

ARCHITECTURE HERITAGE and DESIGN

Carmine Gambardella

XVIII INTERNATIONAL FORUM

Le Vie dei  
Mercanti



# World Heritage and Contamination

ARCHITECTURE | CULTURE | ENVIRONMENT | AGRICULTURE | HEALTH | ECONOMY  
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## WORLD HERITAGE and CONTAMINATION

Architecture, Culture, Environment, Agriculture, Health, Economy,  
Landscape, Design, Territorial Governance, Archaeology, e-Learning

Le Vie dei Mercanti  
XVIII International Forum

Editing: Alessandro Ciabrone

Il volume è stato inserito nella collana Architecture, Heritage and Design, fondata e diretta da Carmine Gambardella, in seguito a a peer review anonimo da parte di due membri del Comitato Scientifico.

The volume has been included in the series Architecture, Heritage and Design, founded and directed by Carmine Gambardella, after an anonymous peer-review by two members of the Scientific Committee.

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**Gangemi Editore spa**

Via Giulia 142, Roma

[www.gangemieditore.it](http://www.gangemieditore.it)

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ISBN 978-88-492-3937-9

Cover: drawing by Le Corbusier 1931. Courtesy Carmine Gambardella

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Le Vie dei Mercanti \_ XVIII International Forum

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**Conference report** 300 abstracts and 650 authors from 44 countries:

Albania, Arizona, Australia, Benin, Belgium, Bosnia and Herzegovina, Brasil, Bulgaria, California, Chile, China, Cipro, Cuba, Egypt, France, Germany, Georgia, Greece, India, Italy, Japan, Jordan, Kosovo, Lebanon, Malaysia, Malta, Massachusetts, Michigan, Montenegro, Montserrat, New Jersey, New York, New Zealand, Poland, Portugal, Russian Federation, Serbia, Slovakia, Spain, Switzerland, Texas, Tunisia, Turkey, United Kingdom.

## Preface

At the state of art, with profound pride I register that the previous editions of the Forum 'Le Vie dei Mercanti' have favored the creation of an international scientific community with over six thousand researchers, distinguished professors, institutional and business sector representatives from more than one hundred Universities and Research Centers from fifty countries in the world. The XVIII edition of the Forum titled 'World Heritage and Contamination' aims to create a cross-critical dialogue, open to cultural contamination and 'without limits', in a logic of integration between competences which extends, and is not limited to, the following disciplines: Architecture, Culture, Environment, Agriculture, Health, Landscape, Design, Territorial Governance, Archeology, Economy, e-Learning. The activities of protection and promotion of World Heritage, understood as a asset shared by all Humanity, are particularly relevant in Italy, responsible towards the world of custody of the largest number of assets protected by the UNESCO. To the World Heritage Properties is added a landscape heritage of enormous variety and beauty to be protected also through the regeneration of degradation and of the 'minor heritage', in line with the provisions of the UNESCO Conventions on material and intangible assets as well as the European Landscape Convention. In this framework the multidisciplinary topics of the Forum represents a 'thing tank' of confrontation, exchange and cultural contamination oriented towards the United Nations Millennium Development Goals. The location of the Forum is of excellence. Campania Region with six World Heritage Properties, two Unesco Man and Biospheres, three assets registered on the Intangible Heritage List is one of the richest Regions in the world for cultural and landscape heritage, particularly 'contaminated' by Mediterranean cultures. No coincidence that the Forum takes place in Naples and Capri, with site visits and presentations of scientific research and operational projects by the Benecon University Consortium, consisting of five Italian Universities, head office of my UNESCO Chair on Landscape, Cultural Heritage and Territorial Governance. The papers, selected by the Forum's Scientific Committee, will be published in the Proceedings of international relevance. Furthermore, the most innovative research and projects will be published in the 'Quaderni' of the A Class international magazine 'Abitare la Terra / Dwelling on Earth'.

*Prof. Carmine Gambardella, General Chair XVIII Forum  
UNESCO Chair on Landscape,  
Cultural Heritage and Territorial Governance*

Con profondo orgoglio, allo stato dell'arte, registro che le precedenti edizioni del Forum 'Le Vie dei Mercanti' hanno favorito la creazione di una comunità scientifica internazionale costituita da oltre sei mila ricercatori, distinguished professors, rappresentanti istituzionali e del settore dell'impresa provenienti da più di cento Università e Centri di Ricerca di cinquanta paesi nel mondo. La XVIII edizione del Forum 'World Heritage and Contamination' si propone di creare un dialogo critico trasversale, aperto alle contaminazioni culturali e 'senza limiti', in una logica di integrazione fra le competenze che si estende, e non si limita, alle seguenti discipline: Architecture, Culture, Environment, Agriculture, Health, Landscape, Design, Territorial Governance, Archeology, Economy, e-Learning. Le attività di tutela e promozione del Patrimonio Mondiale, inteso come bene condiviso da tutta l'Umanità, sono particolarmente rilevanti in Italia, responsabile nei confronti del mondo della custodia del maggior numero di beni tutelati dall'Unesco. Alle Properties del World Heritage si aggiunge un patrimonio paesaggistico di enorme varietà e bellezza da tutelare anche attraverso la rigenerazione del degrado e del 'patrimonio minore', in linea con quanto previsto dalle Convenzioni Unesco sui beni materiali e immateriali e dalla Convenzione Europea del Paesaggio. In questo framework i topics pluridisciplinari del Forum rappresentano un 'thing tank' di confronto, scambio e contaminazione culturale orientati verso gli Obiettivi di Sviluppo del Millennio delle Nazioni Unite. La location del Forum è d'eccezione. La Campania con sei siti iscritti nella lista del Patrimonio Mondiale, due Man and Biospheres Unesco, tre beni iscritti nella Lista del Patrimonio immateriale è una delle regioni più ricche al mondo per beni culturali e paesaggistici, particolarmente 'contaminata' delle culture del Mediterraneo. Non a caso il Forum si svolge a Napoli e Capri, con sopralluoghi e presentazioni di ricerche scientifiche e progetti operativi a cura della Consorzio Universitario Benecon, costituito da cinque Atenei italiani, sede della mia Cattedra Unesco su Paesaggio, Beni Culturali e Governo del Territorio. I paper, selezionati dal Comitato Scientifico del Forum, saranno pubblicati negli Atti di rilevanza internazionale. Inoltre, le ricerche e i progetti più innovativi saranno pubblicati nei 'Quaderni' della Rivista internazionale di Classe A 'Abitare la Terra/Dwelling on Earth'.

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### **CARMINE GAMBARDELLA**

UNESCO Chairholder on Landscape, Cultural Heritage, and Territorial Governance; President and CEO of Benecon SCaRL University Consortium - Research Centre on Cultural Heritage, Ecology, Economy (University of Campania “Luigi Vanvitelli”, Pegaso University, University Federico II of Naples, University of Salerno, University of Sannio). Full Professor of Drawing at the Pegaso University and at the University of Campania. President of the International Forum “Le Vie dei Mercanti” since its first edition in 2003 to the XVIII edition in 2020. Editor and Founder of the series “Surveying is/or Project”, “Knowledge Factory” and “Architecture, Heritage and Design”. Component of the Scientific Committee of International Class A Magazine *Abitare la Terra/Dwelling on Earth* (Gangemi Editor International Publishing). He covered various roles for the University of Campania, including the Pro Rector of Institutions, Academic Senator, Director of the Department of Architecture and Industrial Design Luigi Vanvitelli, Dean of the Faculty of Architecture Luigi Vanvitelli, Director of the Department of Culture of Design, Director of Doctoral School in the Discipline of Architecture, Coordinator of the PhD in Protection, Safety and Representation of the Environment and Structures and Territorial Governance, Coordinator of the PhD Program in Surveying and Representation of Architecture and the Environment. He is author of numerous scientific international papers, publications and proceedings on surveying and representation of the built and natural heritage.



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XVIII INTERNATIONAL FORUM

Le Vie dei  
Mercanti



Design by Le Corbusier 1931  
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XVIII INTERNATIONAL FORUM

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Naples 11 - Capri 12|13 June 2020

## Liberty winter gardens in Palermo: contamination from solar design

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### Abstract

At the end of the 19th century, the city of Palermo boasted a tradition of steel elements that could include the most beautiful railings and light steel structures of the time. The paper shows how the technological, formal and spatial aspects of the metallic construction was derived by the application of Central Europe areas examples to the local reality, providing notions on designs, experimentations and originalities. Canopies, verandas, winter gardens and orangeries are architectural elements in iron and glass that represent an added value for the building, they improve the life quality of the people who live there. In particular, in the Liberty architecture these elements took shape through bold and richly decorated iron structures. These systems offered multiple configuration possibilities and they combined quality, design and innovation with the extraordinary advantages of iron, such as durability, stability and strength. These elements took on a decorative value and at the same time, they substantially contributed to the image and characterization of the building. In addition, they contributed to the improvement of the indoor comfort, especially in winter. The integration of glass and decorated iron had an excellent application especially in Ernesto Basile's architecture in Palermo. Ernesto Basile's Liberty period in Palermo is a happy example of technical, material and formal experimentation. This work shows the results of a research that aims to verify the permanence and variation of structural and decorative aspects of iron constructions in that historical period. Furthermore the study could define, through computational tools, models and study cases to verify the original passive system of the winter gardens conceived and developed in an empirical way but actual nowadays.

**Keywords:** Winter Garden, Liberty Architecture, Indoor comfort, CFD Analysis

### 1. European influences in the Palermo building tradition

The presence in Sicily, between the end of the 19th and the beginning of the 20th century, of some of the most prestigious families in Sicilian history such as the Florio, the Witacher, the Ingham, the Woodhouse and the Hopps determined the economic development of the island and favoured the rise of some of the most famous architects of the Liberty season in Sicily [1].

The new style was characterized by the use of new decorations and the introduction of iron and glass as innovative materials for the creation of increasingly bold structures.

Until the first half of the 19th century, due to the scarce mineral resources present on the island, the difficulties of transport and the high cost of raw materials, the foundries in Palermo and in Sicily in general, had limited themselves to an artisan type of production completely inadequate for the processing of molten iron for building use [2].

In addition to iron, coming mainly from Belgium and England, not only semi-finished products but also complete structures were imported, especially from France, which were advertised as types reproducible in the most various contexts. The first foundries in Palermo, the Oretea, founded in 1841, the Gallo (1842), the Di Maggio (1850) and the Panzera (1870) had to compete with foreign companies, such as the French Izambert, favored over the first ones not so much for a superior quality of products, but above all for the *francophilia* fed by the diffusion of magazines and catalogues that supported the myth and the primacy of France and Paris as the capital of good taste [3].

During the 19th century, however, as the difficulties of finding semi-finished metal products disappeared, it was clear that the different cultural, environmental and climatic conditions made some of the models

proposed by those magazines that were so widespread in the second half of the 19th century, not available uncritically and undifferentiated in the local reality.

It is therefore possible to distinguish, even in the area close to Palermo, cases in which the designers limited themselves on reproducing or placing examples of iron and glass architecture as if they were simple furnishing elements, other cases in which a willingness to type and a critical adaptation to the needs of the place emerged, which brought new impetus to the local production of original elements [4]. In the skylights, galleries, shelters, greenhouses and in all the new iron and glass complements of traditional and non-traditional architectures, the need for that apparent solidity sought and artificially recreated by means of structures that simulated, both in volume and decoration, the wall structures[5] disappeared. On the other hand, the smallness of the membranes and the use of glass panes of considerable size was a condition of fundamental importance, especially in the case of skylights covering the rooms with a particular architectural value, spaces intended for exhibitions or, more generally, rooms with special lighting requirements, such as the winter gardens that began to appear in the noble villas of Palermo on the basis of European culture influences [6].

Careful study was essential in southern cities where intense light casts clear shadows and the sunrays risked overheating the air under the large windows.

In Palermo, one of the first examples of the application of iron and glass architecture is a skylight made in 1860 by Carlo Giachery for the renovation of the former Ministry of State; pyramid-shaped, made with uprights converging to a ring closed by a metal cap and triangular glass panes, it has wrought iron elements on the intrados that create a stiffening between the uprights, providing an intermediate support to the glass panes and forming an ornamental motif [7].

Giachery took over from Antonino Gentile - who was the first to introduce the study of iron structures in his course, a study inspired by articles published in the *Journal du Génie Civil* - for the chair in architecture. Thanks to his expertise in the field, in 1824 Giachery succeeded in reassembling the iron stove for exotic plants built in Germany and donated by Maria Carolina Regina del Regno delle due Sicilie to the Royal Botanical Garden of Palermo.



**Fig. 1:** The "stove" of Maria Carolina at the Botanical Garden of Palermo - 1824

This greenhouse is the first example of iron and glass structure known in town. Regarding the greenhouse, Agostino Gallo in *"Notizie intorno agli architetti siciliani e agli esteri soggiornanti in Sicilia da' tempi più antiche fino al 1838"* reports the difficulty of assembling it without the builder's guidance but at the same time the ability to have the missing pieces built by the local workers who had managed to build in a short time "the showy gallery covered with crystals, above a marble floor, in which tongues of earth are fragmented where the foreign trees planted are green" [8]

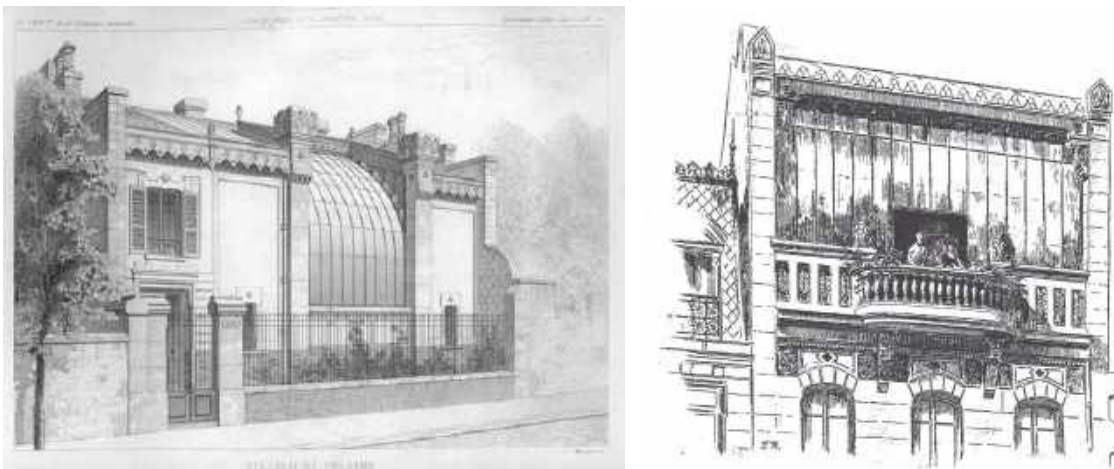


## 2. Experimentation and originality of the new iron and glass structures

It was immediately clear that iron and glass could be used to construct buildings which, in relation to the changing needs of the new bourgeois class, could provide new representative potential and improve conditions of well-being and health. Basile's visits to the Universal Exhibition in Paris in 1867 and in 1878 (on the latter occasion as the official delegate for Italy and designer of the national pavilion) enabled him to come into direct contact with the state-of-art technicians and producers, and contributed on shaping his technological awareness with regard to the potential of iron. Between the initial plans and the commencement of operations, in a period of about 8 to 10 years, which bore witness to rapid French, English and German technical scientific progress (almost always filtered through French publications). In line with the transformations that had given rise to the Universal Exhibition in Europe, in 1872 the architect Enrico Salemi from Palermo dealt with this subject in an article published in the *Nuovi Annali di Costruzioni, Arti ed Industrie di Sicilia* in which he criticized the habit of building with excessive solidity, no longer in line with the utilitarian habits of the century, praising the light iron and glass constructions that seemed to respond to the new demand for greater healthiness, solidity and decoration proportionate to the intended use, taking the shortest possible time in construction. As far as the hygienic aspects were concerned, all nineteenth-century figures of the hygienist engineer and the architecte salubriste had a considerable influence. Although the priority aim remained the construction of a functional building, solid, dignified in its appearance, which guaranteed, increasingly, the need for good hygienic standards that the slender steel structures and the large and bright windows allowed to realize [9]. Joseph Paxton - *ingénieur jardinier* as he liked to define himself - in a report read at the Society of Arts in London on the 13th of November 1850 [10], made specific reference to greenhouses as forerunners of the great crystal palaces of the Universal Expositions of the second half of the 19th century. The attempt to optimize the quantity and quality of the light that penetrated the glass structures - an essential condition for the optimal development of the exotic plants imported from the English colonies at that time - brought Paxton to experiment with new solutions that led from the first heavy and dark greenhouses in Chatsworth made of wood and glass, to lighter solutions involving the use of glass and mixed iron and wood frames with reduced thickness.

## 3. Stoves, orangeries and winter gardens

The slender iron-glass structures allowed the sunrays to penetrate into the rooms, which carried out a bactericidal action: greenhouses, winter gardens or the so-called "*serres adossées*" - often called *stoves* in 19th century documents in Palermo [11], skylights and glazed galleries were in fact elements that characterized many of the healthy architecture of the time. Moreover, in the second half of the 19th century, some types of buildings, such as artist studios and galleries for photographers, became a sort of privileged places where one could speak of a real cult for natural light. A particularly successful example of this solution, the atelier of the painter Leroux in Paris, designed by the architect Hügelin and also published in the *Revue Générale de l'Architecture et des Travaux publiques*, had a glass window of 4.70 meters wide, which was cited as a model because of the thinness of its members and the excellent lighting conditions it provided..



**Fig. 2:** Painter's studios in Paris of the painter Leroux (arch. Hugelin) (da "*Revue Générale de l'Architecture et des Travaux Publiques*")

In the late 19th century Palermo, in addition to these typologies, winter gardens such as those of the Hotel des Palmes, Villino Favalaro and Villa Malfitano, which the designer Ignazio Greco commissioned from the Izambert foundry in 1882, were very successful.



Fig. 3: The winter garden of the Hotel des Palmes (arch. Ernesto Basile, 1877).

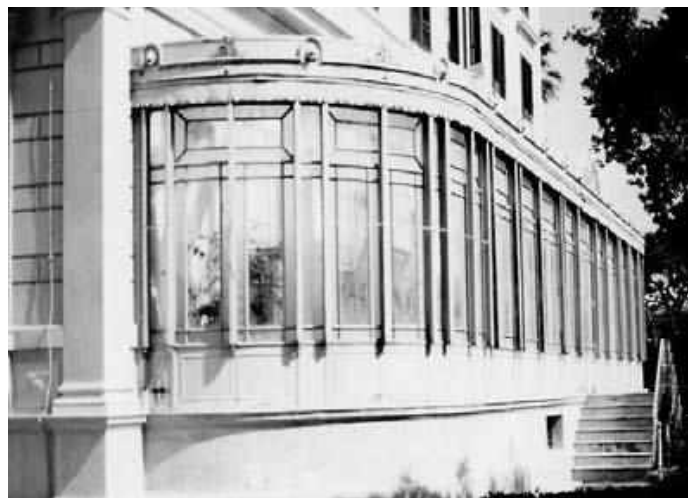


Fig. 4: The Veranda and the Orangerie of Villa Whitaker (arch. I. Greco, 1885-89). Palermo



Fig. 5: The Winter garden of the Villino Favalaro (archh. G. B. F. Basile – E. Basile, 1888-1903). Palermo

The shape of the slender iron members decorated with floral references, the large opaque glass surfaces clearly reflect the dictates of French fashion which through construction magazines spread models and typologies in continuity with the handbook of the time.

The particular conditions that had to be met by these constructions - uniform light from the north, absence of reflected light that would otherwise alter the chromatic perception, minimization of the shadows cast - were more easily realized in these constructions than in large buildings, where any technological difficulties were amplified by the larger dimensions. For this reason, the analysis of the winter garden system is more interesting and emblematic for the study of the ways and effects of natural lighting systems.



Fig. 6: The Winter garden of the Villino Favalaro and the project published on the *Journal de Serrurerie - Parigi*.

#### 4. A passive system still efficient

The daring building typologies and the innovative mechanical assembly systems constitute a repertoire of construction solutions that are still current today and in some cases usable in their "bioclimatic" function [12]. The designers' renewed attention to natural lighting as a system that contributes to energy saving and visual hygiene conditions - re-establishing the relationship between the artificial environment and the natural environment that was thought to be surrogate through technical systems - brings back to the centre of attention those construction solutions aimed at improving the conditions of light penetration into the rooms. In these architectures, conceived almost as "machines" able to make the best use of sunlight, the windows became for the first time part of the volumes no longer as a punctual element, but as large, flat and curved surfaces, in some cases even mobile, characterizing the architecture itself and able to give expression to its function through their shape [13].

The difficulty of interpretation and the perplexities expressed in some cases by the designers with regard to the expressive potential of the glass surfaces, which with their modern and in some cases mechanistic taste were affecting the composition of the fronts of the buildings along the streets of big cities, are evident in the choice made in some cases to conceal or at least to not expose the windows on the façades of buildings facing a main street or square, choosing for their location a wall facing a courtyard, or an interior garden. In other cases, when it was accepted to propose the glass surfaces as an element that contributed to the aesthetic definition of the building fronts, quality results were obtained, capable not only of solving practical problems, but also of reinventing and transforming an architecture through the creation of what could be considered new building typologies.

To avoid direct sunlight, the gallery was generally exposed to the north and closed on the south side with a solid wall. If these conditions were not feasible, the glazing would be hit by direct sunlight for some time during the day. In this circumstances a diffused light was obtained by means of opaque, frosted, granulated or striped glass panes, a solution that during the winter made the gallery less cold as it was exposed to the sun; it also had the advantage, since the amount of light absorbed by this glass is not much greater than that absorbed by transparent glass, that when the sky was overcast this absorption was compensated by the fact that the gallery was exposed to the south, towards the brightest part of the sky, while during sunny days the direct sunlight was all converted into diffused light.



Fig. 7: Exterior and interior view of the winter garden of the Villino Favalaro by E. Basile

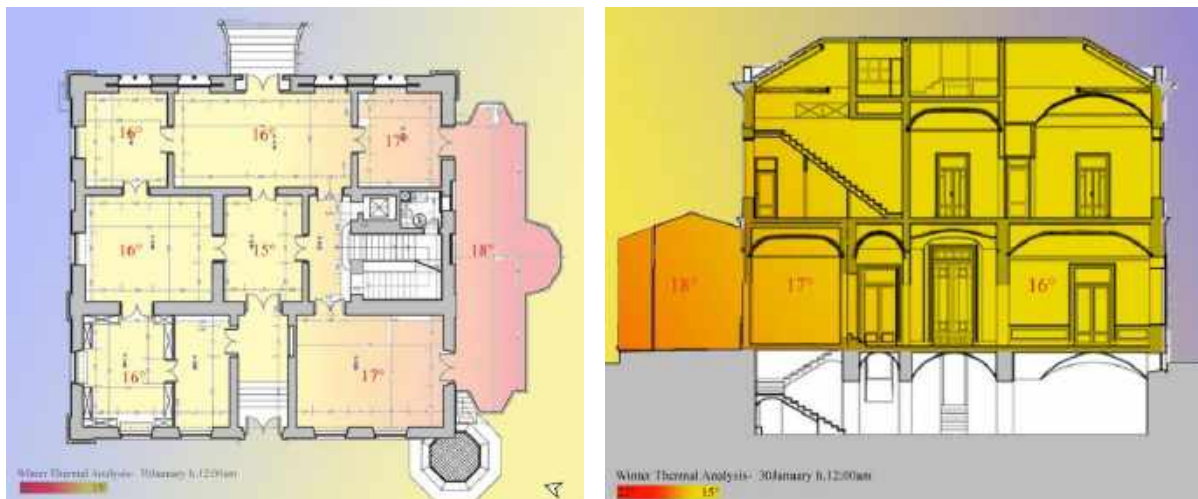
The inconvenience of summer heating was remedied by ventilation or by wetting the glass surfaces of the gallery.

The study, through computational tools, could define models and case studies to verify the original passive system of winter gardens conceived and developed in an empirical but current way nowadays. The habitable greenhouse is one of the bioclimatic systems characterized by a higher possibility of integration with architecture.

The potential of this bioclimatic system is remarkable, both from the point of view of energy efficiency and of expression and architectural language. Solar space systems consist of a greenhouse environment delimited by one or more glass walls which can be configured as a building volume attached to the bioclimatic building or included in to the building volume. Inside the greenhouse space there is a significant increase in temperature and the heat is transferred to the rear rooms in different ways according to which there are different system configurations.

Specific simulations were carried out using the CFD software to test the hypotheses concerning the movement of air and temperature control inside the Villino Favaloro.

The time frame analysed is between 8 a.m. and 15 a.m. With regard to the building, the rubble-filled stone wall has been schematized by setting a material whose thermo-physical properties are the weighted mean between real materials values. In particular, density (1306kg/m<sup>3</sup>), specific heat (1362J/kgK) and thermal conductivity (0.64W/mK) have been considered. In the software the temporal development of the phenomenon is not-continuous, therefore the simulation considers "time steps" lasting three hours. Looking at the results obtained at 12 a.m. and at 3 p.m., it can be observed that solar radiation heat on exposed surfaces cannot entirely conduct itself through the wall, but affects only the outer portion. The wall dissipates heat, due to radiation, during the day and acts as an insulator, thanks to the constituent material features, but more importantly thanks to its thickness.



**Fig. 8:** CFD analysis in winter - 12 p.m - winter garden-Villino Favaloro.



**Fig. 9:** CFD analysis in summer in two different condition (closed and open Windows)- 12 p.m - winter garden-Villino Favaloro.

With regards to the effects of natural ventilation, during the daily hours without wind (6 to 12 a.m.), it can be observed that natural ventilation rises up in to the rooms.

It happens because of the thermal gradient which is established between external and internal environments. It is more evident in the rooms on the East side of the building, which undergoes only a soft radiance during the morning.

The analysis carried out are divided into three types: a) winter analysis, b) summer analysis with window frames open towards the veranda and c) summer analysis with closed window frames to create a filtered area. It can be seen how the presence of the winter garden, designed and located on the south side of the building, influences the internal temperatures of the Villino, especially of the spaces adjacent with this environment [13].

Once the simulations have been made, it can be seen that even during the summer, keeping the windows closed, the veranda creates a thermal buffer zone that acts as a filter for the very high external temperatures. The thermal analysis performed shows that the winter garden of the Villino Favalaro is an integral part of the thermal functioning of the house, as it influences all thermal behaviour both summer and winter.

## 5. Conclusion: safeguard hypothesis

The aim of the research was to focus attention on the exceptional correspondence that is found between the winter garden air conditioning system and the technological solutions that a new way of doing architecture is experimenting in today's landscape of construction [14]. The research wants to verify the relationship between the construction technology developed in the Liberty in Palermo and the rules imported from the European culture. The contamination from other place and constructive rules have been fundamental to create a new particular Liberty style.

Between the 1880s and '90s one can witness the construction of a great number of exclusive homes, which became famous among foreign travellers because of good taste on display in interiors, for their flamboyant gardens and for the experimentation of new materials, decorative apparatuses and new building typologies. This rapid construction had characterized the first growth of the suburban nuclei that arose along the *extra moenia* streets of the city. The new construction elements in steel and glass, designed to improve the healthiness of the rooms, of clear English-reference, had imprinted an imprint of renewal symbol of the ascendant bourgeois class. The iron structures of the Winter Gardens showed constructive elements and members so slim to be on the limit of structural efficiency. They lightly supported the glass plates that enclosed the space. In addition to the aesthetic decoration, they had the function to improve winter comfort by guarantee natural ventilation and levels of comfort that could be satisfactory even nowadays.



Fig. 10: Route between iron and glass buildings in liberty architecture in Palermo

Currently, a project is underway to recover the Liberty tradition by UNESCO. The municipal council of Palermo has proposed to the Sicilian parliament the candidacy of the Palermitan and Sicilian Liberty to be included in the list of UNESCO cultural heritage. Including among the works all the Villini Palermitani, the Liberty itineraries such as Via Libertà, the large buildings, Villa Igiea, and all the works by Basile and the architects and craftsmen of the period. The possibility to demonstrate the actuality of the technological iron and glass application give an add value to this architectures.

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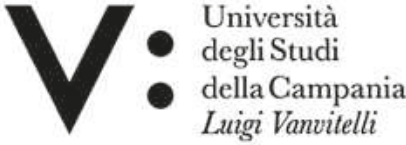
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