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The Recent History of Balcony Design in Housing Buildings as an Archetype of Well-Being

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This article covers the evolution of the balcony archetype since the late nineteenth century when this element, identified as cellular and isolated, a private space above the public and collective realm, took on a significant role in housing buildings. Using analysis of the literature and primary sources, the aim of this overview is to understand the main paradigms and concerns that conditioned the design of balconies and to contribute to the redefinition of the Mediterranean balcony. In this study, a division of recent balcony design history is proposed into three key periods: the rise of open balconies in the nineteenth century related to the new health and hygiene standards; the mid-twentieth century reinterpretation of the traditional shading systems for sunlight and ventilation control on balconies; and the popularization of the glazed balconies on the 1970s in response to the energy crisis. This understanding of how the exploration of balcony design was shaped by the search for comfort and well-being at each moment could contribute to more sustainable housing models in Southern Mediterranean countries.

1 Introduction

During the nineteenth century, the balcony became widespread in Europe thanks to its revolutionary functions of introducing air, light and openness into modern households. At that time, in response to the spread of lung diseases that shattered European cities, the balcony became associated with new standards of health and hygiene and adopted as a symbol of modern life.[1] Marked by this genesis, balconies were still considered to increase the perception of liveability in dwellings when the development of compact and high-density cities became a strategy to promote sustainable development during the last century.

The relevance of balconies as an archetype of well-being was also highlighted during the recent Covid-19 pandemic, when balconies once again became associated with the benefits of being in the open air.[2] In a moment that can be enlightened by a parallel with the past, the pandemic crisis emphasised the collective desire to have a private outdoor space in dwellings and stressed the need to rethink balcony design for the welfare of the community.[3]

Nevertheless, the practice of closing or eliminating balconies is global and ancient, and it has deeply modified the image of some urban environments worldwide. Since the era of vernacular architecture, numerous instances have been observed when inhabitants made adaptations to their balconies, whether it be enclosing them with shutters or glazing, or even eliminating them entirely, which mirrored the cultural and environmental paradigms of each respective period.

The contradictions inherent to this archetype of well-being cause increased uncertainty in the design process. And, in a moment when the balcony archetype is under redefinition in the Mediterranean context,[4] it seems relevant to contribute to the current discussion about the most appropriate design balcony. This can be done by reconstructing the evolution of balcony design in housing buildings throughout some paradigmatic moments of history in which environmental concerns shaped the balcony design.

Therefore, this article covers the evolution of balcony design since the late nineteenth century, when balconies took on a significant role in housing buildings and climate concerns were considered to be directly incorporated into the envelope design.[5] The article is focused on the archetype of private balconies in housing collective buildings in urban contexts which, as explained by Rem Koolhaas in the retrospective *Elements of Architecture*, differ from their "cousins" the porches, or the verandas, because they are roofed platforms along the outside of a house on the ground floor level; from the terraces and loggias since they are un-cantilevered, on the ground or on a roof; and from the gallery (a street in the sky), because it is an elevated walkway that runs alongside the flank of a building, connecting apartments. In contrast, the balcony was identified as cellular

1 Paul Overy, *Light, air and openness: modern architecture between the Awars* (Thames and Hudson Ltd, 2008).

2 Bernardo Zacka, "An Ode to the Humble Balcony," *The New York Times* (2020), https://www.nytimes.com/2020/05/09/opinion/covid-balconies-architecture.html.

3 Efthalia Thaleia Grigoriadou, "The urban balcony as the new public space for well-being in times of social distancing," *Cities & Health* (2020), https://doi.org/10.1080/23748834.2020.1795405.

4 Tom Avermaete, *The impossibility of a Universal Balcony: mutations of a modern element across the Mediterranean*, vol. Elements - balcony (Venezia: Marsilio, 2014).

5 Alejandro Zaera-Polo and Jeffrey S. Anderson, *The Ecologies of the Building Envelope. A Material History and Theory of Architectural Surfaces.* (New York, Barcelona: Actar Publishers, 2021).

and isolated, a private space above the public and collective realm, that balances these two poles.[6] Considering a more generalist overview, the evolution of balcony design is mainly centred on the European context, with a special incidence in the specificities and needs of Southern European countries. Consequently, throughout the analysis of the literature and primary sources (such as drawings and architectural treatises, among others), this paper propose the main stages of evolution of balcony design according to some paradigmatic moments. While the approach is mainly historical, it aims to inform the contemporary debate about the more accurate balcony design options to improve the indoor environment of dwellings in the Mediterranean context.

2 The evolution of Balcony design throughout history

The overview of the literature on the evolution of balcony design allowed the identification of the main trends, each related to paradigmatic moments when concerns with the environment influenced the configurations of the limits of balconies. This study proposes the division of these trends on the design of balconies into distinct moments, as shown in figure 1. The proposed division is somewhat rigid and generalizes trends rather than being sensitive to them. It is relevant to note that the limits between the periods are blurred and that the earlier balcony trends continue to exist, as the new ones do not replace them.

However, this division into time periods allowed for the identification of the main closing boundary systems of each one,[7] which is

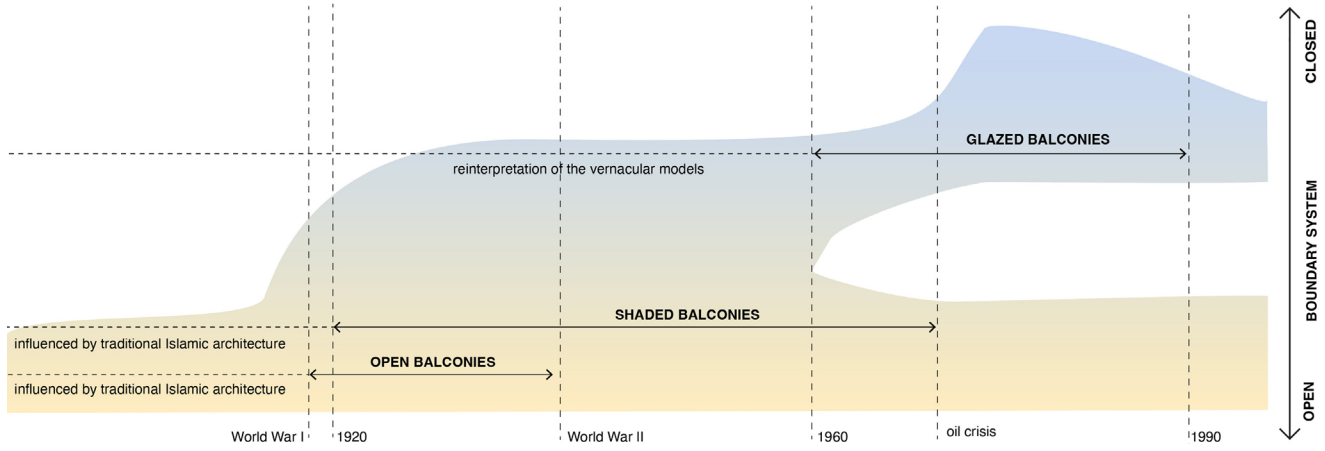
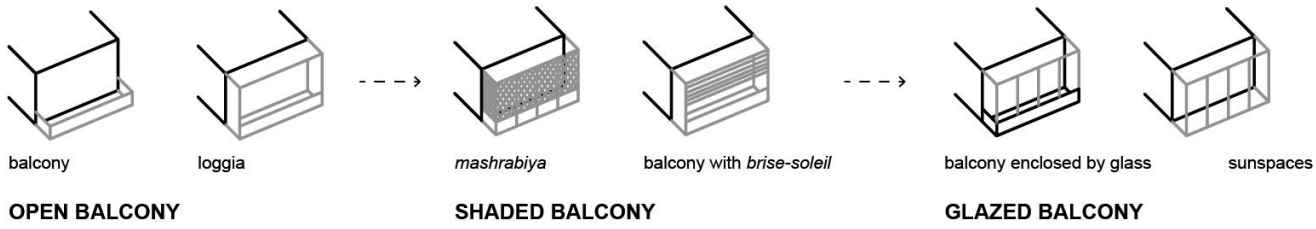


fig.1 The evolution of balcony design between the boundary system and the valorisation trend.

6 Tom Avermaete and Rem Koolhaas, *Elements — balcony* (Venezia: Marsilio, 2014).

7 Ravi Srinivasan and Kiel Moe, *The hierarchy of energy in architecture: emergy analysis* (Routledge, 2015).

fig. 2 Main balcony closing boundary systems.



fundamental to the redefinition of the balcony archetype, illustrated in figure 2, and could be defined as follows:

- open system to the outside, such as projecting balconies, loggias — related to the association of the open balcony with new health and hygiene standards in the late nineteenth century and the consequent importance they acquired in the period between the great wars as an element capable of introducing light, air, and openness into modern dwellings.
- open system to the outside protected by shading systems, such as balconies with brise-soleil, blinds, curtains, and with vegetation — linked to the exploration of shading elements on balconies in the middle of the twentieth century as new components to better control sunlight and ventilation influenced by traditional Islamic architecture, such as the *mashrabiyas*.
- closed system, such as balconies enclosed by glass at their outer edge, otherwise known as *sunspace*s, *wintergardens* and *conservatories* — associated with the reinterpretation of the vernacular models of balconies enclosed by glass during the 1970s energy crisis as a device for capturing and storing solar radiation and reducing energy consumption.

The following text presents the main environmental concerns that conditioned the configurations of balconies, illustrated with some relevant examples of housing buildings in the European context.

2.1 Air, light and openness in the modern way of life

It was during the nineteenth century that the balcony, more than a decorative element, became associated with the new ideals of the "modern way of life" and assumed a main role in housing buildings. In the opinion of architectural historians, this trend was so relevant that the "*mode des balcons*" became a widespread practice and "there is no modern house that does

not have several."[8] In conflict with the proliferation of this element, in his *Dictionnaire Historique d'Architecture,* De Quincy criticises the independent nature of balconies in relation to the main construction, adding that it is an element that disturbs the order of palace and house façades and is "foreign to good architecture."

The construction of Haussmann's boulevards in 1850s Paris is considered to be the moment when "modern balconies" took a central role in dwellings. The critic Tom Avermaete suggests that the conditions were created to accelerate the already ongoing process of turning balconies, which were reserved for aristocratic and public buildings, into a feature of the dwellings of the rising bourgeoisie.[9] The new boulevards were composed of imposing housing buildings, in which the balconies were a symbol of modernity, and the ornamented rails were an indicator of the social status of the dwellers, often portrayed by writers and artists of that time (figure 3).

The hygienist concerns of the late nineteenth century also contributed to the growing importance of the balconies in dwellings, associated with new standards of health and hygiene. The medical conviction in the benefits of fresh air and sunlight as cures for tuberculosis and pulmonary disease that shattered the European cities led to the proliferation of sanatoriums, in which large balconies for treatment in the fresh air became one of the main design characteristics.[10]

Between the 1920s and '30s, modern architects identified the balcony as an element of common application which was capable of introducing sun and fresh air into modern dwellings.[11] In a small book

fig.3 Balcón, Boulevard Haussmann (Cailebotte 1880).

8 Quatremère De Quincy, *Dictionnaire historique d'architecture* (Paris: le Clere, 1832).

9 Tom Avermaete, "Paris, 19th century: La mode des balcon," in *Elements - balcony*, ed. Tom Avermaete, Rem Koolhaas, and Amo (Venice: Marsilio 2014).

10 Ken Worpole, *Here comes the sun: architecture and public space in twentieth-century European culture* (London, UK: Reaktion Books, 2000).

11 Xhulio Binjaku, "Vitamin D Architecture," *e-flux Architecture* Sick Architecture (2022), https://www.e-flux.com/architecture/sick-architecture/453875/vitamin-d-architecture/.

fig.4 "Baby cage," London, 1930s (Cox 1935).

published in 1929, *Befreites Wohnen* (*Liberated Dwelling*), which followed the first *Congrès International d'Architecture Moderne* (CIAM), Siegfried Giedion presented "air, light and openness" as the main tenets of modern architecture.[12]

In this sense, in existing buildings that did not have balconies in England and the United States, having "baby cages" or "bird cages for babies" (figure 4) became a widespread practice during these decades. The advantages of these structures for putting young children in the fresh air outside housing buildings were advertised, and the Royal Institute of British Architects (RIBA) released a memorandum advocating the importance of "balconies for babies in flats," adding that a dwelling without a balcony is "as incomplete as a flat without a bathroom."[13] This practice was abandoned in the middle of the twentieth century when tuberculosis decreased thanks to vaccines, new treatments, and better ventilated dwellings.

According to Nikolaus Pevsner, the modern movement did not emerge because of the new potentialities of the steel frame and reinforced concrete; but instead because the new spirit of the time required them to.[14] Indeed, for Kenneth Frampton, it was the diffusion of reinforced concrete and new modern thought that brought the balcony, after a period of further magnificence recognisable in the art nouveau floral evolutions, to less lavish, more composed and rigorous forms.[15]

With modernity, the idea of the possibility and responsibility of transforming the world also arose in architects.[16] Therefore, in parallel

12 Sigfried Giedion, *Building in France, building in iron, building in ferroconcrete*, vol. 1995 (Canada: Getty Publications, 1995 [1928]).

13 Re Inald John Hands Cox, "Balconies for babies in flats," *The British Medical Journal* (1935), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2459502/pdf/brmedj07551-0079a.pdf.

14 Nikolaus Pevsner, *An outline of European architecture* (Harmondsworth: Penguin Books, 1988).

15 Kenneth Frampton, *Modern Architecture: A Critical History* (London: Thames and Hudson, 1985).

16 Ana Tostões, *A Idade Maior. Cultura e tecnologia na arquitectura moderna portuguesa* (Porto Faculdade de Arquitectura da Universidade do Porto 978–980–8527–04–2, 2015).

with the political exploitation of the balcony as an instrument to exert power in several dictatorial regimes around Europe in the twenties and thirties, some architects adopted the balcony as a tool to promote social emancipation.[17] Due to already being considered a symbol of bourgeois leisure and health, the balcony became an element that architects associated with their newfound social mission.

In the modern and social utopias that followed the period of huge housing demand post World War I, the balcony became a primordial element in the construction of the large complexes that emerged across Europe.[18] Based on the ideals of efficiency and "minimum existence," massive high-rise housing complexes were constructed according to the concept of a house as a *machine-à-habiter (*a machine for living in),[19] to respond not only to the growing population but also to the challenges presented by the change on family structures.

Within the remarkable housing schemes that emerged mainly in the centre of Europe, several examples explored the social role and plasticity of balconies. From a wide range of examples, the present overview underlines some that illustrate the fundamental role that balconies assumed in Europe during the period between wars (1918–39), as well as the impact that this moment still has in contemporary architecture, which is placed on the map in figure 5.

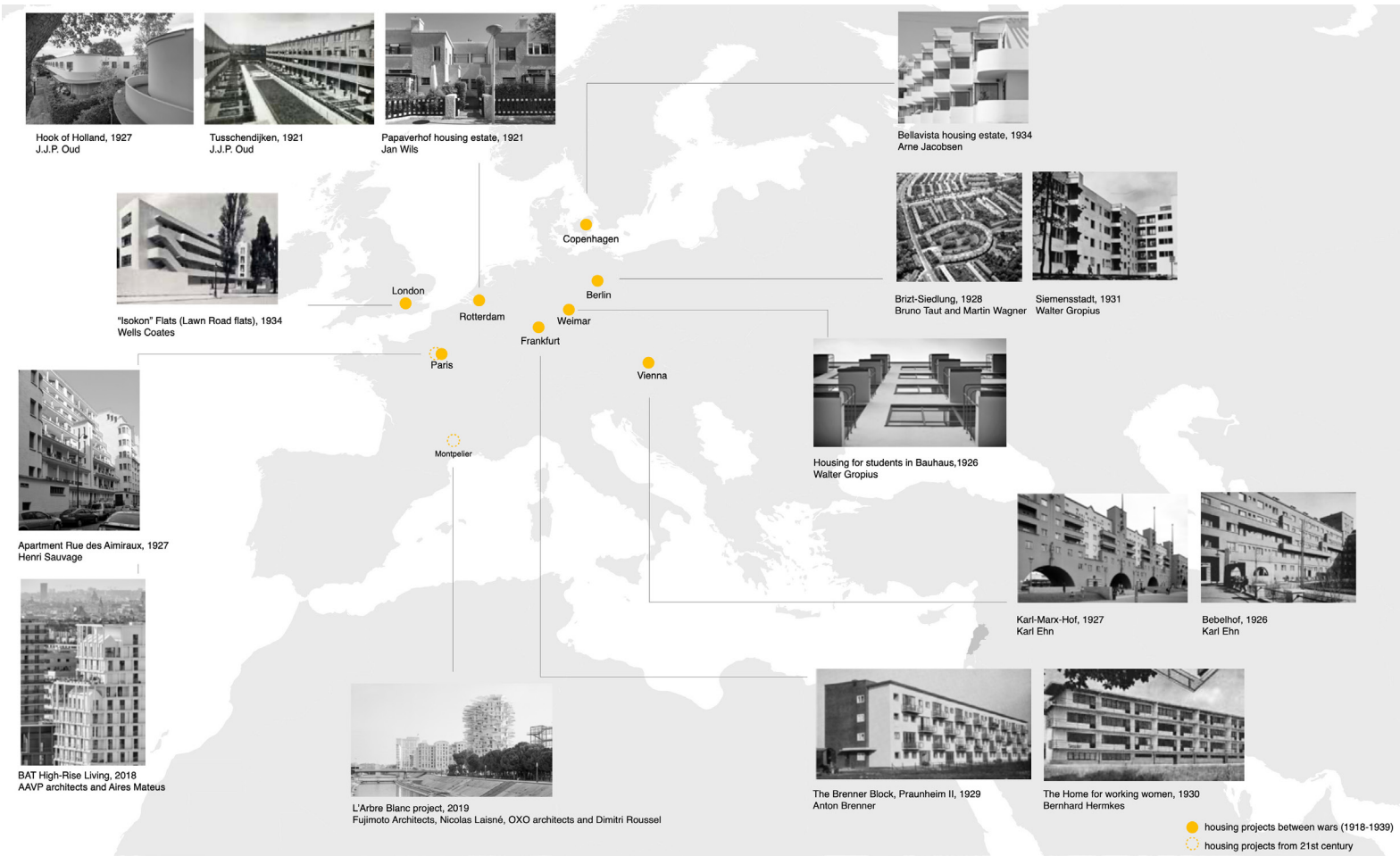
Among those, the early modernist examples of Rotterdam housing reform can be highlighted, such as the Hook of Holland, designed by J.J.P. Oud, in 1927, due to the outstanding expressive formal design of the balconies with round extremities.[20] This construction contrasts with the austerity of the previous complex Tusschendijken, designed in 1921 by J.J.P. Oud; and with the Papaverhof housing estate, designed by Jan Wills in 1921, that maintained the importance attributed to access to the open air.

In Frankfurt, where the trade unions and social democratic co-cooperatives were most effective in influencing politics during the Weimar Republic, some of the most emblematic housing schemes of the 1920s were built. Under the direction of Ernest May, who was invited in 1925 to work as a city architect, in Brenner Block, Praunheim II, projected by Anton Brenner in 1929, the cantilevered balconies were constructed to be interleaved, in order to provide each of the apartments with their own outdoor space and the same amount of light. In this and other examples, such as the Home for working women, projected by Bernhard Hermkes in 1930, the large balconies contrast with the efficiency and economy of the interior spaces designed according to "existence-minimum" spatial patterns.[21]

Although patronage in Berlin worked differently from Frankfurt, according to William Curis, there were also some remarkable housing schemes there.[22] Curtis highlighted those by Walter Gropius for the Siemensstad in 1931, in which the balconies have an identical shape to

17 Avermaete, *The impossibility of a Universal Balcony: mutations of a modern element across the Mediterranean*, Elements — balcony.
18 Manfredo Tafuri, *Vienna rossa: la politica residenziale nella Vienna socialista, 1919–1933* (Milano: Electra, 1980).
19 Le Corbusier, *Towards a new architecture* (Courier Corporation, 2013 [1931]).
20 William JR Curtis, *Modern architecture since 1900* (London: Phaidon, 1996).
21 Frampton, *Modern Architecture: A Critical History*.
22 Curtis, *Modern architecture since 1900*.

fig.5 Mapping of housing projects in which balconies assumed a central role between wars and their repercussion in Mediterranean housing from twenty-first-century projects.



those he designed five years earlier for his Housing for students in Bauhaus; and those by Bruno Taut and Martin Wagner at the Brizt-Siedlung (1929).

The massive demand for housing in 1920s Vienna, shaped by the social-democratic ideals of the Red Vienna Movement, led to the construction of colossal super-blocks with their own collective facilities — known as "Hof." In these large complexes, such as the Karl-Marx-Hof, in 1927 and Bebelhof, in 1926, both projected by Karl Ehn, balconies had a great prominence, highlighting the democratic access to the open air and the image of robustness of these enormous structures which became known as "worker's fortresses."

The exploration of the plasticity and potential of balconies was also notable in the Apartments Rue des Amiraux (1923–24) in Paris, built on the HBM (Habitation à Bon Marché) social housing programmes. In this building, designed by Henri Sauvage for the working class, the façade was made up of a stepped-terrace system with a pyramidal shape. This ziggurat structure, which was a recurring theme in Henri Sauvage's work, provided multiple balcony platforms and allowed sunlight and air to penetrate the central core of densely packed housing units.[23]

As modern architecture spread to Britain and Scandinavia in the mid-1930s and these regions became some of the most active centres of modern experimentation, balconies remained a central element in the housing scheme. In the High Point I flats (1935), designed by Berthold Lubetkin and the Tecton group in London and considered by Kenneth Frampton as a masterpiece for its indoor organization and arrangement on the plot, balconies were assumed as a fundamental element for the connection between the outdoors and the indoor living area.[24] Similarly, in the Isokon Flats (1938), designed by Wells Coates, considered an emblem of a new way of life in the British context, deep balconies connected the longitudinal apartments and collective spaces, such as a bar and a terrace, as a tribute to public and social life. In Copenhagen, the Bellavista Housing Estate, designed by Arne Jacobsen (1934), was a reinterpretation of the Siedlung housing blocks where balconies acquired greater plasticity to achieve maximum sunlight and views of the sea.

In comparison to the exceptional pre-war character, balconies began to multiply in buildings as architectural elements that allowed all inhabitants to access the city. The spatial continuity between interior and exterior was considered by Alison and Peter Smithson as one of the tenets of the modern architecture period.[25] This understanding was shared by the critic and architect Tom Avermaete, who, in his historical retrospective of the balcony element, wrote that one of the primordial roles of balconies in post-war housing projects had been to connect the relationship between individual and collective, between the particular and the ordinary, and between the public and the private.[26] According to this author, these modern concepts of connection had been especially experimented with in

23 Margaret Campbell, "Strange bedfellows: modernism and tuberculosis," in *Imperfect health: The medicalization of architecture* (Montreal, Quebec: Canadian centre for architecture and Lars Müller Publishers, 2012).
24 Frampton, *Modern Architecture: A Critical History*.
25 Alison and Peter Smithson, *The Charged Voided: Architecture* (New York The Monacelli Press, 2001).
26 Avermaete, *The impossibility of a Universal Balcony: mutations of a modern element across the Mediterranean*, Elements - balcony.

the Mediterranean basin, in a pivot between new social democratic regimes and decolonizing countries.

In Portugal, following the movement that began primarily in central Europe in the inter-war period, it is considered that the continuity between inside and outside was only intensely explored in housing buildings starting in the 1950s, when the ideals of the modern movement were fully assimilated into the architecture.[27] One of the earliest modern examples was considered to be the Edifício Carvalhosa, projected by the architects Arménio Losa and Cassiano Barbosa for the Rua da Boavista, a private income-generating building, in Porto in 1945 (constructed in 1953). This example is recognised as an innovative typological solution based on rationality,[28] in which, following the principles of the modern movement, each house was provided with a south-facing balcony-solarium as an extension of the indoor living room.

From Barcelona to Athens, Tel Aviv, and Lisbon, the design of balconies in the Mediterranean basin took advantage of favourable climatic conditions. The experimentation with the relationship between interior and exterior in dwellings, which characterised the architecture of Mediterranean countries in the modern movement, has had repercussions to this day. Due to the risk of leaving out relevant current examples, a portrait of ongoing architectonic experiments with the balcony element will not be made in this work. Instead, I will only mention the projects L'Arbre Blanc in Montpellier, designed in 2019 by the architects collective composed of Fujimoto Architects + Nicolas Laisné + OXO architects + Dimitri Roussel, and BAT High-Rise Living, in Paris, designed in 2018 by AAVP architects and Aires Mateus, in which the long, deep balconies are assumed as part of the project core and defined the image of these housing collective buildings.

2.2 From "mashrabiya" to the deep envelope

Since the Middle Ages, the benefits of *mashrabiya* have been explored as an element of protection in traditional Islamic architecture. These three-dimensional carved wood lattice screens are composed of small wooden balusters, circular in sections and arranged at specific regular intervals, often in a decorative and intricate geometric pattern, and were applied to windows and balconies of some traditional houses to create protection from the outside. Based on the principles of privacy, which state that strangers should not be able to penetrate the intimacy of the home, the *mashrabiya* worked as an architectural veil, similar in function to its textile counterpart, allowing the inhabitants, especially women, to see the movement of the street through the screen, while ensuring their privacy.[29]

Mashrabiya is considered to have emerged in traditional Egyptian architecture in the early Middle Ages and that from there it spread through the Umayyad Caliphate to the Middle East, North Africa and the Iberian Peninsula, and later to South America. However, its diffusion in domestic

27 Tostões, *A Idade Maior. Cultura e tecnologia na arquitectura moderna portuguesa*.

28 Sérgio Fernandez, *Percurso pela Arquitectura Portuguesa 1930–1974* (Porto Faculdade de Arquitectura da Universidade do Porto, 1985).

29 Bechir Kenzari and Yasser Elsheshtawy, "The ambiguous veil: On transparency, the Mashrabiy'ya, and architecture," *Journal of Architectural Education* 56, no. 4 (2003).

architecture can historically be traced to Mamluk and Ottoman periods (1517~1905). Due to being assumed as a suitable solution to improve the indoor environment in arid and tropical climates, the Egyptian *mashrabiya* had a wide dispersion and acquired a considerable variety of styles, identities and designations depending on the location. These devices are known in Yemen as *takhrima* (that which is full of holes), in Tunis as *barqli*, in Algeria as *shamashil*, in Jeddah, Saudi Arabia, as *rowshin*, and similarly, are called *confesionarios* in Spain*, coloniales i*n Peru and *muxarabis* in Northeastern Brazil.[30] In Portugal, the Survey of Portuguese Architecture conducted by the Portuguese College of Architects in the 1960s identified some of these wood screens structures (figure 6), dating back to the seventeenth and eighteenth centuries.[31]

According to Hassan Fathy, the *mashrabiya* had a social but also an environmental purpose. Fathy attributes five main functional roles to *mashrabiya*: controlling the passage of light; controlling airflow; reducing air temperature; increasing air humidity; and ensuring the privacy of the inhabitants, adding that it remains a useful device for improving the indoor environment in housing design.[32] Moreover, indeed, the influence of these traditional elements on modern architecture is recognised.[33] In this period of significant constructive innovations, these screen structures were explored for their capacity to control indoor environmental conditions.

According to several authors, after his journeys to South America (1929) and later to Algiers (1933), Le Corbusier reinterpreted traditional elements, such as *musharabi,* loggias, courtyards, and *mashrabiya,* as new components for protection and passive control of sunlight and ventilation.[34]

30 P. Privitera, M. Diodato, and S. García Sáez, "Solar radiation influence on pre-modern openings features: La Coruña and Valletta," in *Vernacular Architecture: Towards a Sustainable Future* (CRC Press, 2014).

31 AAVV Francisco Keil do Amaral, *Arquitectura Popular em Portugal* 4ª edição ed., ed. Ordem dos Arquitectos – Conselho Directivo Nacional (2004 [1961]).

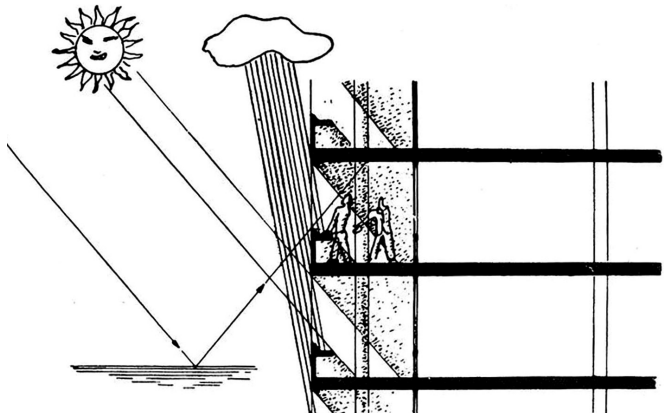
32 Hassan Fathy, *Natural energy and vernacular architecture* (University of Chicago Press, Chicago, IL, 1986).

33 Kenzari and Elsheshtawy, "The ambiguous veil: On transparency, the Mashrabiy'ya, and architecture."

34 C. E. Pastor, "The integration of light: LeCorbusier," Article, *EGA Revista de Expression Grafica Arquitectonica* 23, no. 32 (2018), https://doi.org/10.4995/ega.2018.9804, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85047768747&doi=10.4995%2fega.2018.9804&partnerID=40&md5=623bc4e279a5a791dd0566b86d99a2f1.

fig.6 Mashrabiya, Guimarães, 2018.

fig.7 Le Corbusier sketch (Frampton 2001).



This exploration originated the development of the brise-soleil shared loggia, which for architectural critic Reyner Banham was one of the last structural (passive) innovations for controlling the environment. Banham considers that Le Corbusier returned to the advantages of traditional massive walls after his other master concepts had not been as successful for environmental management: le *mur neutralisant,* a hermetically sealed air cavity system tempered and controlled by the *respiration exacte* effect.[35]

After testing a screen system composed of distinct layers of curtains in La Clarté, in Geneve (1932), some decades later, in Marseille's Unite d'Habitation (1952), Le Corbusier applied independent loggias protected by brise-soleil, creating a "semi-lifted mask" that screened the outdoor environmental factors across the indoor living spaces. Using sunlight as an important design tool, Corbusier systematically studied the capacity of *loggia-brise-soleil* (figure 7) to generate shadows and protection.[36]

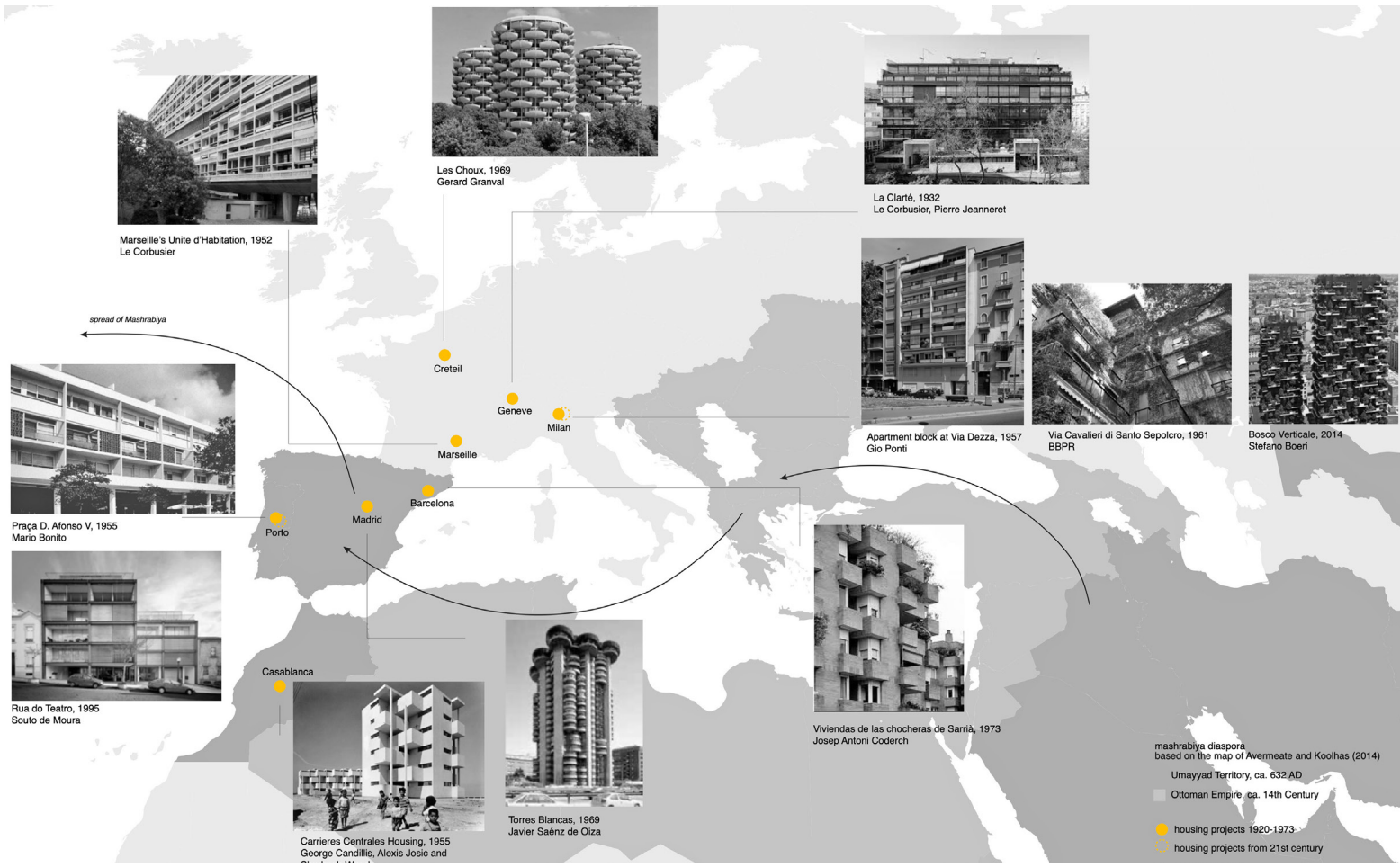
In the decades following World War II, the design of outdoor collective spaces decreased in importance. Mainly in high-rise housing developments, terraces and galleries almost disappeared, and the private balcony was considered an attempt to compensate for the loss of these collective spaces. From there, the depth of the envelope with cavities and the dissolution of the façade boundaries through a variety of shading systems were tested as ways to control the interior environment and ensure maximum privacy while maintaining a view of the outside.

On the map in figure 8, some examples of balcony shading systems dating between 1920 and 1973 are placed in their geographic locations. These were referred to in the following overview because traditional Islamic wood screens strongly influenced them and were a reference for the shading systems tested during the early twenty-first century.

35 Reyner Banham, *The architecture of the Well-temepered Environment*, ed. Second Edition (Chicago: The University of Chicago Press, 1984 [1969]).

36 I. Requena-Ruiz, "Bioclimatism in the Architecture of Le Corbusier: The millowners association building," Article, *Informes de la Construccion* 64, no. 528 (2012), https://doi.org/10.3989/ic.11.121, https://www.scopus.com/inward/record.uri?eid=2-s2.0-84874003447&doi=10.3989%2fic.11.121&partnerID=40&md5=8fd96b498032754589350a2328a4d6dc.

fig. 8 Mapping of housing projects between 1920 and 1973 and their repercussions in the twenty-first century.



In Milan in 1957, the architect Gio Ponti reinterpreted the archetype of the Mediterranean balcony basin in the design of the Apartments Block at Via Dezza. Gio Ponti updated the traditional *mashrabiyas* and loggias of the region, designing the balconies as a screening element between the house and the city. The balconies, which he called "inhabitable viewing frames," were composed of multiple layers of frames, screens, and surfaces, a created canvas for distinct forms of appropriation through everyday objects, plants, and art. In his projects, mostly not realised, Gio Ponti addressed the importance of the balcony, highlighting its ability to offer inhabitants an active role in defining the environment through their intervention in the closing elements of the façades.

In the Mediterranean context of the following decades, deep balconies were designed not only to control indoor environmental conditions but also to create individuality in mass housing projects. In Madrid, in 1969, Javier Saénz de Oiza used circular balconies on the Torres Blancas project to redefine the image of the modern skyscrapers and to emphasise the collective character of Mediterranean culture.

The appropriation of housing buildings by their inhabitants was also explored by Antonio Coderch. At the TEAM 10 group meeting in Royaumont in 1962, Coderch presented a collage of balconied structures, coining the balcony as an element that promotes the participation of the future user, suggesting new shared responsibilities in the co-production of new buildings. His conception of the balconies in Viviendas de las chocheras de Sarrià in Barcelona in 1973 as polyvalent spaces reflects the ongoing exploration of the connection between the private and the public domains.[37] Almost simultaneously, the plasticity of the balcony elements was also explored in the massive housing project Walden 7 (1975) by Riccardo Boffil in Barcelona, and in Les Choux, in Creteil, near Paris, by Gerard Granval, to reduce the feeling of anonymity in emerging mass housing projects.

Shading systems on existing balconies were also developed due to the inhabitants' preference for closing them. The complex and multifunctional shading systems that emerged in Tel Aviv in the 1930s and 1940s were a paradigmatic example of this practice. In the 1960s and 1970s, this system became not only a clandestine practice but was also adopted by builders and architects.[38]

During the following decades, across the Mediterranean, from Spain and France, to Italy, and from Israel and Algeria to Mocorro, shaded screened balconies were subject to constant revisions and mutations. Alongside systems for sifting light and creating privacy on balconies, such as curtains and wooden structures, the use of vegetation on façades has also been intensively tested. In Milan, the collective of architects BBPR, famous for the Torre Velasca, developed a series of projects

37 Julio Barcena, "JA Coderch y "Las Cocheras de Sarrià" (1968–75): de la domus al Team 10" (paper presented at the Pioneros de la arquitectura moderna española: el proceso del proyecto = Pioneers of modern Spanish architecture: the design process, 2021).

38 Carolin Aronis, "The balconies of Tel-Aviv: cultural history and urban politics," *Israel Studies* (2009).

across the city recapping the concept of "*edificio a gradoni*" with thick vegetation protecting the balconies. The 1961 building on Via Cavalieri di Santo Sepolcro, with a cascading green balcony, became a reference for similar housing projects of the twenty-first century, such as the Bosco Verticale, designed by Stefano Boeri and constructed in 2014 in Milan, which is a tower with large planters for vegetation inserted at the edges of its balconies.

In Portugal, precast concrete brick assembled panels have been widely applied as a current system to screen light and views on balconies. The building of Praça D. Afonso V (1952–55) in Porto, designed by Mario Bonito, where open concrete bricks create shade over the west-facing balconies, is an outstanding example of this practice. During the following decades, other systems were tested, such as the openable metallic shutters to create distinct degrees of permeability, that contributed to emphasizing the geometric and abstract image of the housing building at Rua do Teatro (1992–95), in Porto projected by Eduardo Souto de Moura.

The intense experimentation of the shading systems in balconies between 1920 and 1973 influenced the contemporary trend towards a deep, porous, spatial envelope as an architectural assembly that allows view, shade and air to breathe across the depth of the facade, operate alongside performance concerns as a set of filters capable of mediate the outside atmosphere.

2.3 From vernacular architecture to energy concerns

The development of the first greenhouses of the eighteenth century, together with progress in the glass industry, and the beginning of large experiments with iron and glass, led to adaptations in traditional constructions to the specific climate conditions of each context. The arrival of large-space glassmaking technologies coincides with the so-called Era of Enlightenment, a moment when the transparency in buildings was associated with liberation from the obscurity of the *Ancien Régime*.[39]

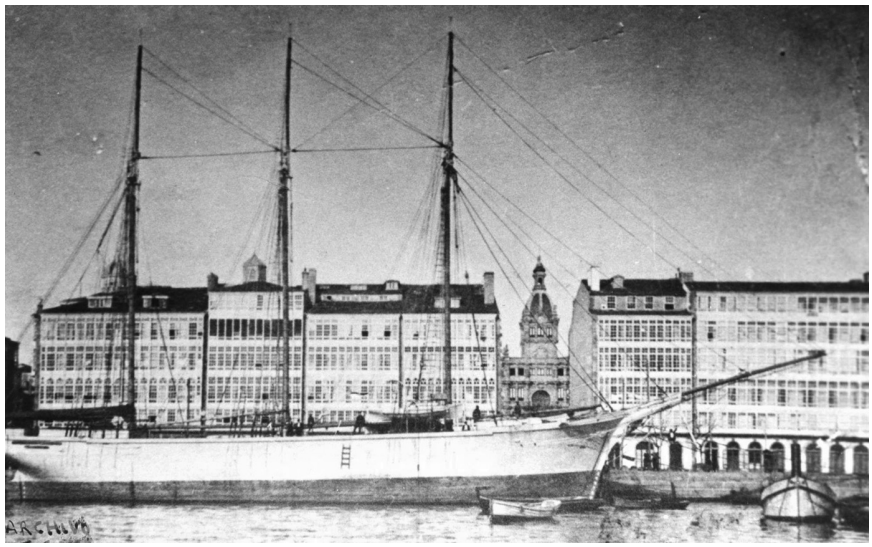
However, while the spread of glass in construction was associated with this ideological content, the application of double-glazing was related to the incorporation of concerns over comfort in the façade. Some authors have traced the application of a double layer of glass in construction to two phenomena: first, the development of the greenhouse effect and its capture of solar radiation, and second, the ability of the air cavity to act as buffer space and create thermal insulation.[40]

Therefore, in the beginning, the introduction of glass in balconies was an adaptation of the envelope of the buildings to specific climatic constraints in particular regions. A paradigmatic example of the transformation of the balcony occurred in the cities of La Coruña and Ferrol at the end of the eighteenth century (figure 9). Facing a peculiar climate condition, derived from the lack of protection against the Atlantic

39 Zaera-Polo and Anderson, *The Ecologies of the Building Envelope. A Material History and Theory of Architectural Surfaces*.

40 Maria Wall, "Climate and energy use in glazed spaces," (Lund University, Lund Institute of Technology, Department of Building Science, 1996).

fig.9 Galerías de La Marina in Coruña (Aniorte 19–).



winds and the reduced solar radiation compared to the average of the Iberian Peninsula, traditional Galician architecture developed many systems of protection.[41] One of these was the *galería*, a balcony enclosed by wooded frame windows that replaced the pre-existing wood screens of *mashrabiya (confesionarios)*.[42] Some authors argue that the foundation of the *galería* is related to the shipbuilding tradition in Ferrol, and that during the nineteenth century, in parallel with the new production of windowpanes in the region that reduced previous imports from Germany and lowered the prices, these *galerías* rapidly spread throughout the region of Galicia, where they were considered a more coherent environmental solution against the peculiar windy and humid conditions.[43]

Due to the suitability of local climate conditions, the use of glass in balconies also spread throughout the north-eastern region of Portugal (Terras da Beira). The *Arquitectura Popular em Portugal* (Popular Portuguese Architecture) survey published in the 1960s presented several examples of vernacular glazed balconies in this region. This study pointed out that these balconies, usually oriented south and west, became a characteristic element of rural architecture and one of the most used spaces in the house throughout the year.[44]

By the end of the nineteenth century, a range of technologies, mostly associated with the glass industry, became widely available, and replacing the traditional wood *mashrabiya* began to be a trend even in places where it had fewer environmental benefits. In Valletta, Malta, the glass balcony *gallarjia*, which substituted the old louvered shaded balcony,

41 Xose de Castro Arines, *O libro das galerias galegas* (La Coruña: Edicios do Castro, 1975).

42 Jesús Ángel Sánchez García, "En el balcón, en el palco, en la galería. Estrategias de la mirada en la arquitectura del siglo XIX," (2012).

43 Privitera, Diodato, and García Sáez, "Solar radiation influence on pre-modern openings features: La Coruña and Valletta."

44 Amaral, *Arquitectura Popular em Portugal*

created relevant modifications in the indoor environmental conditions leading to severe overheating problems.[45]

Simultaneously, in northern European cities, such as Vienna, Berlin, or Prague, the double window (*Kastenfenster)* became a common solution. It was developed and largely applied due to the dual demand of daylight and openness while creating a well-tempered environment and preventing heat loss. These experiences were soon adopted in the modern Soviet experiments, which influenced Le Corbusier in developing the use of double windows and the development of the *mur neutralisant* — a system that consists of an air cavity created by a double façade and tempered by controlled ventilation, the *respiration exacte* effect (figure 10). With this system, Le Corbusier aimed to create a consistent internal temperature regardless of the exterior environment. Even though these concepts were highly criticised and were never implemented due to the amount of material and equipment required,[46] the ideas came to influence the creation of other solutions based on the advantages of double glazing.[47]

45 Privitera, Diodato, and García Sáez, "Solar radiation influence on pre-modern openings features: La Coruña and Valletta."

46 Banham, *The architecture of the Well-temepered Environment*.

47 Harvey Bryan, "Le Corbusier and the 'Mur Neutralisant: An Early Experiment in Double Envelope Construction" (paper presented at the Proceedings of the Ninth International PLEA Conference, 1991).

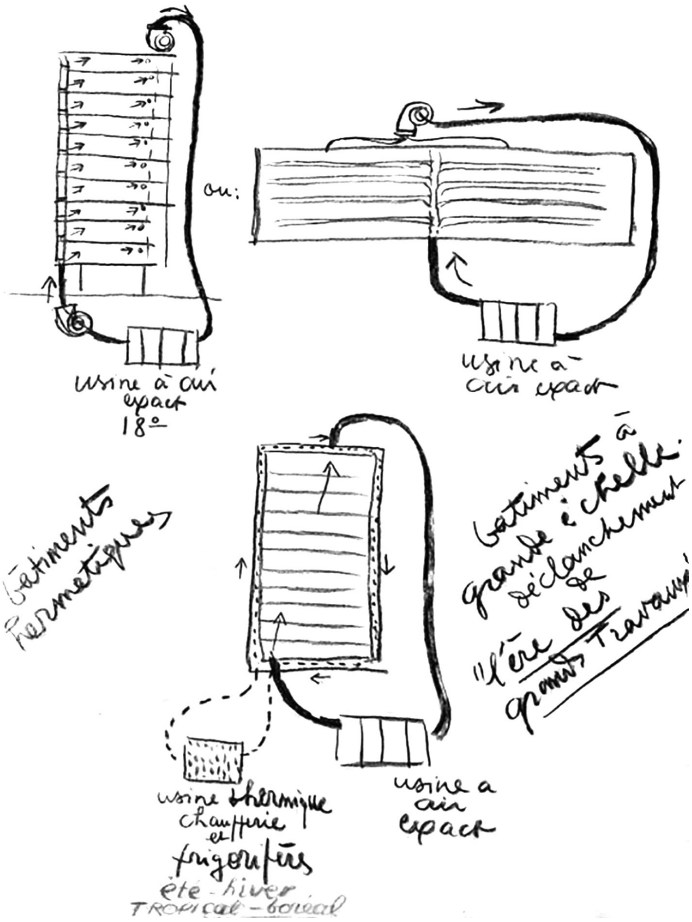


fig.10 La Maison a respiration exacte (Le Corbusier 1930).

As a result of these failed technological attempts in the first decades of the twentieth century, and due to the new mechanical environment management techniques that freed architecture from local climate constraints, the benefits of glazed structures were neglected for almost forty years.[48] Only when energy prices rose due to the energy crisis of 1973 did the environmental thermal advantages of the greenhouse return to the composition of the building envelope.[49]

After OPEC (Organization of the Petroleum Exporting Countries) proclaimed the oil embargo on some Western countries, reducing energy consumption became a priority in construction. Architects and engineers reacted to this crisis by intensifying ongoing studies on new techniques and solutions for more efficient use of energy and natural resources. However, despite the strong commitment to investment in the study of solar devices in construction,[50] the experimental ecological design of the 1960s and 1970s was not properly addressed in the major histories of modern architecture of this time.[51]

At that moment, in parallel with the reinterpretation of the low-tech double-glazing façade technologies, glazed spaces were considered solar collectors with the capacity to gather large amounts of energy and reduce the energy demands of the adjacent buildings.[52] From the reinterpretation of Le Corbusier's *mur meutralisant* to the study of the Trombe wall, the glass double-façade envelope and solar device solutions, among which the widespread glazed balconies can be highlighted, have become some of the most explored passive-building technologies. Some examples, which are placed on the map in figure 11, represent the relevance that the glazed spaces adopted to achieve energy efficiency in the second half of the twentieth century and their influence on the glazed systems adopted during the twenty-first century.

The Trombe wall, invented before the 1960s as a solar collector-accumulator, composed of a massive south wall covered with external glazing, was developed further after the oil crisis to achieve energy efficiency with passive heating and natural ventilation. The main objective of the first experiments, such as the house designed by French engineer Félix Trombe and architect Jacques Michel in 1967 in Odeillo, France, was the solar efficiency of the dwelling. The Trombe wall closed the house completely to the south, and left the indoor space with little natural light and views. However, with the development of the Trombe wall, gradually the air cavity of the system began to be transformed into a usable greenhouse space, creating a glazed area, which, due to its distinct operation between summer and winter, could be used almost all year round. This was the case of Maison à Argenteuil, in Val d'Oise, also in France, designed by Marc Vaye and Frédéric Nicolas in 1979. In this house, the space between the glass and the thermal mass wall is used as a greenhouse space and integrated with the entrance. Nevertheless, like the previous examples, the adjacent room

48 Banham, *The architecture of the Well-temepered Environment*..

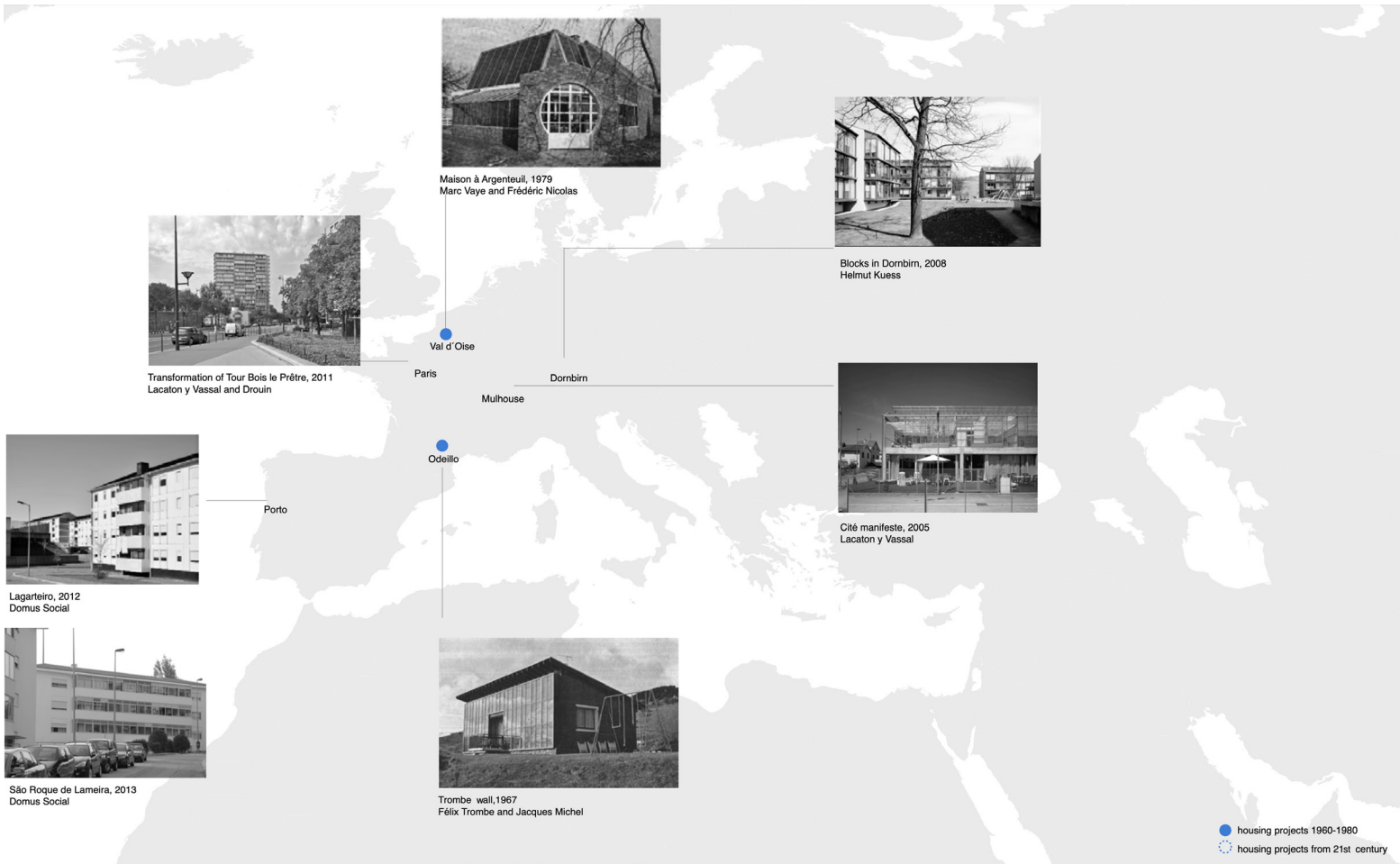
49 Giovanna Borasi and Mirko Zardini, *Sorry, out of gas. Architecture's response to the 1973 oil crisis*. (Montéreal, Québec: Canadian Centre for Architecture, 2007).

50 Victor Olgyay, *Design with climate: bioclimatic approach to architectural regionalism* (Pinceton: Princeton University Press, 2015 [1963]).

51 Piero Medici, "The Trombe Wall during the 1970s: technological device or architectural space? Critical inquiry on the Trombe Wall in Europe and the role of architectural magazines," SPOOL 5, no. 1 (2018).

52 Wall, "Climate and energy use in glazed spaces."

fig.11 Mapping of housing projects in the second half of the twentieth century and in the twenty-first century.



maintains a lack of transparency and natural light due to the absence of an opening in the wall between the greenhouse and the indoor living room.[53]

When, during the 1980s, energy prices declined in Europe, the investigation of the Trombe wall apparently lost its appeal. However, the exploration of the previous decade influenced the introduction of greenhouses and glazed spaces in buildings. In the 1980s and 1990s, large, glazed courtyards and atriums were incorporated in public buildings and offices, while glazed balconies and glazed galleries became a generalized practice in housing buildings around Central and Northern Europe,[54] due to the easy and simple adaptation of the original open balcony systems.

In the 1990s, the passive solutions of glazed balcony structures became increasingly sophisticated with each site-specific condition. Nevertheless, with the industry developments of the prefabricated aluminium frames, the tendency to close the balconies also extended to other contexts regardless of their particular climatic conditions.[55] In some Mediterranean countries and contexts with hot climates, this practice became generalized as an informal adaptation done by the inhabitants, mainly motivated by reasons other than energy efficiency.

Therefore, some authors have considered that, at the turn of the new millennium, the in-between liminal glazed spaces inhabited by people and plants become a noteworthy contemporary trend, in contrast to double glass façades that were almost abandoned due to the difficulty of recovering the substantial amount of space used in terms of rental efficiency.[56]

Lacaton y Vassal often exploited the potential of greenhouse technology to provide a substantial increase in building area with a space that was neither internal nor external. In their projects, the aim of introducing glazed balcony derivations in housing buildings was to add an extra multifunctional space to dwellings, as is the case with the housing project *Cité manifeste* (2001–05) in Mulhouse, where the very morphology of the building resembles a greenhouse. As an alternative to the policies of demolition of housing blocks built in France after the second war, together with Frédéric Drout, they developed the research project *Plus – Les Grands Ensembles de logements – Territoire d'exception*, where they proposed the radical transformation of the existing building with the insertion of intermediate spaces, which they called *wintergardens*. The principles of the study were first applied when they won the competition for the rehabilitation of Tour Bois le Prêtre, a typical 1960s residential block in Paris, and the success of the intervention led to the application of the same ideas to other buildings that were at risk of demolition.[57]

Several other examples across Europe have used similar strategies for rehabilitating housing complexes. In the refurbishment of housing blocks in Dornbirn (2008), in the Austrian region of Vorarlberg, the architect Helmut Kuess introduced glazed balconies, called *conservatories*, to add extra indoor space, which also work as thermal buffers.[58] In Porto, the

53 Medici, "The Trombe Wall during the 1970s: technological device or architectural space? Critical inquiry on the Trombe Wall in Europe and the role of architectural magazines.

54 M. P. Wilson, O. B. Jorgensen, and G. Johannesen, "Daylighting, energy and glazed balconies: A study of a refurbishment project in Engelsby, near Flensberg, Germany," Article, *Lighting Research & Technology* 32, no. 3 (2000), https://doi.org/10.1177/096032710003200304, https://www.scopus.com/inward/record.uri?eid=2-s2.0-0039339562&doi=10.1177%2f096032710003200304&partnerID=40&md5=80556feae69e32a0f923e7dbe0ec8115..

55 Zacka, "An Ode to the Humble Balcony."

56 Zaera-Polo and Anderson, *The Ecologies of the Building Envelope. A Material History and Theory of Architectural Surfaces*.

57 Frèdèric Drout, Anne Lacaton, and Jean-Philippe Vassal, *Plus: large-scale housing developments. An exceptional case*, ed. Editorial Gustavo Gili (Barcelona, Spain: Editorial Gustavo Gili, 2004).

58 Helmut Küess, Manfred Koller, and Thomas Hammerer, "Residential complex in Dornbirn," *Detail Green-English Edition,(1/11)* (2011).

interventions for improving social housing constructed in the 1960s followed in some cases the informal process of enclosing balconies initiated by the inhabitants. In Lagarteiro (2012) and São Roque da Lameira (2013), some parts of the access galleries and balconies were already closed, and the option taken in the rehabilitation project was to homogenize the block by closing all intermediate spaces with glass.

Faced with operations like these on ordinary housing for which the design strategy contributed to the existing fabric, some academics point out that the common practice was not so successful. Franz Graf and Giulia Marino consider that these major interventions normally do not take into account the impact on heritage nor the intrinsic qualities of the buildings.[59] It has become consensual that rehabilitation interventions, and on this matter, the transformations of balcony spaces, should be defined according to the intrinsic qualities and heritage value of the building itself, balancing heritage conservation with the environmental paradigm.[60]

3 Final remarks and conclusions

This examination of the literature on the evolution of the balcony reveals that this liminal space has been characterized over time as an archetype of well-being. It has been the search for inhabitants' well-being, defined by the *Cambridge Dictionary* as "the state of feeling healthy and happy,"[61] that has motivated the major evolutions in the design of balconies. In this search for well-being, the evolution of balcony design has reflected the paradigms of the times, and has a direct attachment to the ecology of economics, politics, and social structures of these contexts. During the last decades, this archetype has acquired distinct shapes and boundaries to attend to the modifications in the notions of health and comfort and to respond to the changes in the inhabitants' valorisation of contact with the street and the existence of private outdoor spaces for leisure and recreation.

In this paper, it was proposed that the paradigms and main concerns of each time, motivated by the search for well-being, together with technical developments, conditioned the specificities of balcony design. The present overview identified three moments of particular relevance to the evolution of balconies design:

The association of the open balcony with new health and hygiene standards in the late nineteenth century and the consequent importance they acquired in the period between the great wars as an element capable of introducing light, air, and openness into modern dwellings.

The exploration of shading elements on balconies influenced by traditional Islamic architecture in the middle of the twentieth century as new components to better control sunlight and ventilation.

The reinterpretation of the vernacular models of balconies enclosed by glass during the 1970s energy crisis as a device for capturing and storing solar radiation and reducing energy consumption.

59 Franz Graf and Giulia Marino, "Housing Reloaded Collective. Housing in Europe, 1945–2015," *Docomomo Journal* 54, no. ARTICLE (2016); Franz Graf and Giulia Marino, "Modern and green: heritage, energy and economy " in *La cité du Lignon 1963–1971*. Étude architectural et stratégies d'intervention (Lausanne Infolio 2012).

60 Nuno Valentim, "Projecto, património arquitectónico e regulamentação contemporânea. Sobre práticas de reabilitação no edificado corrente." (Faculdade de Arquitectura da Universidade do Porto, 2016)..

61 "Cambridge Dictionary - English Dictionary," 2023, accessed April 2023, 2023, https://dictionary.cambridge.org/dictionary/english/well-being.

62 Srinivasan and Moe, *The hierarchy of energy in architecture: emergy analysis*.

In summary, the overview of the evolution of the definition of the balcony demonstrates that, throughout history, it has become consensual that balcony design is defined by the relation between three domains: the outside, the inside and the in-between. This review also reveals that the importance given to each balcony domain has been influenced by the demand for inhabitants' well-being, which modified construction paradigms over time and consequentially originated distinct balcony boundary system.[62] The aim of identifying these stages of balcony design is to inform the redefinition of the Mediterranean balcony, which in this current critical and symbolic moment, characterised by the attempts to respond to climate change, could contribute to developing more sustainable housing models for a growing urban population.

The extreme exploration of the design of in-between inhabited spaces is considered a noteworthy contemporary trend at the turn of the new millennium, and it highlights their potential as passive elements which are capable of improving the interior environment quality within dwellings and contributing to the well-being of the inhabitants.

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