Microclimate and *Forma Urbis*: The Topicality of Gaetano Vinaccia’s Theoretical Work (1881-1971)

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Abstract: - Despite the depth and scientific accuracy of his theoretical contribution, Vinaccia’s work on the relationship between microclimate and town design has been largely neglected. Both the author’s biography, which is still by no means studied in depth, and his most important professional works reveal a curriculum closer to that of an erudite *fin de siècle* architect than to an enthusiastic vanguard of a new era. Even if Vinaccia tried to compose a complete treatise on the matter (The City of Tomorrow, 1943-1952), his work was unable to overcome the scepticism of his contemporaries. In fact, the overwhelming diffusion of the Modern Movement’s statements up until the World War II prevented him from being recognized, until today, as one of the most interesting authors on the topic.

Key-Words: - Vinaccia, urban design, microclimate, polisclimatology, sustainability, architecture

1 Introduction

According to the statement of the leading critics, the first aim of the whole Modern Movement was a radical reform of the relationship between architecture and the building process. Driven by the desire for a more equal society, the architects of the early decades of the twentieth-century moved the centre of the discipline from a super-structural dimension to the performance of a deeper role in urban and social transformation. Looking at housing as a social need rather than as a consumerist good, the new architecture aimed to have a new role in defining the lifestyle and conditions of the working class.

1.1 Illness of the working class

The leading role played by Gropius and Meyer’s Bauhaus in the diffusion of the *Neue Sachlichkeit* [1] spirit is well known: goods, furniture, houses and cities should be built as a result of a production process through an optimization of shape, materials and functional needs. The building programme became more responsible for social goals, and architects were involved directly (both as planners and as managers) in urban development. The topic of the healthiness of buildings, first set out by Friedrich Engels in his text *The Condition of the Working Class in England* (1844), had already been addressed at the turn of the century, but it had never been faced with such a scientific and methodical approach before. The work of Hannes Meyer, Mart Stam, Walter Gropius, Erns May and Alexander Klein on *Existenzminimum*, “minimum dwelling”, which was the focus of the CIAM II in Frankfurt am Main, aimed at reducing building costs (including the cost of land consumption) by a reduction of the worthless surfaces of houses. Furthermore, the balance was moved so as to see man as a biological entity who requires rest until the following working day. Nevertheless, research on typology reached some standard formulations of the new working-class building environment, in which the amount of daylight, fresh air, heat and silence was radically maximized. Carlo Aymonino noted that the illustrations associated with the statement expressed by the authors during the CIAM conference did not describe any quality of space, but only the organization of space [2]. All demands for the representation of social rank as well as tastes, preferences and differences were considered an aspect of the bourgeois social heritage and thus abandoned. This ideology-driven approach, led by Walter Gropius, aimed to break up the structure of contemporary society (based on differences between social classes), making it easier to establish a socialist one. However, the studies on modern housing units were not sufficient to support their political plans, so the next year the focus moved from the house to the city. During the third CIAM
congress (Brussels, 1930), Siegfried Gideon defined the goal of the, so-called Modern Movement as that of reaching the most efficient formulation for a typological scheme for building on a different scale. The mechanical precision used in measuring the houses’ space was applied to urban design. The proposal for new neighbourhoods based on linear high-rise blocks, which was developed in the early 1920s in Germany, became the standard. In 1919, Theodor Fisher (1862-1938), who was the first chairman of Deutscher Werkbund and professor at the Technical University of Munich, realized a plan Alte Heide in which each block is at a distance from others twice its height, in order to prevent façade shading [3]. Five years later, Otto Heasler (1880-1962) developed the principle in the Georgsgarten Siedlung. This rule, later called Heiligenthal after R.F. Heiligenthal (who, in 1921, published his book Deutsche Städtebau – “German city planning”) [4], became the Neue Sachlichkeit’s standard approach for housing climate control between 1925 and 1933. The linear high-rise blocks were south-north oriented in order to ensure maximum and equal insulation for the apartments. Gropius’s diagrams, shown at CIAM III (1930), aimed to define a new universal typology for new settlements, while simultaneously achieving three goals: First, to ensure a more efficient building process for a new socialist society, which should level class differences. Second, to define a minimum standard requirement for human space, both at the housing scale and the urban one. Third, to take over every form of private and public space that had been directly or indirectly linked to the models of the past (squares, boulevards, parks, streets), which were considered expressions of bourgeois society. In 1927, Ludwig Hilberseimer published his Großstadtarchitektur [5]. The author, starting from a criticism of the Siedlung, offered his own point of view on modern architecture and his open opposition to all traditional architecture that did not interpret, radically, the new spirit. Application of standard housing units along a line, repetition of the same floor plan to achieve best performance in terms of costs and land consumption, serial and regular deposition of blocks, orientation along the solar path, suppression of every hierarchy in the shape of public space, breakage of any direct relation between the building and the streets, repeatability and universality of typological schemes all entered the mainstream of architectural thought. Furthermore, the traditional opposition between the city and the countryside was easily overcome. Clearing the ground from blocks and streets allowed houses to establish a direct relation with nature, providing a large increase of buildings’ healthiness. In this way, the countryside became part of the city, and conversely the urban landscape changed in the direction of increased openness [6]. The manual Architect’s Data, by Ernst Neufert, first published in 1936, aimed for the ultimate standardization of the whole of the human environment. Following the Heiligenthal approach, Neufert also added diagrams in order to help architects find the right building orientation. Architect’s Data was an enormous success. It was translated into 18 languages and went through several editions. Nowadays, it is still generally the most consulted building manual.

2.1.1 Le Corbusier and his contemporary sources on the heliothermic axis

Aiming to narrow down his whole theory for the “civilization machinist”, between 1922 and 1930, Le Corbusier set the standard for the new modern urbanism. In 1922, at the Salon d’Automne, he presented his Ville contemporaine de 3 millions d’habitants, in 1925, his Plan Voisin for Paris, and ad in 1930 the Ville Radieuse, which was shown at the third CIAM in Brussels [7] [8]. In the Ville Radieuse, the theory of the heliothermic axis, which was published by Pidoux, Rey and Barde in 1928 [9], despite it never being directly cited by Le Corbusier, became “l’armature du tracé urbain”. In fact, Pidoux-Rey-Bardet’s theory supported LC’s passionate urban renewal, providing some scientific evidence for the architect’s ambitions for building layout [10]. Despite the theory being disputed by Bardet (1943), Vinaccia (1943), Hermant (1943) and Leroux (1946), it had a dramatic influence on architects of the following generation [11].

1.2 Urban climatology research in Europe until World War II

According to Fionn MacKillop [12], publications on microclimatology and the urban climate increased significantly from 1960 onward. Nevertheless, in terms of the emergence of the discipline, in the early century, the first significant peak was in the 1930s. Rudolf Geiger (1894-1981), who was a German meteorologist and climatologist, is still considered as one of microclimatology’s founders. Between 1930 and 1939, he worked with the Russian climatologist Wladimir Peter Köppen (1846-1940) on the Handbuch der Klimatologie in Fünf Bänden, which, despite never being completed, had wide resonance in scientific debate in the 1930s. In 1927, he published his Das Klima der Bodennahen Luftschicht, translated in 1950 as Climate Near the
Ground, which can still be considered a milestone in micrometeorology. The treatise describes how temperature, wind and light may vary under the influence of ground shape, vegetation, daylight, topography and interrelations between humans and the microclimate. The German-born climatologist Helmut Erich Landsberg, who developed his career in the U.S.A. after moving from Germany in 1934 [13], considered Father Albert Kratzer’s book Das Stadtklima (1937) the origin of scientific debate on microclimate. Nonetheless, Landsberg noted that in Das Stadtklima’s first edition, Kratzer had already cited 255 papers. Analysing in depth the bibliography of its first edition (1937), some issues needs to be highlighted. Most of the cited works are climatic reports and statistical surveys, and some are more related to fog, dust or pollution prevention. Nevertheless, there were a significant number of contributions in which urban planning, climatic issues and wellness are clearly interrelated. As for the remainder, there are several papers dating to around the 1930s, but a small group are dated earlier. Light and shadow distribution on buildings had already been investigated by Heiligenthal in 1921 and Benndorf and Brausnitz in 1926 [14]. The relationship between meteorology and architecture was discussed by Schmauss in Meteorologische Grundsätze im haus un Städtebau (1914) [15], and Kassner’s Die meteorologischen Grundlagen des Stadtebaulichen Vorträge even dated from 1910 [16]. Furthermore, a large percentage of the quoted papers were written by German or Austrian scientists, a group of whom worked in Munich before 1934. As a consequence, we can assert that two phases can be distinguished. The first period dates from the late nineteenth century to the late 1920s. During this beginning phase, studies worldwide aimed to contribute by describing the relationship between cities and climate, and by highlighting modifications provoked by each other. The state of the art in the urban microclimate discipline in the early 1930s was far from well established. There was no complete treatise, except some dissertations on specific topics. Most of the contributions came from Germany, with a lesser number from France, England and Austria. In the second period, up until World War II, climatic urban planning was looking to become an autonomous discipline. Treatises became, gradually, more specific and systematic. However, despite the success of the topic among meteorologist, architects and planners (with the exception of Kratzer in his book) showed no sign of a comprehensive attempt to make connections in this emerging discipline. Moreover, the Bavarian monk was neither a planner nor an architect. The contents of The Climate of the Cities do not provide any direct suggestions for urban design, except one. In relation to the topic of the solar exposure of the city block, Kratzer mentioned Bernhard Christoph Faust’s city plan drawn up in 1824. “The residential streets”, said Kratzer, “run E-W, with all house-fronts facing south, so that each house may get as much sunlight as possible.” In fact, Faust (1755-1842), aside from discussing building orientation, mostly referred to ancient Roman settlements. Despite the fact that he was a physician, he expressed his point of view through his Sonnenbaulehre theory. According to Plessner [17], who was Kratzer’s source, Vitruvius largely inspired Faust. His Sonnenbau system (described in Faust’s Andeutungen über das Bauen der Häuser und Städte zur Sonne, Hahn’sche Hofbuchhandlung, Hannover, 1829) aimed at providing as much sun as possible to houses by planning settlements on a north-south oriented grid and by ensuring the right distance between the blocks. The Sonnenbau theory was supported by the Bayern architect, Gustav Vorherr (1778-1847). In 1818-1821, Vorherr designed the so-called “Sun Road”, on the border between the ancient city centres of Munich and Ludwig. The road is strictly south oriented. In conclusion, led both by scientists and by architects and planners, Germany was generally the centre of the debate on urban climate planning. Even if the topic was to be addressed more distinctly after World War II, history shows a rich and growing debate that can easily be found in documents dating back to the nineteenth century. Furthermore, the scientific approach to research shown by architects in the early 1920s and the interest of meteorologist in urban issues together provided the opportunity to establish a common ground to contribute to future cities’ development. The influence of German culture abroad, even in this field, is well known; nevertheless, some heterodox figures, such as Gaetano Vinaccia, may reveal a more complex framework.

1.3 The debate in Italy
After 1925, Fascism changed its political organization, moving from being a social and political movement to a more organized structure coinciding with the central state. The Fascist party, as an institution, required physical representation. Italian architects, divided between traditionalist and rationalist, engaged in a cultural war in order to capitalize on this opportunity. According to Manfredo Tafuri (1935-1994), in 1926 the so-called “Gruppo 7” was founded. It can be considered one
of the most inspired teams of the Italian Modern Movement. In 1928, the MIAR (Movimento Italiano per l’Architettura razionale, “Italian Movement for Rational Architecture”), held the first exhibition on rational architecture. Three years later, the Tavola degli orrori, a collage of the worst traditional architecture of the past, was shown. Both the magazine Quadrante (director Bardi) and Casabella (director Pagano) supported this attack against the old architecture, aiming to convince Mussolini to adopt the modern (international) style for public buildings [18]. Nevertheless, the conservatives strongly opposed this attempt to change. In Milan, Muzio, Greppi and De Finetti kept following their personal interpretation of the bourgeois city, led by Camillo Sitte’s teaching [19], leaving no room for international-style theory. In Rome, Giovanni, Foschini, Fasolo and Del Debbio tried to remove any reference to foreign experience. Magazine as La Ronda, Architettura e Arti decorative and Valori Plastici, promoted the national cultural heritage. The bombastic praise of “Italian being” was taught in the architecture faculties. The scientific and pragmatic approach to building was methodically neglected to advance research on archaeology and antiquity [20].

The dualism between modern and traditional architecture was, apparently, overcome by Marcello Piacentini. To give one example “Siamo d’accordo”, he wrote: “ma i grandi monumenti romani e tutta l’architettura della Rinascenza […] Non furono razionali, tutt’altro che razionali, decorative, formali, belli perché belli”. Later, in his book L’architettura di oggi (1930), he wrote “Il moderno in Italia si è fermato alle sole teorie semplificatrici. […] Da noi l’ambientalismo e il carattere locale prendono il sopravvento sul tipo di edificio. […] Si confonde l’appellativo di –Italiano- con quello di “antico”; nella stessa maniera che si vuol far passare per straniero ogni tentativo di modernità”. Both Piacentini’s cultural duplicity and his capability in interpreting the conservative will of the Fascist party enabled him to become the keystone of public policies on building, so that the, so-called “School of Rome” monopolized the best opportunities and occupied the key positions in cultural debate. Despite his ignorance of modern architecture, his huge influence on contemporary architecture prevented Italian research becoming linked to the most advanced experiences abroad, and thus Rome’s cultural conditions became hostile to the idea of Neue Sachlichkeit [21]. The advance of this damaging and reactionary front was partially interrupted by the publication of Giuseppe Samonà’s book, La Casa Popolare degli anni ‘30 (1935). Samonà, who later became Dean of the Venice School of Architecture, tried to focus on international research on public housing. The topic, which in Europe had led his contemporaries to build the most inspiring architecture of the early twentieth century, would have had the same success in Italy. Samonà praised Gropius’s approach to new settlement planning and approved of Klein’s research on minimum dwelling. Nevertheless, the book was largely ignored. Despite the political context, his explicit apology for the socialist Karl Marx Hof cannot explain such a general repulsion towards his work. In fact, the book contains, and methodically organizes, some concepts that would have destabilized the mainstream. The prerequisites of Gropius’s vision could not be applied to a society that was going along a very different route. Moreover, the organization of the Italian Architecture School could not facilitate a scientific approach to the matter.

The last chances for Italian rationalist architecture to be linked to the modern international movement were the E42 Exhibition Masterplan and the Milano Verde plan for the Sempione area in Milan (Albini, Pagano, Gardella, Minoletti, Palanti Predeval, Romano - 1938).

The first was completely managed by Piacentini, who designed monumental old-style scenery in which Rational architecture would have only been tasked with defining a sparkling image. The Milano Verde plan has generally been considered the most important Italian contribution to European modern urban planning prior to World War II. Despite the direct reference to Hillberseimer and Gropius’s approach, the masterplan in Milan did not have the same explicit contents. The proposal did not have any ideological character or the same social perspective. The radicalism of the German architect’s design was tempered. Nor was open space was not distinct from buildings in the MM’s plans. Seeking a balance between the garden city models and linear high-rise building, the urban design actually looked like a restyling of Sitte’s bourgeois city. Repetition of standard typological configurations was not completely adopted. Conversely, variety was desired and promoted. Relatedly, the Milano Verde plan oriented the grid perpendicular to the Corso Sempione, which is oriented NO-SE. This means all of the blocks are NE-SO oriented. Nonetheless, apart from applying Heiligenthal’s rule, the project did not mention any research on the microclimate of space and wellness [22].
1.4 The rational vernacular

The theme of rationalization, standardization and optimization of housing and urban transformation, which was characteristic of the 1920s in Europe, was expressed in Italy in a local manner. In the Der Untergang des Abendlandes (1918-1922) by Oswald Spengler, which was translated into Italian by the Fascist ideologist Julius Evola, described the West as though it were in the phase of its decay. The German philosopher also looked both at the metropolis and at materialism as the causes of this decline. Influenced by Spengler’s works, in 1927 Mussolini started his anti-urban policies aiming at shaping Fascist society based on the family and the craft-guilds, reducing cities’ growth. Several new towns were founded to provide a workforce both for the mines (in Sardinia) and the countryside after land-reclamation (in Lazio). Italian colonies in Africa also provided a new opportunity to explore spatial organization. The exhibition Architettura rurale nel bacino del Mediterraneo (1936, the VI Triennale di Milano) moved the focus onto the vernacular architecture, seeking suggestions that would have led to a new Italian way towards rationalism. Pagano, who was the director of the exhibition, tried to interpret the spirit of the time, without the Neue Sachlichkeit can be read as the last attempt to provide a local rationalism. Pagano, who was the director of the exhibition, tried to interpret the spirit of the time, showing the architecture of the local past as genuine and practical. The main evidence for the rational approach of these buildings was offered by their perfect orientation and climate control [23]. This can be read as the last attempt to provide a local version of the Neue Sachlichkeit without the application of any industrial process.

1.5 Climate and design in early Italian manuals

Irenio Diotallevi and Franco Marescotti, who were both Pagano’s apprentices, are still often considered the Italian forerunners for the topic of building-related illness. In Costruzioni-Casabella, they published some evidence for the relation between wellness and housing. These articles, which were grouped together in Ordine e destino della casa popolare (1941), aim to directly link illness and the shape of buildings, focusing on the lack of insulation and ventilation as the main factors for the onset of disease in the working class. After World War II, the rebuilding phase offered the opportunity to reclaim the idea. In 1946, Il Manuale dell’Architettore, written under Mario Ridolfi’s supervision, was published for the first time. In 1948, Diotallevi and Marescotti resumed the matter with Il problema sociale, costruttivo ed economico dell’abitazione. In both manuals, it is easy to find a connection with the German experience, and the issues of orientation and ventilation of building were largely explained with graphics and diagrams. In Ridolfi’s work, the scientific and pragmatic approach prevailed. In this, it appeared similar to Neufert’s Bauentwurflehre (1936), which was published in Italy in 1946 as Enciclopedia pratica del progettare e costruire. In this manual, architecture had no direct social role; it was simply a problem of technical knowledge [24]. Conversely, Diotallevi and Marescotti’s manual wanted to focus on the relation to moral issues. Even if the authors knew the work of Klein, Gropius and Hillberseimer well, their aim was to move the Italian debate on housing on to more advanced issues related to human health.

2 Vinaccia: An innovator of an outdated architect?

Because of his classification as a minor architect, Gaetano Vinaccia’s biography has not been studied in depth. Even if only modest information is available, it may help to explain both the person and his scientific contribution. According to Cesare Silvi [25], who had direct access to Vinaccia’s archive, Vinaccia was born in Naples in 1889. Due to the travails occurring in his family, his formational experience was acquired in the field. However his career was not localized. In 1909, Vinaccia was awarded a high school diploma at the Brescia Technical Institute. In 1917, he achieved the qualification of Professor of Architectural Drawings. Between 1919 and 1926, he published some minor books relating to historic heritage, antiquity and archaeology. Furthermore, a minor work opportunity in Rome (on the Via Monteverdi, Rome, 1918) [26] suggests an approach that would hardly have had any chance to be recognized in the complicated framework of Italian architectur in the 1920s and 1930s. Silvi also reports Vinaccia’s graduation in civil engineering, achieved in 1926 at the University of Freiburg, and his stay in Rome, in 1930, when he was appointed as a teacher of technical drawing at a local high school. As Vinaccia himself reported, it was during his stay in Rome that his interest in insulation radically increased. Thus, between 1935 and 1943, he published several works in which he attempted to take up a role in the international debate. Examining Vinaccia’s productions we can recognize four different phases. In the first period, from 1919 until 1926-1927, he applies his knowledge in the field of architecture, achieving only mediocre success. The second, from 1926 to
1930, which corresponds to his stay in Freiburg, can be considered as the more fruitful experience of his life, due to the opportunity to be linked with the most advanced research in architecture, in meteorology and in civil engineering. The third occurs during his stay in Rome, when, as a board member of the architectural magazine Case d’oggi, he tried to influence the debate on typology led by rationalist architects worldwide. The last phase was during his attempt to lead towards an Italian approach to urban microclimate design, and closed with the publication of his most cited work Come il clima plasma la forma urbana e l’architettura: la sanità e l’igiene cittadina, La Città di Domani, Vol. I (1943) [27]. The stay in Freiburg was, certainly, a turning point in Vinaccia’s career. Despite revealing that his interest in building insulation started in 1930, he was dramatically influenced by the German cultural environment during his studies. The Bavarian milieu offered many suggestions, both in the field of the urban microclimate and of modern architecture, because of the presence of personalities such as Schmauss, Köppen, Geiger and Kratzer (the meteorologist), and Theodor Fisher, who, as mentioned before, was a professor at the Technical University of Munich and the leader of Deutscher Werkbund. Therefore both Fisher’s Alte Heide Plan and Otto Heasler’s Georgsgarten Siedlung should have been well known to Vinaccia as a student. Moreover, his knowledge of the German language could have given him direct access to the reading of Heiligenthal’s Deutsche Städtebau (1921). At the time of his return in Italy, three CIAMs had been held. As stated, the second was on typology, and the third on urbanism. Not surprisingly, Vinaccia’s published productions developed following the same order. When the Italian cultural climate changed to a more local interpretation of rationalist hypotheses, Vinaccia tried to put into practice his knowledge of antiquity and his capability in the field of engineering to support an Italian path towards modern architecture. Despite the fact that his works, both as an architect and as an ante litteram microclimate urban designer have been largely ignored, Vinaccia’s works reveal an exciting modernity. In fact, his pioneering spirit was always mixed with a proud sense of belonging to local architectural traditions. This intermediate position could not have had any appeal for the European Modern Movement’s inner circle, nor even for the more up-to-date Italian magazines. Conversely, his scientific point of view would have sounded obscure to most Italian architects, whose academic approach on architectural issues was no means inclusive of technical contents. Therefore, it was between the 1930s and 1940s, when Piacentini’s leadership radically emerged in the Italian debate, that Vinaccia started to find room for his proposals. Nevertheless, after World War II, the Roman cultural circle, which revolved around Piacentini’s controversial personality, was blamed for Italy’s alleged backwardness in relation to international Modern Movement innovations. Thus everyone, who could be considered to be making compromises with the past, started to be ignored. Moreover, the general interest in microclimate effects on buildings dramatically declined, until the 1970s, when the international oil crisis forced it back on the agenda. Therefore, the question of whether Vinaccia can be considered as an innovator or not largely derives from the architectural criticism point of view. In order to look at Vinaccia’s role in history from the right perspective, we may consider that, until World War II, his contribution did not have a well-defined discipline in which to be classified.

According to Harzallah, Montavon and MacKillop, the first organic treatises on urban microclimatology are Oke’s work and Landsberg’s The Urban Climate (1981). Moreover, neither of these were architects, so they had no chance to dramatically influence architecture and urbanism. Therefore, when, in his La Città di Domani, Vol. I (1943), Vinaccia coined the definition “Polis-climatologia” (from the Greek πόλις [pólis]- κλίμα [clima]- λόγος [logos]), he was an absolute innovator. In this way, he aimed at founding a new approach to urbanism that would have been driven more by scientific concepts than by theoretical or political ones. Therefore, it was his singular nature, that did not allow him to be taken into account as he deserved. Nonetheless, he was fully aware of his professional fate when, in 1936 he wrote [28]: “On urbanism we should take into account some comparison between different house typologies, all those of today and all those we wish for in the immediate future, when the strength of things will inevitably win over misoneism and [when], as usual, the misoneists will strut around their forerunners, taking advantage of the fruits of those pioneers who will be considered by them as past-lovers.” Gaetano Vinaccia (1936). In 1936, Vinaccia had not yet written the best of his scientific productions, so that his statement cannot be considered as an end point in his enthusiastic attempt at founding a new discipline. The point is that Vinaccia clearly knew that, in the framework of the Italian condition, he had only one option: to convince the establishment that his scientific theories did not contrast with the mainstream, but could conversely support the Fascist rhetoric of the supposed superiority of
Roman civilization. From this perspective, Vinaccia’s works on microclimatology applied to architecture and urbanism are absolute astonishing.

2.1 Vinaccia’s most important publications
During his stay in Rome, Vinaccia started his attempt to influence the cultural debate through several publications both on typology and urban planning, focusing on the topic of relations with the microclimate.

2.1.1 The Star-shaped Building (1932-1936)
In 1936, in the magazine Case d’Oggi, Vinaccia illustrated his scheme for the pentagonal and heptagonal star-shaped house. The project appeared previously in L’Architettura Italiana (1932) with the title “Progetto di casa economica” [29]. The earlier purpose was to rationalize internal building space in order to gain economical, aesthetic and hygienic advantages. Concerning the economical issue, the star-shaped building offered the possibility to build a single staircase to serve 10 (pentagonal) or 14 (heptagonal) apartments per floor, thus reducing cost per unit. Thus, the money saved could have been invested in building aesthetics. Moreover, the star-shaped plan guaranteed three different exposures for each flat, taking advantage of inner natural ventilation and sunlight. The adoption of a glass skylight on the roof would also have contributed to entrance hall and stairwell ventilation and lighting. The effectiveness of the skylight had already been confirmed in Vinaccia’s previous, successful work in Rome (1918 - house in Via C. Monteverdi, no. 20). The urban advantages of Vinaccia’s typology were confirmed after seven months. The author compared the urban layout made up of star-shaped buildings with some others, which were composed of different building typologies. The comparison also took account of planning-fees and construction costs. Here, Vinaccia clearly refers to Le Corbusier’s cross-shaped skyscrapers, but his proposal aimed at a technical development of the concept. Nevertheless, the author supports the Modern Movement theory of urbanism in proclaiming his preference for high-rise buildings.

2.1.2 Sun Path in Architecture and Urbanism (1938)
According to the author: “The purpose of this study is to call architects’ attention to the knowledge of the sun’s illusory motion in order to rationalize urban planning. […], giving a serious scientific basis to the urban codes, often arbitrary and irrational” [30]. The book is structured in six sections. The first three are characterized by more technical contents. The book offers graphics which provide basic information on sun path (trajectory, height, and azimuth), sunlight of building surfaces, and related thermal effects. The fourth and fifth chapters deal with the sunlight in planning and architecture, defining both the best orientation and proportion for each “sunlight urban programme”. The latter is imposed by the local climate and latitude. Vinaccia also examines the effects on the sunlight/shading of building surfaces caused by street grids in different orientations and ratios (H/W ratio) at different latitudes. An in-depth examination of 30 Italian cities with an “equisolare plan” [31] closes the urban section. Concerning the studies on the urban block, the author investigates the orientation and internal arrangement of buildings in relation to the sun path and building function. The last section deals with the use of solar heat in agriculture (solar greenhouses) and in domestic central heating systems. The study is innovative for its time, providing interesting reflections on energy and economic gains relating to the passive exploitation of the sun in those countries that are located in advantageous climates such as Italy and the African Italian colonies of the past. What emerges from the text is the author’s up to date technical and interdisciplinary knowledge. The bibliography mainly presents texts on meteorology, physics and astronomy, but Vinaccia’s attention to global studies noticeably emerges, especially French research on the heliothermic axis by A. Rey and Brooks (Berkeley, California). [32].

2.1.3 Rationality of the Romans’ castra (1939)
The manuscript [33] deals with the orientation of ancient Roman settlements. In particular, the author claims that religious dogmas and rituals did not determine a city’s position. He states that the N-S and E-W directions of the city axes originated from rational reasons more related to the need for protection from annoying, unhealthy winds, and to the need for the best sunlight exploitation. Referring to classical writings (Vitruvius, De Architectura; Vegezio, Institutiorum Rei Militaris ex Commentariis Catonis, Celsi, Trajani, Hadriani et Frontini; Varrone, De Re Rustica; Columella, De Re Rustica; Hygini Gromantici, De Castris Romanis), Vinaccia highlighted the ancient Greeks’ and Romans’ knowledge of various effects at different latitudes, both of the wind and the sun on cities’ level of comfort. For Vinaccia, the Romans’ attitude to managing these issues both in urban and architectural design is surprising. With regard to the
urban-scale analysis, the author noted that Roman-founded Italian cities show a deviation of about 30° from the N-S axis. According to his studies, this deviation was to protect from both the cold winds from the N-NW sector, and the unhealthy, wet winds from the S-SE. Moreover, this orientation guarantees sufficient sunlight on all four building surfaces. With regard to the building-scale analysis, Vinaccia’s work is confined to the heliothermic theories contained in Vitruvius’s writings [34], in relation both to the inner deposition of space and the execution of customary activities. By his reading of this work, the author’s attempt to show Roman settlement as the most rational clearly emerges. The references to Vitruvius’s writing and the other classics, allow him to be accepted by the cultural mainstream. Nevertheless, his deep development of technical issues makes him comparable to contemporary scientists.

2.1.4 The City of Tomorrow (1943)

The book is the first of the two volumes that constitute The City of Tomorrow (La Città di Domani). It includes previous studies on microclimate and urban design. According to the author, the text aims to promote city-planning awareness in order to instruct technicians both on design and health-related building issues. Therefore, the planning and the microclimatology should leave room for a new discipline: “polisclimatology”. The new discipline would have supported architects both in the correct choice of the location for the city’s foundation and in modelling the urban form. With this purpose, Vinaccia analyses the main meteorological phenomena. For each of them, he highlights the physical causes, the benefits for and harm to human health, the relations with the built environment and the solutions used in the history (contained both in vernacular examples and in ancient documents such Vitruvius, Hippocrates, etc.). In addition to solar radiation, the issue of wind had already been developed in previous publications, Vinaccia analysed the effect of atmospheric moisture, fog, rain, atmospheric pressure, winds, the electric field and the ionization of the air on man and the urban environment. With regards to winds, the wish of the author was for the foundation of “Urban Anemometry”, an approach which would have been able to provide reliable data about the speed and frequency of winds in urban areas. Concerning the sun, the author introduced new control tools for effective sunlight (the poliseliometro and the photographic survey). Vinaccia resumed his “Urban Programme for Sunlighting” in relation to the three recognized climates (equatorial, intertropical and temperate) and, finally, he expounded his theory on “Vinaccia equisolare orientation” for the “equalization of sunlight among all the four sides of a cubic block” [35], clearly in opposition to the heliothermic axis theory of Rey, Barde and Pidoux (1928), left also by LC from the 1940s. The erroneous interpretation of heliothermic issues has been later confirmed by Harzallah et.al. [36]. The text ends with a chapter on the microclimatic benefits of green areas in urban space and an annex on more specific topics, such as the quality of the soil, drinking water, sewerage and building codes. Concerning the latter, Vinaccia expounds the need for an upgrade of the code with regard to health and local climate. Several plates on applied “polisclimatology” round of the text.

3 Innovation in Vinaccia’s thought

As stated previously, Vinaccia played a minor role in the history of architecture. Nevertheless, the contents of his works make the author extremely contemporary. There are several reasons to reconsider this figure. Among these, emerges Vinaccia’s contribution to the founding of “polisclimatology”, as a link between planning and microclimatology. However, the cultural and historical background was not favourable to its dissemination. Moreover, after the World War II, the “bioclimatic” approach was overwhelmed by the large-scale use of technology in building. This trend went on until the 1960s, when important research on vernacular solutions and architectural regionalism was published (B. Rudofky, 1964 [37]; V. Olgyay, 1963 [38]). It would only be in the 1970s-1980s, during the international oil crisis and the looming environmental disasters (global warming, 1986; hole in the ozone layer, 1985, etc.) that the “bioclimatism” caught on. It seems interesting that Lansberg, in 1981, still declared there was a lack of dialogue between planners and meteorologists, and only in 1998 did B. Givoni [39] affirm its beginnings. In the light of this, Vinaccia appears as a pioneer. In fact, although most of Vinaccia’s theories were already known in the distinct international scientific sectors, he was perhaps the first to organize these into a systematic approach. Furthermore, Vinaccia’s education as an architect contributed to a more humanistic idea of architecture and planning. In this perspective, the urban microclimatology represents only an additional scientific subject to take into consideration in urban design. Despite the fact that most of Vinaccia’s theories do not achieve the in-depth scientific analysis that the current researches
have, Vinaccia seems to reveal in advance several important issues related to microclimatic urban design. Among these are:

Urban canyon studies of wind and solar radiation. He took into consideration the relationship between the building’s height and the street’s width (H/W ratio), the building’s surface and the street’s geometry in relation to solar radiation’s penetration (SVF) in order to allow (or to avoid) urban ventilation and sunlighting. Studies have also considered latitude, altitude and orientation.

Images and theories contained in La Città di Domani, Vol.1, suggest that Vinaccia was aware of several technical issues, such as the “vertical air-film” development in the proximity of the building’s surfaces, caused by the surface’s temperatures and the street’s orientation [40]. Still today, most of contemporary authors debate these issues; among them M. Santamouris [41], F. Allard [42] and E. Erell et.al. [43].

The possibility to use a surface’s geometry and a material’s exterior texture to improve (or to reduce) the “actual sunlighting” on a building. Vinaccia knew very well “The Cosin Law” (according to Oke (1976) [44]: “The relationship between the radiation received by a surface and the incident beams”), and the influence of a material’s albedo on solar radiation’s reflectivity or absorption.

The necessity for different design guidelines in relation to diverse latitudes (“Urban Programme for Sunlighting”). Vinaccia’s programmes have also been developed in relation to his research on vernacular architectures in different climates (the Arab city in a hot climate, the courtyard house in temperate zones and the villa in a cold climate). These studies allow him to suggest low-tech and low-energy-costs architectural solutions. This topic is also approached by several contemporary researchers; for example, P. Oliver [45], H. Coch [46], etc.

The influence of topography on local microclimate. From the studies, Vinaccia appears as an interdisciplinary, up-to-date researcher, able to manage physics, meteorological, astronomical and architectural issues simultaneously (he was aware of the air pressure differences that generate rainfalls, fog and winds in the mountains; the heat exchanges between land and sea that cause local breezes on coasts; the Venturi effect on airflow, etc.).

The use of tools to support the project, such as the poliseliometro, useful for understanding the sun’s profile on building surfaces. Today, this role is entrusted to software.

Finally, the lack of climatic data in urban areas, indispensable for urban design and planning.

3 Conclusion

Research on Vinaccia’s work shows his innovative contribution to environmental urban design. As stated above, his ideas could be appreciated neither before nor after the World War II. Therefore, it is necessary to reconsider this figure, especially today when the environmental and bioclimatic issues strongly arise in architecture and planning. Nevertheless, the validity of Vinaccia’s intuitions and their actual correspondence with the most up-to-date research should be investigated in subsequent studies.

References

[4] Roman Friedrich Heiligenthal, Deutsche Städtebau, Carl Winter, 1921
[5] Ludwig Hilberseimer, Großstadtdarchitektur, Julius Hoffmann, 1927
[9] Adolphe Augustine Rey, Justin Pidoux, Charles Barde. La science des plans de villes: ses applications à la construction, à la extension, à l’hygiène et à la beauté des villes: orientation solaire des habitations, Payot, 1928


[31] ‘Id., *Il corso del sole in urbanistica ed in edilizia*, p. 228


[34] Vitruvio, *De Architettura*, Einaudi, 1997


[40] Vinaccia, *La Città di Domani*, p.89


