproduction continues to be done by printing.

8. FINAL CONCLUSIONS

Thus, during the study period, it can be seen that the evolutionary process of the graphic representation of planning is especially conditioned by conceptual aspects and not so much by more instrumental aspects, as is the case of the changes in technical drafting, printing and reproduction techniques. Such changes and concepts have been introduced gradually. This continuous incorporation of conceptual and instrumental conditioning factors, though quite confused in time, has established a path that clearly characterizes the drawing and graphic representation of planning and urbanism. And it should be noted that with regard to instrumental factors they are far more significant and decisive in the periods after those reviewed.

In the study, when observing the evolutionary process of the representation of the city and of its planning, "a priori" the model of planning cannot be seen to have had an especially decisive influence in its graphic representation. It is quite clear that, regardless of the model of city projected, the graphic elements and resources that are used to represent it are totally conditioned by the instrumental techniques and by the concept of representation of the period. It is clear that occasionally the model of city represented brings about the use of a specific set of graphic resources, but the resources and how to use them are not always the same. It can also be stated that, according to the scale of representation of the map, the application criteria and the use of various graphic resources are various and several. However, these nuances are not always constant and, and in any case, they can be considered almost irrelevant, especially if these graphic documents are seen from a certain global perspective.

In general, the graphic model remains constant for long periods of the history of urbanism, and is particularly influenced by the instrumental techniques applicable in each of them. Only such personalized considerations as "graphic style" or other trivial ones, like the available means, slightly alter the representation of some of the urban aspects drawn.

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