TeMA

Journal of
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

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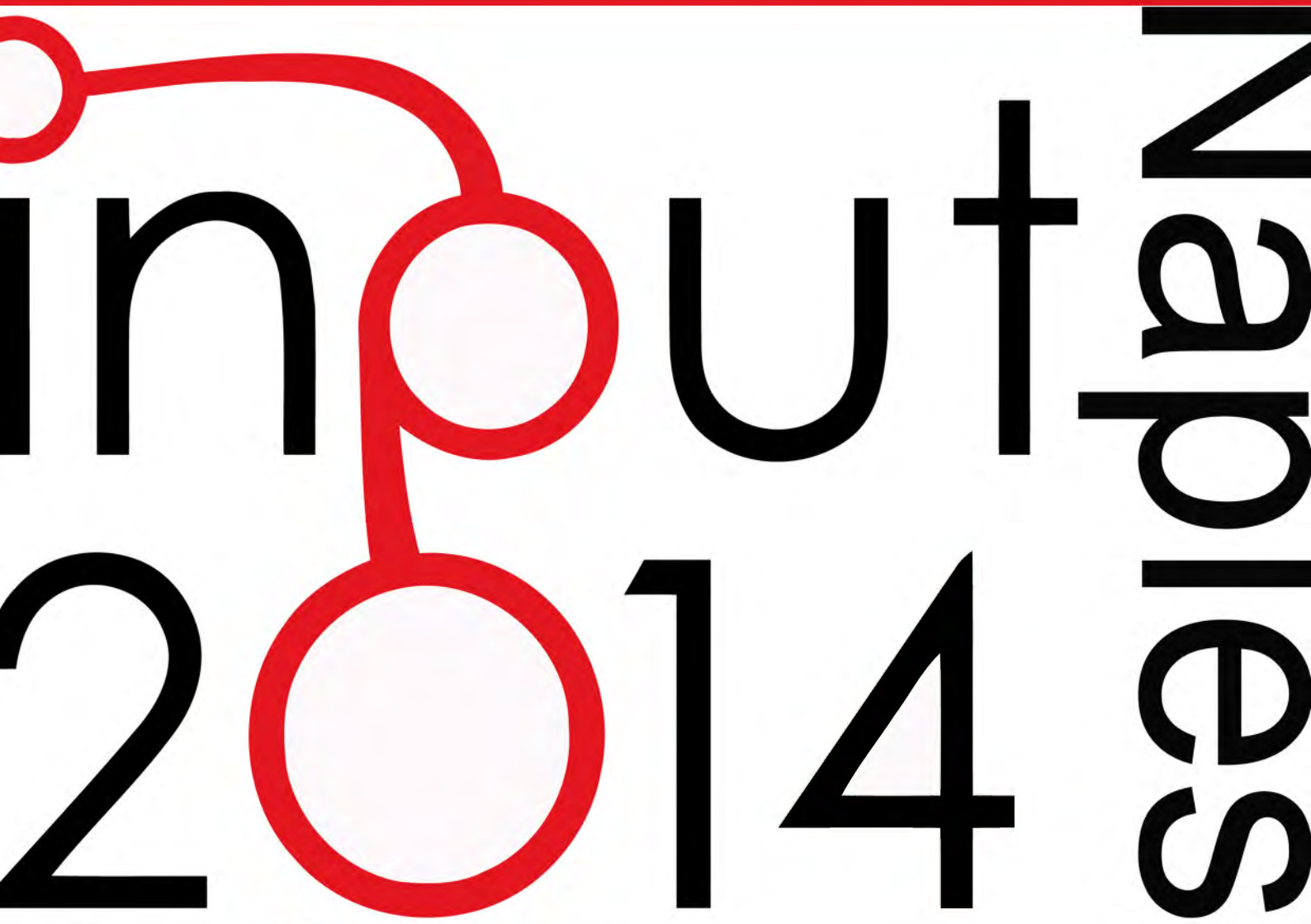

Smart City

planning for energy, transportation and sustainability of the urban system

Special issue, June 2014

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SMART CITY

PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

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TeMA Journal of Land Use, Mobility and Environment

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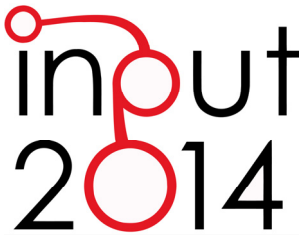
TeMA Journal of Land Use, Mobility and Environment

This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



TeMA Journal of Land Use, Mobility and Environment

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EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website www.input2014.it . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website (www.tema.unina.it). The codex is not present on the pdf version of the papers.

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Eighth International Conference INPUT
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SPATIAL ANALYSIS OF URBAN SQUARES

'SICCOME UMBELLICO AL CORPO DELL'UOMO'

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ABSTRACT

Urban squares, despite their apparently self-evident consistency, actually represent one of the most uncertain issues of present urban planning. Denied and neglected by modern architecture, then sought after in the last decades, squares are commonly recognized as fundamental identity making elements in urban settlements as well as in their respective communities. Since their revival in the late '900, the design of urban squares has been a challenging task for generations of planners and urban designers, since, despite any effort, most of the squares worked out can hardly succeed in competing with the historic ones. What appears to explain the failure of most attempts is the actual uncertainty in the definition of what an urban square really is, or should be: not a mere open space, nor only a pedestrian path, nor necessarily a wide or regular space, nor always a junction of streets. Perhaps all these things together, but also something more, what makes the matter to overcome the limits of a strictly physical vision to approach social and cultural meanings.

The purpose of this research is therefore to investigate around the link between spatial aspects and social issues, so as to identify the spatial features that allow an urban square to actually play a social and cultural role.

As a testing ground of such effort a wide set of Italian squares was assumed as a case studies series, in order to catch the spatial code of their success as relation and public representation places; and some configurational parameters will then be proposed for reproducing such capability, so as to actually support the planning and design of urban squares.

KEYWORDS

Urban squares; spatial analysis; grid configuration

1 INTRODUCTION

"*La piazza principale debba in nel mezzo e centro d'essa città, o più propinqua a quello che si può, essere collocata, siccome umbellico al corpo dell'uomo*"[1]

Francesco di Giorgio Martini, Trattato di Architettura Civile e Militare (1482)

Urban squares, despite their apparently obvious and self-evident consistency, actually represent one of the most uncertain and disputed issues of present urban planning. Central element in traditional urban design (as epitomized by the famous rule by Francesco di Giorgio Martini), denied and neglected by modern architecture, then sought after in the last decades, squares are commonly recognized as fundamental identity making elements in urban settlements as well as in their respective communities. Since their revival in the late '900, the design of urban squares has been a challenging task for generations of planners and urban designers, since, despite any effort, most of the squares worked out can hardly succeed in competing with the historic ones. What appears to explain the failure of most attempts is the actual uncertainty in the definition of what an urban square really is, or should be: not a mere open space, nor only a pedestrian path, nor necessarily a wide or regular space, nor always a junction of streets. Perhaps all these things together, but also something more, what makes the matter to overcome the limits of a strictly physical vision to approach social and cultural meanings.

A square is a public open living space, the meeting and relation space par excellence, where people do meet and gather day by day, so that the term itself gets easily extended to other meanings: in Italian common speaking, "scendere in piazza" (literally "to go down to the square") means to revolt, "aizzare la piazza" (literally "to excite the square") means to arouse riots, "abbandonare la piazza" (literally "to abandon the square") means to get off the public stage, "ascoltare la piazza" (literally "to listen to the square") means to sound out public opinion, "mettere in piazza" (literally "to put into the square") means to publicize and spread news, "rovinare la piazza" (literally "to ruin the square") means to damage one's reputation; and so on, thus demonstrating that in current Italian speaking the square does definitely stand for the people, the physical representation of its community meaning.

The purpose of this research is therefore to investigate around the link between spatial aspect and social issues, so as to identify the spatial features that allow an urban square to actually play a social and cultural role. And the ideal key for such investigation is the configurational approach, in that it focuses on the urban grid and appraises its as the very interface between the physical and perceivable city, made of streets, squares, blocks and buildings, and the phenomena (both material and immaterial) that occur along its paths.

Space Syntax is based on the assumption of the primary role of the urban grid in the making of urban phenomena (Hillier, 1996a); in that it regards the urban space as a "common medium of the physical city and the experiential city as well as of the socio-economic city and the cognitive city" (Hillier, 2005), it will hence the key for searching the spatial features, if any, that make an urban open space suitable for actually working as a meeting and relation place, that is a square.

As a testing ground of such effort a wide set of Italian squares (Piazza San Francesco in Arezzo, Piazza del Popolo in Ascoli Piceno, Piazza della Signoria in Florence, Piazza Grande in Leghorn, Piazza del Duomo in Parma, Piazza della Cisterna and Piazza della Collegiata in San Gimignano, Piazza del Campo in Siena, Piazza San Marco in Venice, Piazza dei Priori in Volterra, among the most renowned ones) was assumed as a case studies series, in order to catch the spatial code of their success as relation and public representation places;

[1] 'The main square must be located just in the middle and centre of the city, or as near as possible, as the navel in human body'.

and some configurational parameters will then be proposed for reproducing such capability, so as to actually support the planning and design of urban squares.

2 BACKGROUNDS

As mentioned above, the configurational approach was assumed as the tool for investigating around the spatial features, if any, which make an urban open space suitable for effectively working as meeting, relation and interaction place, that is a square. What suggested it is the fact that such approach is based on the primary role of the urban grid in the phenomena occurring along its paths, in particular movement distribution and activities location. Roughly speaking, the grid configuration is what actually indicates and suggests the likely distribution of movement flows and hence the pre-condition for the use of urban land (Hillier, 1996b). In order to materialize this relational features, several operational techniques have been so far proposed, experimented and widely discussed; while all those techniques share the same conceptual bases of the configurational approach, as a matter of fact they appear to divide with reference to the specific way each of them indicates for reducing the urban grid (the primary element of urban phenomena, as announced above) into a system, and hence to the spatial elements to be selected, observed and provided with configurational values.

The so-called axial analysis was the first configurational technique to be introduced in 1984 (Hillier, Hanson, 1984), and is still by far the most widely diffused; it reduces the grid into a complex of intersected segment, the axial lines, which compose the so-called axial map, the system to be analyzed. The visibility graph analysis, or VGA, reduces the grid into a system covering it with a mesh of dots, called vertices, in mutual visual relationship, composing the so-called visibility graph. The convex analysis reduces the grid into a system of polygons, called convex spaces. All the configurational techniques are actually aimed at providing each element of the system with a full set of numeric parameters, to be assumed as configurational variables, suitable for reproducing the configurational state of the system. Some of them deserve a particular attention. Connectivity is the configurational equivalent for the notion of degree in graph theory and is the number of elements directly connected to the observed one. Integration is the configurational equivalent for the notion of closeness in graph theory and is the mean depth of the observed element with respect to all the others. Choice is the configurational equivalent for the notion of betweenness in graph theory (Freeman, 1977) and is the frequency of the presence of an element in the shortest paths mutually connecting all the couples of other elements.

While the first one – connectivity – is a local index, in that it is computed taking into account only the observed element and the surrounding ones, integration and choice are global parameters, since they result from the consideration of the whole grid of the settlement. Beside them, which are shared by all the configurational techniques, other more specific parameters were introduced as exclusively referred to some of them; in particular, the so-called clustering coefficient measures the degree to which nodes in a graph tend to cluster together, that is how concentrated the neighbourhood of that node actually is. In VGA, the clustering coefficient of a vertex is the ratio between the number of visual connections within its own isovist and the number of those that could in theory exist. Clustering coefficient hence reproduces the degree of convexity of the isovist of a vertex, or, in other words, its level of intervisibility, that is how many vertices do share the same isovist (Turner et al., 2001).

A large amount of studies and researches has gone discussing and demonstrating the capability of those indices to represent significant urban aspect, and to reproduce and simulate several variables and phenomena. Above all, the integration value, which is by far the most used and significant configurational

parameter, was widely demonstrated as a reliable indicator of urban accessibility; if the notion of accessibility is intended in terms of attractiveness towards activities, and if it is regarded as 'pure' (that is depending on the spatial relationships on the grid and not on the presence of the located activities), the integration value was in fact demonstrated able to reproduce its distribution, and therefore, the distribution of positional appeal (Cutini, 2001). Those results, on the other hand, appear to correspond to the intrinsic meaning of the notion of integration, that is the mean closeness or proximity of an element with respect to all the others. In that integration takes into account the proximity of an element to the others, it materializes its potentiality as a destination point from all the locations. Integration value can be concretely computed either in a global view (taking into account the elements of the whole grid, so as to obtain the global integration) or in a local view (computing only the elements lying in a topologic circle with radius R around the observed one; usually R= 3 and the resulting index is called local integration, or radius 3 integration). Choice value is quite a different matter: in that it takes into account the frequency of the presence of an element in the paths connecting all the others, it materializes the distribution of through movement. In other words, it expresses and measure a different kind of urban centrality, based on movement rather than on proximity: rather than pinpointing an element as an ideal location for activities (as integration), choice indicates and hence narrowly reproduces the distribution of movement, and therefore the optimal location for activities movement-oriented. Connectivity reproduces the spatial potentiality of an urban location as a point of local connections, hence measuring how many locations can be directly reached (or perceived) from a given urban space. In VGA such index is called neighborhood size, as it measures the spatial dimension of the actually perceived urban area from the observed vertex; since the vertices are uniformly scattered within the urban space, the neighborhood size is obviously proportional to the metric dimension of that area.

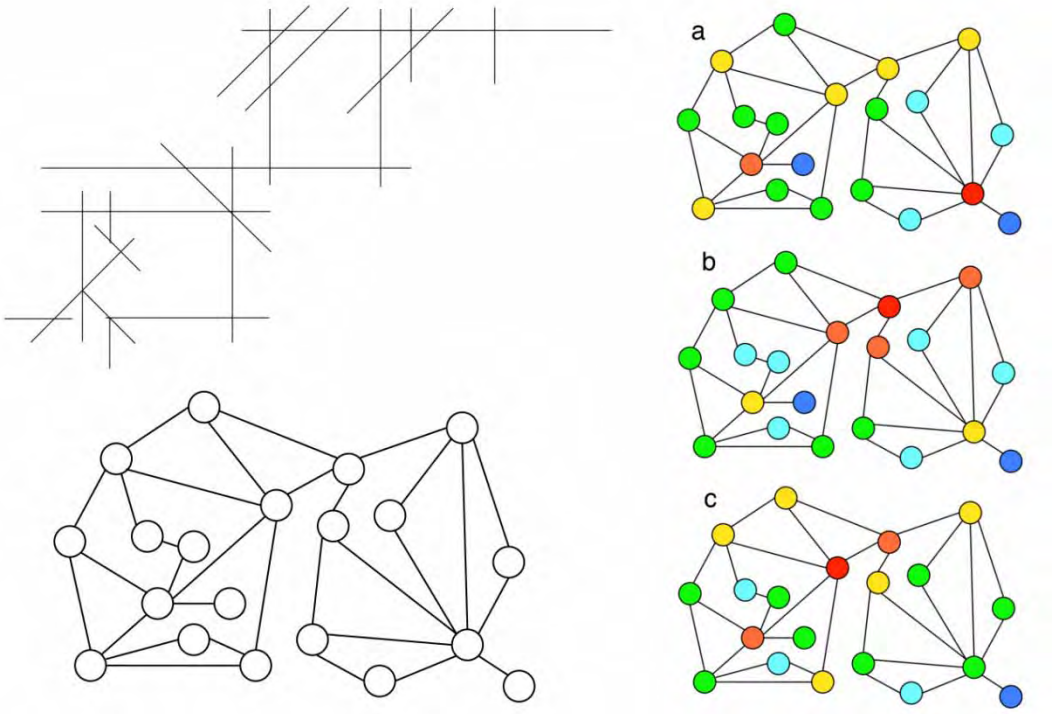

Fig. 1. An example: an axial map (top left) and its correspondent graph (below); on the right, distribution of connectivity (a), choice (b) and integration (c) values in the graph. Warm colours (up to red) stand for high values

Summing all up, and roughly speaking, the three parameters mentioned above (integration, choice and value) can be assumed as different indicators of urban centrality; or, better, they indicate different kinds of

urban centrality, which can even not coexist, how it can be observed in the axial map of figure 1, relationally represented by the graphs on the right: here three different nodes are respectively provided with the highest values of connectivity (a), choice (b) and integration (c), thus materializing the differences discussed so far.

3 GRID CONFIGURATION AND URBAN SQUARES: METHODOLOGY

The common experience of Italian urban settlements points out a specific bi-dimensional element – the piazza – whose presence cannot but be recognised as one of the most prominent elements in the genesis and consistency of urban settlements, so as to be acknowledged in most cases as the very heart of the city. Here the Italian term piazza is deliberately used, since the English translation into 'square' could hardly appear appropriate and satisfactory: in Italy a piazza is not a mere open space, nor a pedestrian path, nor necessarily a wide or regular space, nor always a junction of streets. Probably (or, better, often) all these things together, but also much more. A piazza is a public open living space, the meeting and relation space par excellence, where people gather day by day. Such an important significance is proved by the presence, within each Italian urban settlement, of a main piazza, generally hosting the prominent political, administrative and religious activities and the most frequented public uses and events, so that it is plainly assumed as the heart of the public life of the town. This kind of role is particularly evident in small and medium size towns, where only one place within the settlement stands out with those features.

Although in the following the Italian term will be presented translated into square, we are at pains to advise the reader of its actual intended meaning.

The issue with this research can hence be presented as follows: is it possible to identify the configurational features of a square? Or, in other words, can we find a configurational setting such as to assign an urban open place the functional role of a square? Definitely, can we configurationally recognize a square? As it was shown above, the very reason for applying a configurational approach to the investigation on city squares is the fact that it focuses on the shape of the urban grid and appraises its features as the interface between the physical city - the streets and squares, as well as the blocks and buildings aligned along them - and the phenomena (both material and immaterial) that occur along its paths.

'Paradoxically, the real challenge to our two city paradigms comes not from the well-formed, well-functioning city, but from its - real or apparent - pathology. Where cities seem to go wrong, often as a result of belief-based interventions which come in time to appear mistaken, the problem of one city confronts us with immediacy and urgency by demanding to know if there is any sense in which the physical and spatial form of our interventions has contributed to their apparent failure' (Hillier, Vaughan, 2007). On such regard, urban squares can be seen as an ideal field: squares as relation places are constantly present in urban projects and emphatically highlighted; from renewal urban projects up to the new development plans and even in the far remote shopping mall around the edge of the sprawled city, a square appears as the pivot element of public space. Nonetheless, such planning challenge often are unsuccessful: although aimed at becoming meeting and relation spaces and to catalyze social life, most of the squares worked out in last decades remain lacking in movement, crowd, activities. What arouses the question this research is concerned with: why on this regard the two cities don't match? Or, what prevents the physical city to meet those social, cultural and functional needs? Or even, more specifically: how an urban square ought to be planned and shaped so as to actually comply with the functions it is requested for?

In order to identify the configurational setting suitable for assigning (or recognizing in) an urban open place the functional role of a square, such role, from a social and cultural point of view, ought to be primarily identified. Given the functional role, it will be easier to search for the spatial features suitable for fulfilling it.

Of course an urban square, as a prominent public space of the community, is provided with a whole amount of cultural and social meanings, mainly referred to political or/and religious representativeness, which both the geometric features of the space and the architectural features of the buildings are to assume and materialize and the presence of monuments concur in enhancing; and those meanings and representative role ought not to be ignored or neglected. Nonetheless, the prominence of squares cannot be reduced to the mere architectural relevance of buildings and monuments: outstanding urban squares do actually appear lacking in monuments prominent buildings; as well as outstanding architectures and monuments often can't succeed in making the encompassed space a real and working square. The key factor for squares should hence be elsewhere; and, as far as concrete functions are concerned, and referred to the whole settlement, the matter is mainly relational. Gathering, meeting, interacting: these are the functions and the social purposes of the urban open spaces should be aimed to, so as to be properly called squares; or, better, to effectively be suitable for working as squares. In long-lasting quarrels as well as in several historic essays on city planning, regarding a city as a community house, squares have been commonly defined (and undoubtedly, to a certain extent, are) urban rooms, the public spaces par excellence, where people do gather, do meet and do interact. Even in common speaking, the notion of square is tightly connected with the functions of gathering, meeting and interaction; as a basic example, even in virtual reality, terms as agora or forum clearly evoke and represent the function and place of meeting and interaction that in physical cities an urban square actually materializes.

In configurational terms, gathering means integration, meeting means choice, interacting means connectivity. More in detail, in fact, the potentiality of an urban place so as to favour interaction deals with the richness in its connections, so that that place can be perceived and directly reached from a large amount of other places. The capability of a place to represent a meeting point cannot but deal with the number of the paths actually sharing that place, where therefore they meet and intersect each other, no matter where they come from or go to. The effectiveness of an urban place for gathering people depends on its actual accessibility, that is, in configurational terms, in its integration value: high values of global integration do, in fact, stand for high proximity to all the other places all over the settlement, and hence high attractiveness potential. We can hence assume that squares ought to be provided with concomitant high values of connectivity, choice and global integration, possibly over the respective 90° percentile, so as to be located within the connectivity core, the choice core and the integration core. Yet, something else, more local, should be provided: since an square is a container (of gathered people and their interactions) few local (that is geometric) properties appear necessary: first, for what concerns the physical dimension, a square ought to be capable to encompass people, by and large the whole community, thus requesting some prominent size. This further feature can be exactly reproduced by the mean value of neighborhood size within a convex space. Moreover, for what instead regards its morphology, such container should appear as enclosed as possible, being surrounded and encompassed by some continuous material boundary (walls, buildings); a strong enclosure is then expected to provide squares with a feeling of human-scaled outdoor rooms.

Lastly, as intended at favouring meeting and interaction, the square would be expected convex, thus made by points in direct and mutual visual connection. This last property was well synthesized by the fitting expression of a square as 'luogo degli sguardi (place of glances)' (Portoghesi, 1990), spatial unit where everyone can see (and be seen by) each other and interact with each other. The mean value of clustering coefficient appears suitable for narrowly reproducing this spatial feature, in that it expresses the degree to which the vertices of a convex space share the same isovist, and hence the level of intervisibility they are provided with. Summing all up, we have so far identified three non-local (that is relational) properties and three local (that is geometric) properties, which the configurational techniques appear suitable for

recognizing, appraising and even measuring. For what concerns the operational tool to be used, some discussion on the existing configurational techniques will be here briefly sketched. As it was shown above, the mentioned operational techniques presently survive and are actually used all over the world, suitable for different applications, with different purposes. In particular, axial analysis and visibility graph analysis appear somehow complementary, as their respective pros and cons mutually and symmetrically balance and overcome each other. The main limits of axial analysis are, in fact, its plain indifference to the two-dimensional spaces; what is obviously overcome by the visibility graph analysis. On the contrary, the main faults with VGA are its computational complexity and the lacking of any correspondence between the elements of the system (the vertices) and the physical elements of the urban grid (streets, squares, blocks, etc.). In the matter of the present research, where squares (that is bi-dimensional spaces) are concerned, the convex analysis can hence appear a suitable tool for bridging the gap between axial analysis and VGA: it is obviously bi-dimensional, from a computational view it is even easier than the axial analysis, and its single elements (the convex spaces) actually correspond to material portions of the urban grid; moreover, some of them (the fattest ones) actually correspond to the geometric entities that are generally acknowledged as urban squares. The convex analysis can hence be preciously used in order to determine the non-local configurational properties pointed out above, so as to describe the relational features of the spaces with respect to the whole grid; the local features will then be observed by visibility graph analysis, thus completing at a local scale the configurational state of the selected convex spaces.

4 CASE STUDIES

The method sketched above was applied onto a wide set of urban squares, over twenty cases selected among the most interesting and renowned Italian ones. The short selection that will be briefly presented in this paper goes from ideal cases to real ones. With reference to the matter of urban squares, in fact, an interesting starting point is represented by the well known Renaissance ideal cities respectively drawn by Giorgio Vasari, Bonaiuto Lorini and Vincenzo Scamozzi, here assembled in figure 2.

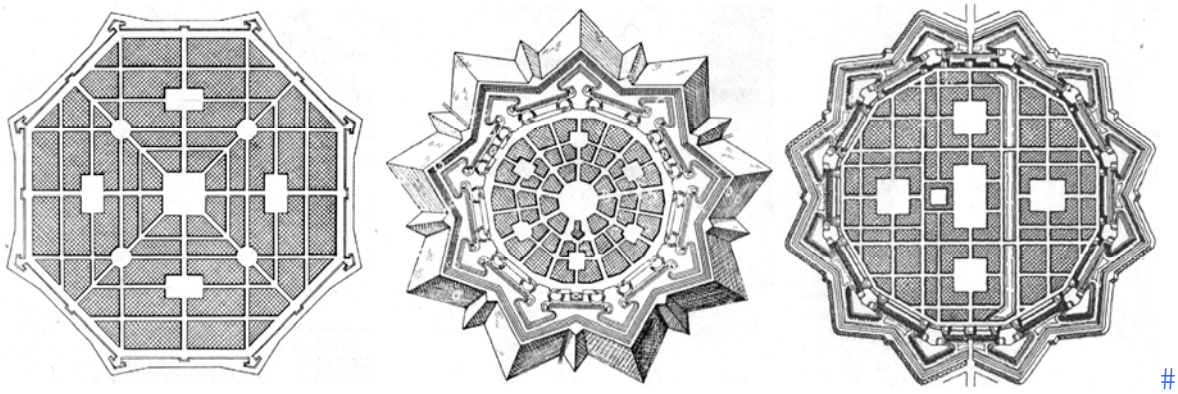

Fig. 2. Ideal cities of the Renaissance: G. Vasari (1570), B. Lorini (1609), V. Scamozzi (1612)

Apart from chronology (all worked out at the turn of the 17th century), those plans share our issue as a key theme, with a main square right in the geometric centre of the settlement and several other squares variously scattered around; their scheme makes hence them ideal cases as referred to the matter of squares. Proceeding from ideal to real, a good intermediate point is Grammichele, planned and actually built in Eastern Sicily after the earthquake of 1693; and also in this case the presence of a clear hierarchy of squares makes it an excellent testing ground of the proposed method.

The further case study is utterly real: it is Siena, whose Middle Age settlement is characterized by the presence of several different squares; among them, the outstanding Piazza del Campo, whose analysis can conveniently conclude the present discussion. The output of the convex analysis of the three ideal cities is here reported in figure 3, showing the distribution of connectivity (a), choice (b), global integration (c) and radius 3 integration (d). Figure 4 then represents the distribution of neighborhood size (a) and clustering coefficient (b) as it results from VGA. In both figures, the chromatic representation uses warm tones for high values and cold colours for low values of the indices.

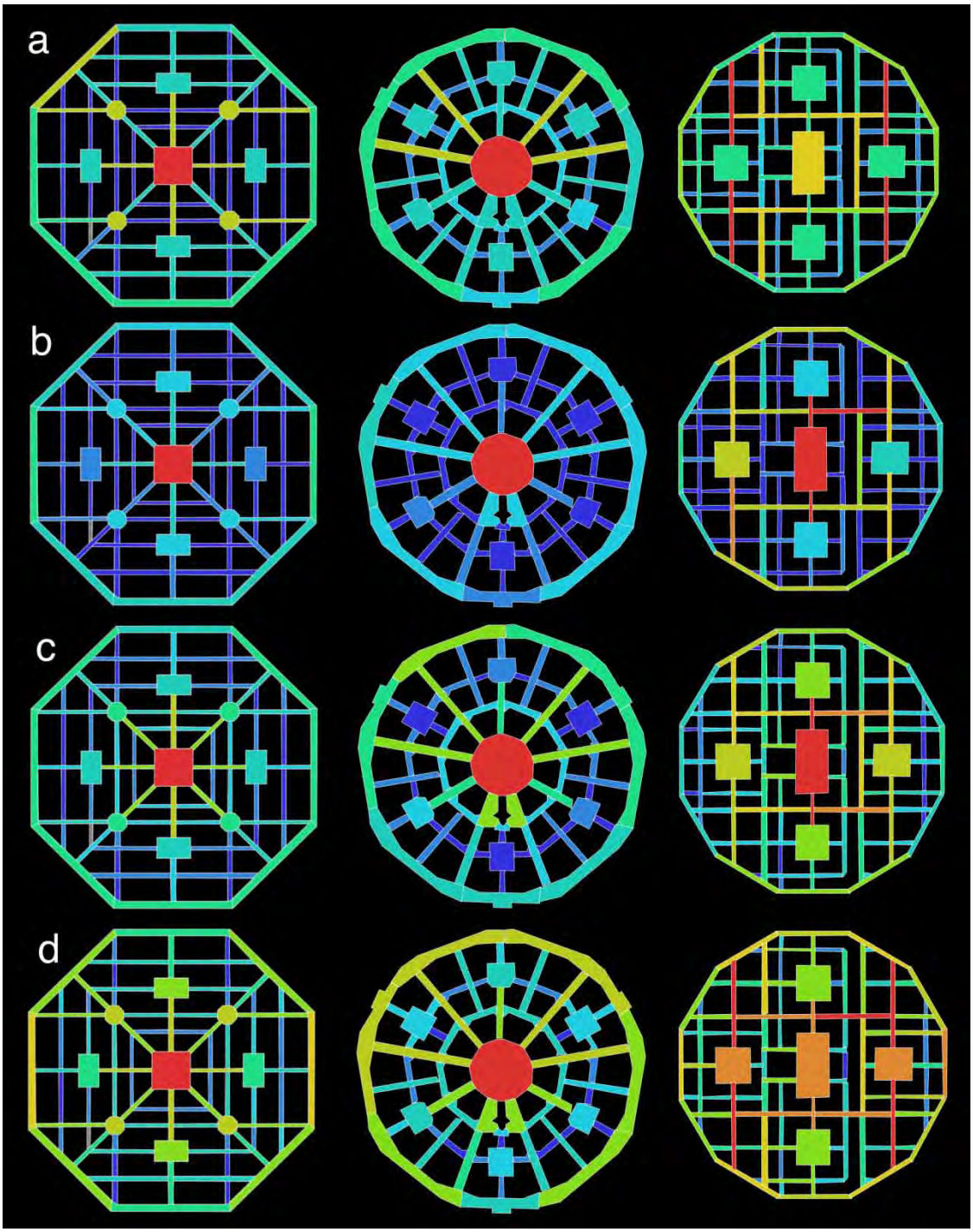

Fig. 3. Distribution of connectivity (a), choice (b), integration (c) and radius 3 integration (d) in the convex maps of the ideal cities of fig.2

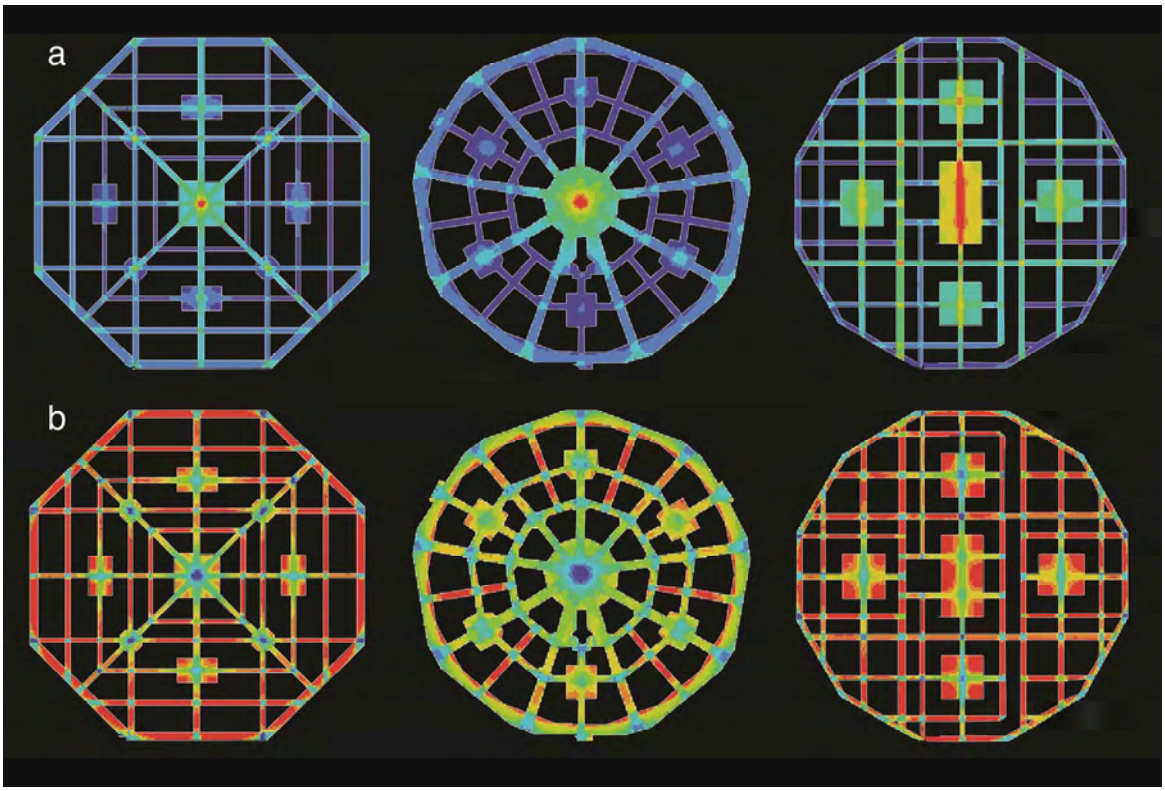

Fig. 4. Distribution of neighbourhood size (a) and clustering coefficient (b) in the visibility graphs of the ideal cities of fig. 2

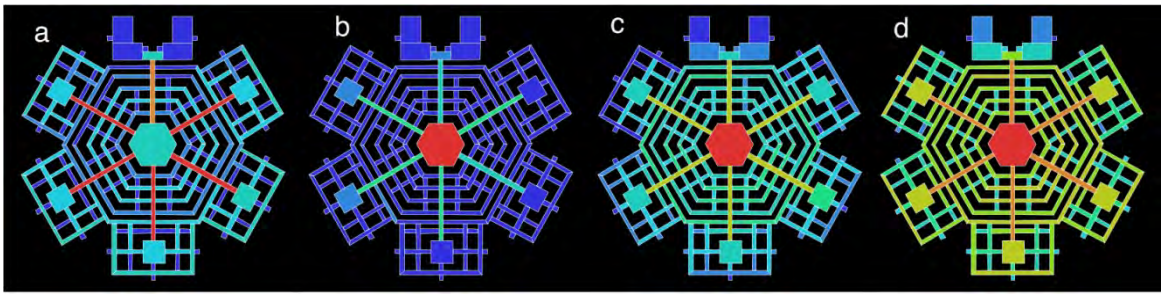

Fig. 5. Distribution of connectivity (a), choice (b), global integration (c) and radius 3 integration (d) in the urban grid of Grammichele

The output of the convex analysis and VGA of Grammichele is here reported in figures 5 and 6, which respectively show the distribution of connectivity (a), choice (b), global integration (c) and radius 3 integration (d), as well as the distribution of neighbourhood size (a) and clustering coefficient (b) resulting from the VGA of the same grids. The results so far appear to reproduce a clear hierarchy of open spaces: a central square, which is central as located into the barycentre and because of its prominent global integration and choice values (in intense red in the maps of figures 3 and 5), surrounded by local squares, to be said local in that globally poorly integrated but provided by good values of radius 3 integration. Such values do actually characterize both the three Renaissance ideal cities (fig. 3) and the real settlement of Grammichele (fig. 5). For what concerns the local properties of those squares, significant values of neighbourhood size and clustering coefficient appear to characterize them (fig. 6), even though the large number of connections squares do request cannot but penalize the clustering coefficient of many vertices of theirs. It could be intriguing to notice that the question of the difficult suiting of connection and enclosure was widely faced and discussed by Camillo Sitte, who proposed and exemplified several morphologic solutions in order to make those two conflicting aspects to co-exist and match (Sitte, 1889).

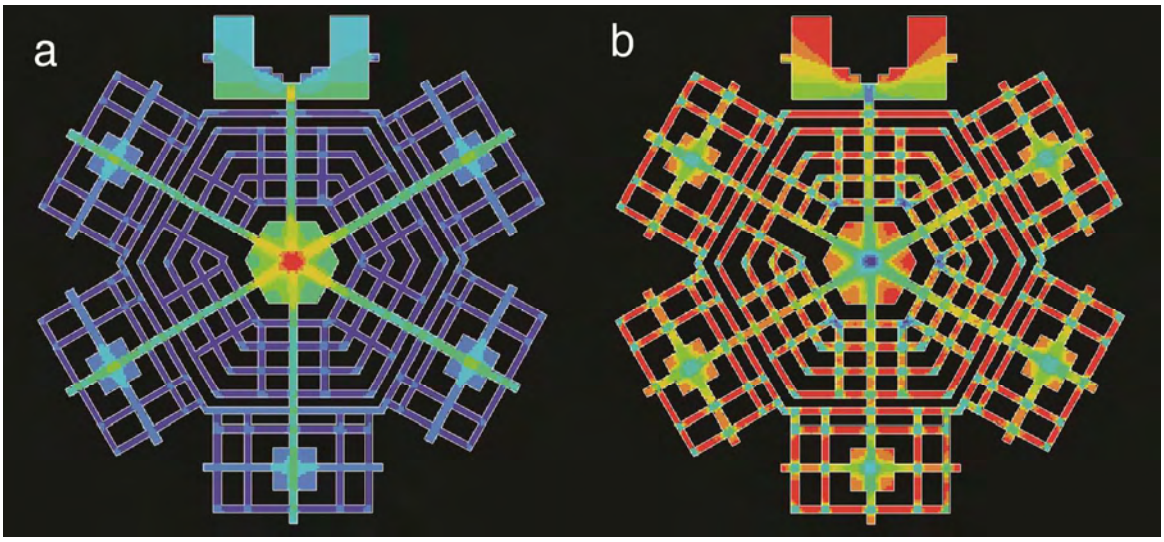

Fig. 6. Distribution of neighbourhood size (a) and clustering coefficient (b) in the urban grid of Grammichele

The configurational analysis of Siena corroborates and extends the findings above. Again a main global square is here highlighted (fig. 7) by integration, choice and connectivity values, pointing out Piazza del Campo as the very central square of the settlement; again only clustering coefficient appears to weaken (fig. 8), due to the large presence of connections the square is provided with. Also in Siena, several secondary squares appear scattered all over the grid, all provided with significant values of radius 3 integration, neighborhood size and clustering coefficient, which attest their relevance as meeting places at a local scale. In order to highlight this features, the table 1 reports the ratio v of the choice value of Piazza del Campo and the maximum frequency it would present, if it were located on all the shortest paths between any couple of the other lines of the system, compared with the main squares of the ideal cities of fig. 2: Piazza del Campo stands on over the 80% of the shortest paths connecting any couple of the other convex spaces of Siena.

	Vasari	Lorini	Scamozzi	Siena
C_h = choice value	2344	1907	1782	40418
N = nr. convex spaces	89	67	102	316
v = C_h / N(N-1)/2	0.60	0.83	0.35	0.81

Table 1. Choice values of the main squares

5 CONCLUSIONS

The results above can be briefly summarized as follows. The selected configurational indices appear suitable to reproduce significant features of wide urban spaces, making hence possible to work out a sort of taxonomy of the convex spaces with regard to their predictable potential as urban squares. The global configurational indices provide information about the position of the element with respect to the whole urban grid, while local parameters add some information about the geometric properties of space: in concrete, integration and choice indicate how the actual (or planned) urban location of a square allows it to intercept and gather crowded movement flows, so as to favour meeting and encounter; neighbourhood size and clustering coefficient – in a way - tell us about its local geometry.

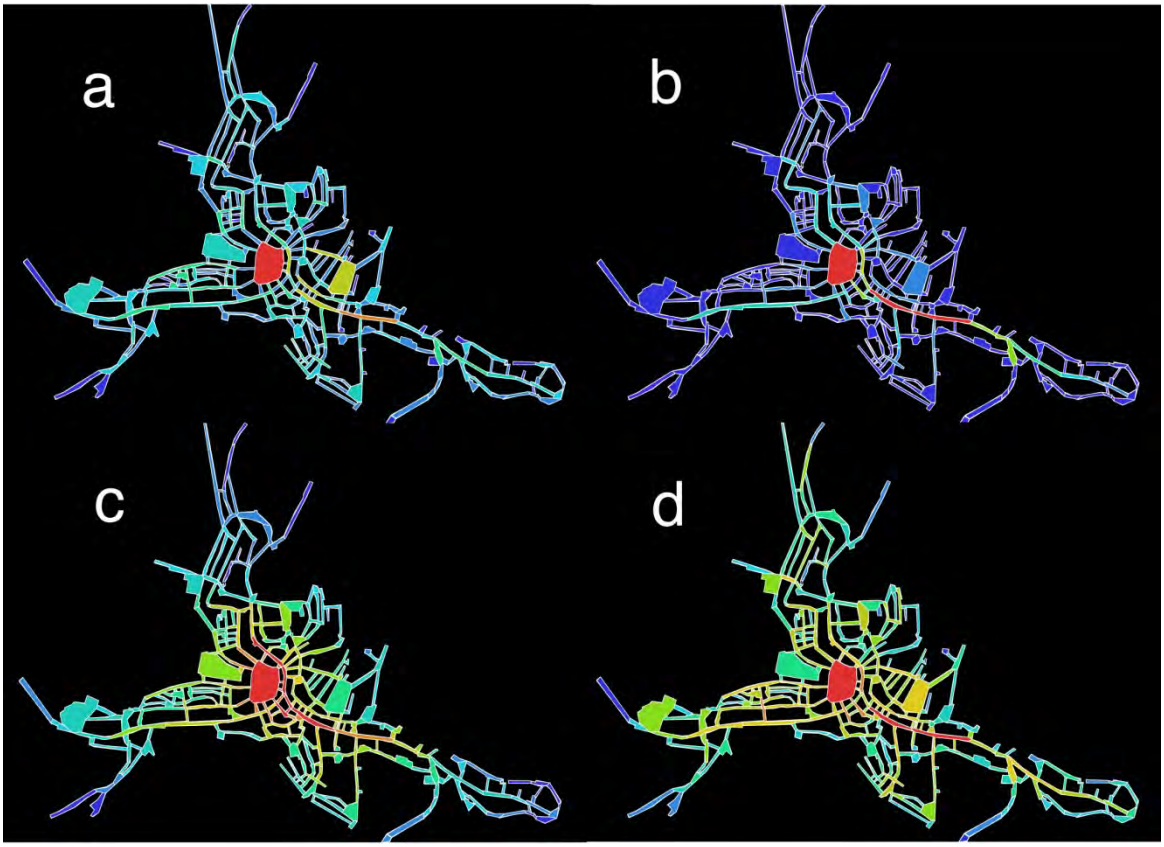

Fig. 7. Distribution of connectivity (a), choice (b), global integration (c) and radius 3 integration (d) in the urban grid of Siena

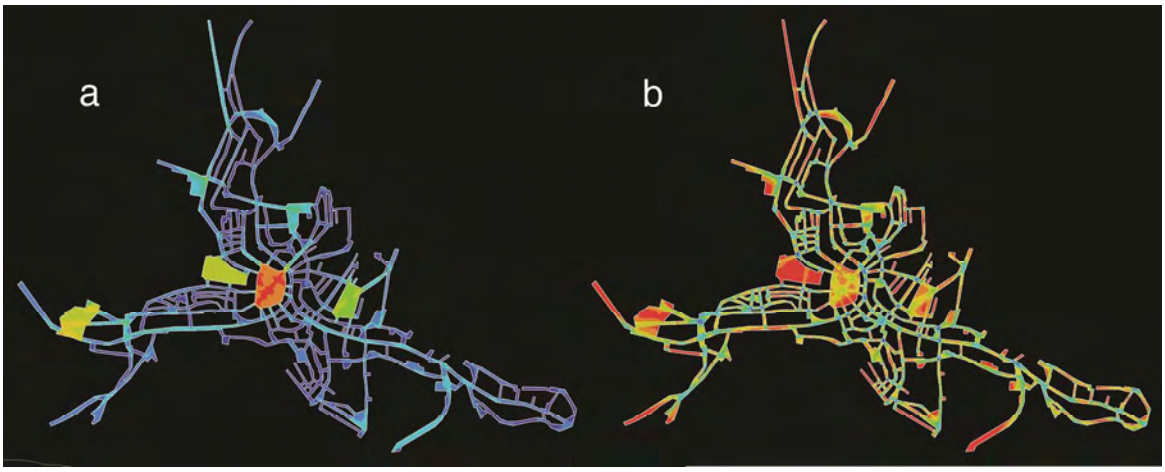

Fig. 8. Distribution of neighbourhood size (a) and clustering coefficient (b) in the urban grid of Siena

As a matter of fact, recurrent configurational values appear to characterize the convex spaces that correspond to the selected urban squares. In all the observed case studies, the main square of the settlement results provided with the highest integration value, and in most of them, also with the highest values of connectivity and choice. The mean value of neighborhood size, resulting from visibility graph analysis, again assigns those places the top of ranking, while in some cases the mean value of clustering coefficient appears to weaken, as a consequence of the large number of converging streets. Some further consideration arises from the observation of so many built urban squares, which, although designed in order to work as meeting and relation spaces, hardly appear achieving such role. On this regard, the results so far

suggest that such failure results from the disregard of the configurational (both global and local) properties such a role actually requires: too fragmentary and indefinite their space, and too far and segregated from the main movement flows in term of their position. Summing up, the local properties of such places are not coherent with their functional role, nor, chiefly, coherently related. The grid of an urban settlement, as its public space, was impressively defined as “a mechanism for generating contact” (Hillier, 1996b); in this mechanism a square does hence represent the place where contact becomes encounter, meeting, interaction; that is to say, it is the natural harbour where people, moving through the urban grid, “passing each other like ships in the night” (Hillier, 1996a), finally pause, meet and gather.

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As a researcher in Town Planning in the University of Pisa, since 1996 Valerio Cutini teaches Urban Planning at the School of Engineering of the University of Pisa. His main interests and studies are in the areas of the analysis of urban settlements, aimed at focusing on their development and the diachronic transformation of their morphology and functional consistency.