



Representation, identity and sustainable design in the urban texture

Cardinale, Tiziana¹ Calia, Marianna²

Keywords: urban morphology; microclimate; sustainability; representation; identity

Abstract In the formative project of the International Doctorate Program in “Architecture and Urban Phenomenology”, the different urban phenomena are investigated at the same time in the composition, historical and representation area. This is the context of our interest in the phenomenology of urban connections that have generated the cities and who have kept intact the uniqueness.

The morphological, spatial and material characteristics of the urban texture, mainly modifying radiative and convective exchanges, determine the specific microclimate of an urban space. The microclimate analysis of an urban texture, defined as a set of connected buildings, streets and squares, is conducted by identifying how and in what way the specific aspects of that part of the texture change the values of climatic variables on a local scale. The physical urban space can be seen as a system that assimilates energy and returns it under other invisible forms that depend on the organization of the space in an environment and by its composition. Generally large urban sites produce local climatic conditions more extreme than those that occur in a non-urbanized one: a greater urban density produces a drier climate, with higher and fluctuating temperatures, with less wind and a higher pollution rate, which reduces solar radiation. The urban morphology, ie the three-dimensional shape of a set of buildings and urban spaces, is crucial in terms of external microclimate and environmental quality. The type of urban form affects very strongly the wind distribution in the urban texture. The size, shape and the proportion of streets, courtyards, squares and gardens affect access to solar radiation and have an indefinite number of specific microclimates, small areas with very different conditions which may be decisive in the heat island urban configuration.

To describe and model the interaction of the urban texture with the energy and climate the following aspects should be considered: location, form factors, physical limitations and natural vegetable components of the system.

The research, on the topics of knowledge for the recovery of memory and identity of the architectural character of a place, started with the analysis and the survey of localized parts of a significant number of case studies located in the South of Italy and in the Mediterranean area and was consolidated with insights into southern and eastern China. The aim was to understand and describe the genesis of architectural types, urban junctions, forms and ways of living, which characterizes these cities and gives life to the complex urban organism.

This work therefore proposes to identify the essential principles, criteria and models for the construction of urban ecolabelling systems, notably by focusing on air and thermal pollution phenomena such as the effects of energy-hungry cities to suggest visions and strategic actions in the refurbishment, preservation, design and planning.

In this way it is possible to bring to the attention of other scholars and researchers, including international one, the contribution of ideas and thoughts that the architectural tradition and the Italian sensibility may provide, for the recovery and conservation of cultural heritage ancient or recent.

1. DiCEM, Unibas, Matera, Italia

2. International PhD, integrated SSD ICAR/14-17-18. Administrative Office: University of Basilicata. Consortia: Faculty of Engineering of Salerno, Escuela Tecnica Superior de Arquitectura de Madrid, Universidade de Lisboa Technology, Hochschule Bremen.

1 The elements of the urban texture and the urban heat island¹

The urban morphology, ie the three-dimensional shape of a set of buildings and urban spaces is crucial in terms of external microclimate. Generally the large urban centers produce local climatic conditions more extreme than those that occur in a non-urbanized one. It can be said that a greater urban density is the origin of a drier climate, with higher and fluctuating temperatures, with less wind and with a higher level of pollution, which reduces solar radiation. The amplitude, the shape and the proportion of roads, courtyards, gardens and squares affect the access to solar radiation and the winds distribution and determine an indefinite number of small areas with very different climatic conditions that can be decisive in the configuration of the urban heat island.

In the literature (Auer 1978, Stewart and Oke 2009) there is a first classification that distinguishes the environment in which the heat island is formed between rural area and urban area. As suggested by Stewart and Oke, two of the greatest experts on the phenomenon, it is more appropriate to base the models of urban expansion on technical and scientific criteria that refer back to thermal considerations to define an Energetic Signature focusing not only on the individual building but also on blocks, neighborhoods, cities and regions. The two researchers focus their interest the study of the LCZ (Local Climate Zones), each of which is characterized by a specific geometry and a particular land use that produces a single surface temperature under a clear sky. The Oke's classification identifies the various *urban climatic zones* (UCZ) also according to the percentage of impermeable surface (buildings, roads, parking), the verticality ratio of urban canyons λ_s (defined as the ratio between the average height of the main roughness elements, such as buildings and trees and the average distance between nearby elements). The area is then studied for its physical and anthropomorphic characteristics and the classes are grouped according to their ability to change wind, temperature and humidity of the climate. Thus there are four landscape subclasses: urban, agricultural, natural and mixed. The urban landscapes have an almost entire impermeable cover of the surface and high-rise buildings, the agricultural landscapes are disturbed by growing crops and by different techniques of land use and, finally, natural landscapes keep their original footprints.

With reference to the micro-scale level, by dividing the subclasses according to their surface properties and overlapping the layers, it is possible to classify the territory according to twenty *Thermal Climatic Zones*, which are defined as local scale areas with an aerial temperature relatively homogeneous in the thermal cover layer (*Canopy Layer*). In order to investigate the relationship between urban heat island and urban shape you have to observe and compare the urban features that characterize the different parts of a city, that you can match to several families of urban macro textures. The term "urban texture" means a territorial, planning and constructive organization, which has homogeneous characteristics from the point of view of the historical transformation and of the formal and dimensional relationship between public and private spaces. From this definition, different types of urban textures, classified and analyzed according to the urban issues mentioned above, were considered for the city of Bari, which has a typical Mediterranean climate. The identification process of these areas has followed a simplification and a generalization in order to bring out the salient features of each of them and allowed to identify five major categories in the city (*Thermal Climatic Zones*, Stewart and Oke, 2008) in which you can aggregate the urban textures studied (*Modern Core, Old Core Blocks Shore*) and which are then characterizable from the thermal point of view.

Looking at the development of the city of Bari you can first identify a compact and intricate texture that characterizes the old town, where roads and buildings are inseparable and are gathered around the landmark buildings of ecclesiastical, political and economic power (the San Nicola's Basilica, the San Sabino's Cathedral, Ferrarese's Square, Mercantile Square). The coast

¹ Paragraph written by Tiziana Cardinale. Building Engineer and Architect, international PhD Student in "Architecture and Urban Phenomenology" University of Basilicata. DiCEM (Department of European Cultures and the Mediterranean. Architecture, Environment, Cultural Heritage). Matera.

is a natural component with which the city and its shape interact more and constitutes the so-called mixed area characterized by the presence of coast, sea and artificial elements such as ports and waterfronts (*Shore*).

The historical center has a verticality ratio equal to 3 and for this reason and for the period of construction, it corresponds to the *Old Core*. Close to the old town there is the so-called Borgo Murattiano, of nineteenth-century edification, characterized by a geometric and a regular mesh and marked by some axes of functional relevance, such as Vittorio Emanuele's main street, Sparano's street, and Cavour's Main Street. The Murat district is constantly subject to intense road traffic caused by private and public vehicles. The verticality ratio of the urban canyons is around a value of 1.5 and makes the whole texture comparable to that of the *Modern Core*. It is clear the almost total absence of organized green spaces, whose quantitative presence is not even enough to meet the regulatory standards. The main environmental centralities are Garibaldi's Square, the Picone's Lama and the Valenzano torrent that may increase the currents intensity and facilitate the lowering of the temperature gradient along the central part of the city. For the rest there are only small size trees along the De Rossi and Putignani's street, but they do not provide any mitigation to the urban microclimate. Another important structuring axis of the urban texture is Capruzzi's street that marks, together with the station strip, the boundary between the continuous geometry of the Murat chessboard that consists of blocks of the same shape and the city that begins to expand with no limits in the Bari plain. The contemporary city is dominated by the logic of the addition to the parties and extends itself in a radial structure, which starts from the discontinuity line represented by the station strip and expands itself reaching the municipalities and the neighboring villages that today often become cities in the cities. There aren't green areas, with the exception of 2 Giugno Largo and one in the Poggiofranco district between De Laurentis' street and Giulio Petroni's street, in any case with a total area of little importance compared to the municipal area (Fig. 1).

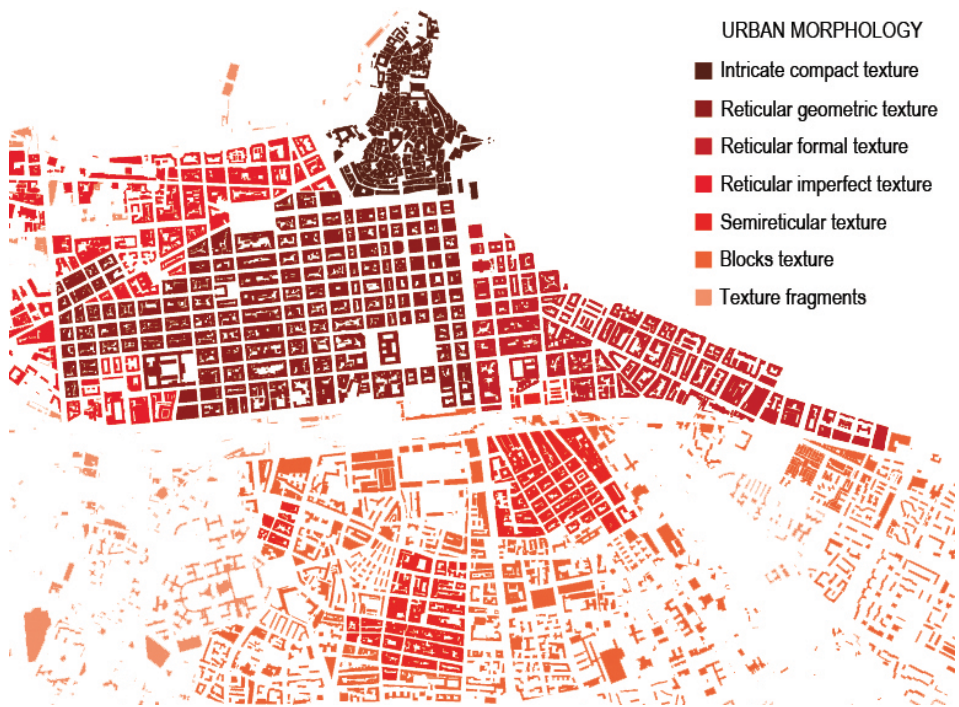


Fig. 1 The urban texture in the city of Bari (Apulia, Italy)

The consolidated forms of the historic town, with its characteristic medieval system and the regularity of the reticular module with its ordered and monotonous texture, give way to open shapes organized in individual subdivisions independently from the other parts of the city, to composite and organic textures structured along the radial primary and secondary urban roads of which relevant examples are Caldarola’s street, Amendola’s street, De Gasperi’s main street, Petroni’s street. Textures fragments expand themselves throughout the city, making more and more uncertain the boundary between city and countryside. This part of the city show generally a verticality ratio between 0.75 and 1.55 (Tab.1).

	λ_p (%)	λ_v (%)	λ_I (%)	λ_s (m/m)	Ap_c (sqm)	Ap_{tot} (sqm)	Ap_{veg} (sqm)	Ap_{imp} (sqm)	W_x (sqm)
Intricate compact	46	11	43	3	150428	327402	36145	140829	4,2
Reticular geometric	55	3	42	1,5	660622	1194935	35660	498652	14
Reticular formal	43	5	52	1,25	323970	747129	33392	389767	13,4
Reticular imperfect	36	8	56	1,18	354461	971703	74178	543064	14,1
Semireticular	57	0	43	1,55	131889	230110	0	98221	10,3
Blocks	16	28	56	0,75	148940	935034	264420	521674	23,1
λ_p = covered area/total area λ_v = green area/total area λ_I = impermeable area /total area λ_s = verticality ratio of urban canyon					Ap_c = building area Ap_{tot} = total area Ap_{veg} = green area Ap_{imp} = impermeable area W_x = characteristic width of urban canyon				

Tab.1 Morfologic and climatic parameters for the urban texture of Bari

Through the systematization of all the collected information is possible to identify the areas in which urban heat island has greater or lesser entity. Moreover, thanks to the recent development of bioclimatic design tools, you can treat in a concise and simplified way the main aspects that characterize the microclimatic behavior of the urban textures considering simultaneously location, shape, physical limitations and vegetal and natural components of the system. For this reason, some experimentations were conducted with the software ENVI-Met in selected areas in three representative districts of the urban typology of the city of Bari: the Old Town (Compact intricate texture), the Borgo Murattiano (reticular geometric texture) and the Japigia district (blocks textures), in order to understand the impact of the parameters listed above on comfort and the urban heat island. A first consideration regards the highest temperature ever recorded in Japigia due to the increased insolation, the large space between the buildings and the large percentage of impermeable surfaces; despite the less insolation in the Old Town compared to the Borgo Murattiano there are higher temperatures because of the higher verticality ratio and the hot air which tends to stagnate in the narrow urban canyons ("thermal trap effect"). The greater heating is fortunately partially limited thanks to the fact that, unlike the rest of the city, the materials with which the historical center is built have a predominantly light-coloured gradation that allows high rates of reflexivity. During the hours when minimal or no insolation does not affect the results, you have the lowest temperature in Japigia, thanks to a greater air circulation for the presence of larger spaces and for the evapotranspiration of vegetation that favors the air cooling.

2 Represent the complexity²

2.1 Identity of traditional heritage and architecture of Mediterranean cities

Consider the urban environment as a whole, in its dimension historical-social and geographical-environmental, include the special “ways of living” in a design common to many civilizations, is a necessary condition for a critical reading and understanding of the complex urban phenomena under study. One of the problems of modern expansion of city centers is a phenomenon that is generating the end of crossing spaces such as streets, roads, canals, squares, courtyards, open spaces, that lose their connection function and generate empty neutral spaces without name and quality. Often, today, the tireless pursuit of technical skills and extreme solutions leading architects to lose the feeling of being able to recognize and enhance identity and memory of the cities that they manipulate. In contrast to this way of working, is playing an increasingly important role the theme of enhancement and renewal of places where it is layered history of ancient civilizations. The current situation, in my opinion, could regenerate into qualified and sustainable forms, if only it were properly understood in its mode of growth, aggregation and adaptation, social as well as environmental.

Almost always the cities under study are subject to extreme weather events, to which men have known how to adapt to survive over the centuries. This is the case of the oases of the Western Desert of Sahara, of the city of Petra in Jordan, of Tunisia, but also of the historical centers built along the “*Gravina*” of “*Murgia*”, such as Gravina, Laterza, Ginosa, Castellaneta and Matera or as houses carved in Loess Plateau in China. Within an accurate list of case studies, such as Santorini in Greece, Ksar and Matmata in Tunisia, Cuenca and Ronda in Spain and Massafra and Gravina in Puglia, the case of the city of Matera is considered as evidence of a way of living and relating to the environment in which natural caves, underground architecture, tanks, fences, farms, churches and palaces, succeeded one another and coexist, excavated or built into the tufa of the “*Gravine*”. Walking through the narrow and winding streets characteristics of the centers analyzed, you will come across often in *cul de saq*, small squares that make up the limit and the filter between the city and the domestic space. In the case of Matera they are the “urban rooms”³, which in Altamura become “cloisters,” in Gravina “neighborhood unit” in Dakhla “*darb*” in Beijing “*hutong*” and Shanghai “*longdang*”. This aspect of closing is typical in areas with a hot and arid climate like that of most of the city overlooking the Mediterranean Basin, or hot and humid as the plateau of the Loess in China, and that therefore they need to protect themselves, but at the same time to create a unique identity. The climatic significance of these narrow and winding passages and of open spaces that create areas of social exchanges, providing air circulation and the generation of shadows, is clear. In the oases of the Sahara Desert, it is common to use cooling devices integrated in the architecture of the city, called “chimneys of the wind”. Such devices, seamlessly integrated with materials, forms and colors of the built environment, are used both for cooling of roads and urban places, both in private homes.

We need to start from the rich memories of the past, to see how the successive transformations in the climate and landscape, together with the drastic changes in the social organization of populations, are reflected in the evolution of architectural artifacts. The research was conducted with the establishment of a graphic and photographic repertoire, which can

² Paragraph written by Marianna Calia. Architect, international PhD in “Architecture and Urban Phenomenology” University of Basilicata. DiCEM (Department of European Cultures and the Mediterranean. Architecture, Environment, Cultural Heritage). Matera.

³ The word “camera” indicates that it is in the open spaces, which constitute a room in addition to the closed and covered of the surrounding housing. «They are “*Camere Urbane*”, theater of contamination between public and private sectors, not only squares, streets and alleys, but also those snippets in the urban space, numerous, often extended, almost always bumpy, that cannot find a precise correspondence in planning terminology usual». Tommaso Giura Longo, *I Sassi da museo a città*, in Parametro, n°123-124, p. 40, Faenza 1984. In: M. O. Panza, *L'architettura delle Camere Urbane*, Grafie, Potenza 2008.

complement the current knowledge of the ancient urban centers of an adequate number of case studies and the environmental context in which they are formed, confirming the graphical representation as articulated methodology of investigation and immediate communication tool.

The element that have in common the historical centers object of study is, first, the close connection between city and nature. In all cases, in fact, the houses themselves become landscape; in the case of the villages in the desert, through the constructive language of mud bricks, and in other cases through the rock excavated from man skillfully and put in continuity with the natural elements of the landscape. In the “*Sassi*” of Matera, as well as in Petra or in the Loess Plateau in China, you can appreciate the close interpenetration of natural and built-up area, through the immediate reading of the various stages of evolution of technologies and building types, from living in cave to the construction of partitions and dab made of tuff and clay. Through the analysis of urban nodes, is understandable, also, the continues evolution of compatible exploitation of existing natural resources, such as network storage and channeling of water in collective tanks visible both as in Matera and Gravina as in the oasis of Dakhla in Egypt, or in the Fujian *Tulou* in China, but also is understandable the use of building materials derived from rock site in the first, and obtained by mixing water and sand in the second. In an intricate urban system in which the built overlaps the excavated and the natural cavities and where the streets are the coverage of the homes below, another element of comparison with the oases of the Sahara is the complex system of water collection that, in both cases, is perfected in a refined design of pipelines and underground tanks, which act as a matrix for the road network overhead (Fig. 2).

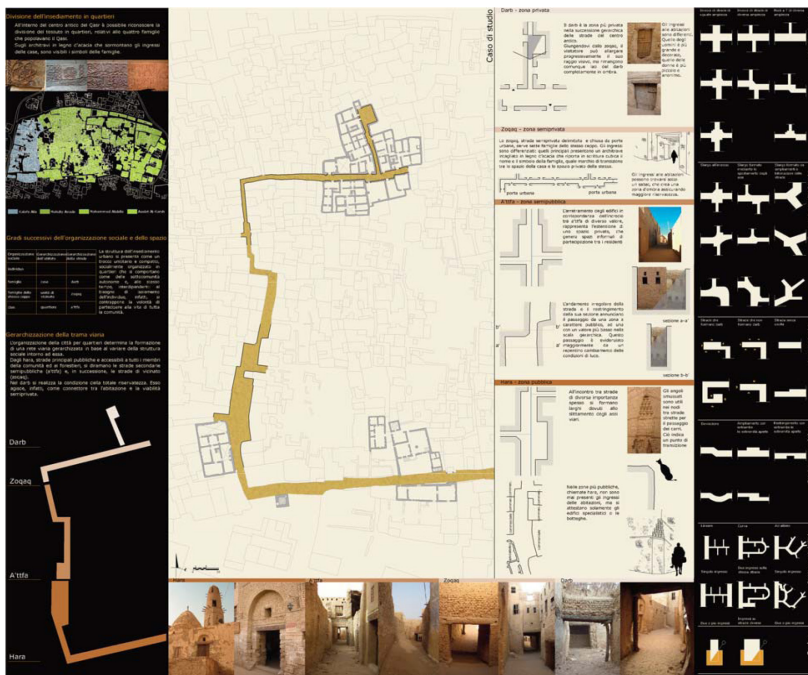


Fig. 2 Spatial succession of a Darb, lane in Qasr of Dakhla Oasis. Egypt. Graphics processing part of the thesis of the author, entitled: "The buildings in mud bricks in the oases of the Western Desert: the case study of Qasr Dakhla-Egypt." February 2007.

In all cases, for what I could check, these urban agglomerations are an outstanding example of the ability to create architectures using few and local resources in a responsible respect of natural environmental, almost a symbiosis between the place and human intervention. Another similarity between the cities of stone, the villages in the desert and the Chinese villages, is the theme of the

labyrinth that, from original graphics and geometric figure, is understood as tangle of streets that offer the look of someone who walks like many viable alternatives. In the *Qasr* Dakhla oasis, the need to have had narrow, winding streets had matrix climatic, but also social; in stone towns, the labyrinth is due to the continuous accretion of houses, up to the saturation of living space, while in the case of Beijing, *hutongs* are alleys formed by lines of *siheyuan* (traditional Chinese courtyard house), as well as in Shanghai, lines of *shikumen* form *longdang*. Even the vertical growth of the houses in the oasis of Dakhla has affinities both on the construction of multiple levels of the houses in the “Sassi” of Matera, that on the houses of the old town of Cuenca in Spain, where you get to count up to twelve floors excavated or constructed “clinging” to the rock (*casas colgadas*) (Fig. 3); in the first case the motivation is primarily climate, while in the second it is the sequence with which they were saturated and stratified available spaces in the rock. The final product, in almost all cases analyzed, it is a perfect balance between human needs, quality and morphological characteristics of the ground in a continuous fit to the site.



Fig. 3 Cuenca, Spain. Front of the old town on the “Gravina”. October 2012. (Photo M.Calia)

2.2 Forms and ways of living in China between tradition and symbolism

What is happening today in many cities in China, is an uncontrolled advance of modern technology and economies without scruples, that often lead to the killing of entire “pieces of historical city” to make way for huge skyscrapers without identity, faces only to meet functional needs of population growth. In recent years, the city of Guangzhou, such as Shanghai and Beijing, experimented on it the building, the transformation, the gradual replacement of parts of the city no longer correspond to the social demands, that changing more or less suddenly, consequentially change the overall image of the city, in which combines elements having historical, typological and formal characteristic very different, with serious negative impact on the climate balance. In traditional houses, the principles of *fengshui* were followed to obtain the correct thermo hygrometric working in the house during different times of the day and with the alternation of the seasons. For several decades, is becoming a willingness to use the correct traditional methods of construction and management of the house, as opposed to the recent trend speculative. “Bamboo house” is the name of a particular type of Cantonese house, characterized by a system of entrance frame very special. It is a sliding wooden door, which fulfills three main functions: security against intrusion, family's privacy and ventilation of the house (Fig. 4).



Fig. 4 – Guangzhou, Cina. Drawings and photographs of “Bamboo House”. September 2010. (Photo M.Calia)

The *fengshui*, a practice still followed today in architecture, emphasizes the harmony between man and nature and is seen as a way of obtaining good fortune and well-being through the observation of layout, directions and precise compositional schemes. The etymology of the word

shui (water) was implying that the appropriate place for the building should be close to both water and sunlight. The population of the south of the country, also has a habit of growing a few plants at the entrance of the villages or in private gardens. It is very useful to build a house near a river or a lake because residents will have ample supply of water for drinking, washing and irrigation. It is also very useful to build a house which faces the sun because of the abundance of daylight will ensure the growth of plants and the right temperature of the rooms.

The Geomancy has very ancient origins in China, since the XII to the III century b.C. there were activities to select the sites best suited to building both city and of individual buildings, acquiring the ability to choose through experiments which continued for millennia, through the experience of man. In the book of Chinese classical literature on geomancy, “The Book of the tabernacle,” is written: «For a dwelling the orographic relief of the place is like his body, the source or other forms of water resources are his blood flowing in the arteries, the earth is like his flesh and his skin, the prairie and the woods are like his hair, the house is like his clothes, the door of the house is like his hat and his belt. When everything has been well analyzed and resolved, then there will be the ideal requirements and you will find the best place where to place a lucky accommodation»⁴. This passage shows that the ancient dictates of *fengshui*, a dwelling is understood as a particular environment, including all the essential elements to a settlement, especially natural ones.

References

- Auer, A. H. (1978). Correlation of land use and cover with meteorological anomalies. *Journal of Applied Meteorology*, (17), 636 – 643.
- Bruse, M., Fleer H. (1998). Simulating surface–plant–air interactions inside urban environments with a three dimensional numerical model. *Environmental Modelling & Software*,(13), 373 – 384.
- Cerasi, M. (1988). *La città del Levante. Civiltà urbana e architettura sotto gli ottomani nei secoli XVIII-XIX*. Milano: Jaca Book.
- Conte, A. (2008). *Comunità Disegno. Laboratorio a cielo aperto di disegno e rappresentazione nei Sassi di Matera*. Milano: Franco Angeli.
- Greco, C. (2003). *Le case in terra del Fujian*. Roma: Meltemi.
- Giuffrè, A., Carocci, C. (1997). *Codice di pratica*. Matera: La Bauta.
- Fusaro, F. (1984). *La città islamica*. Bari: Laterza.
- Mattone, R. (2001). *La terra cruda tra tradizione e innovazione*. In: *Costruire in Laterizio*, 92 pagg. 70-77, Milano: Tecniche nuove.
- Panza, M. O. (2008). *L'architettura delle Camere Urbane*. Potenza: Grafie.
- Ragette, F. (2003). *Traditional domestic architecture of the Arab Region*. Sharjah: American University of Sharjah.
- Restucci, A. (1998). *Matera. I Sassi, manuale del recupero*. Milano: Electa.
- Stewart, I. D., Oke, T. (2009). Newly developed “thermal climate zones” for defining and measuring urban heat island magnitude in the canopy layer. *Symposium & Eighth Symposium on Urban Environment*, (11 – 15).

⁴ Cit. *Il Libro della dimora*. in: C. Greco, *Le case in terra del Fujian*, Meltemi, Roma 2003. Pag. 97.