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ARQUITECTURA FLEXIBLE

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LA FLEXIBILIDAD COMO HERRAMIENTA PARA LA PARTICIPACIÓN EN ARQUITECTURA
FLEXIBILITY AS A TOOL FOR PARTICIPATION IN ARCHITECTURE

Germán López Mena (0000-0002-5635-4698)

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p.15 INTRODUCTION

Habitat is understood as the dynamic interaction between the physical framework of architecture and human activity, which is in constant social, cultural, and economic evolution.

"The encounter between human action and a natural context is what gives rise to architecture. An encounter based on action, the sum of actions within a specific context. To inhabit, therefore, is to transform a place to adapt it to certain needs and uses. For this reason, the concept of inhabiting is inseparable from that of building. To build with the purpose of creating a protective environment. To inhabit is to build"[1].

This encounter between human action and the built environment requires, for long-term sustainability, a reconsideration of both design and construction processes. The main objective of this article is to analyze flexibility in architecture as a key concept for promoting greater sustainability in the built environment.

It is argued that flexibility, in its various forms (use, design, and execution), facilitates the participation of users and other stakeholders, resulting in a more adaptable and sustainable architecture. Through conceptual analysis, case studies, and theoretical reflection, this article examines how flexibility enables spaces to adapt to changing social, economic, and environmental dynamics, contributing to a more resilient habitat.

DIFFERENT WAYS OF APPLYING THE CONCEPT OF FLEXIBILITY IN ARCHITECTURE

The flexibility of a space allows it to adapt or transform in response to changing needs or circumstances. This concept is essential in both public and domestic spheres for several reasons. Firstly, social, economic, and cultural realities are constantly evolving, and architecture responds to this dynamic. Additionally, ways of life of different populations vary depending on context and circumstances, which are also continuously changing. Likewise, the techniques for

p.16 improving and producing habitats are continuously evolving. And, more importantly, when the concept of participation is incorporated—especially citizen participation—the architectural outcome reflects the perspectives of the various stakeholders involved, thus enhancing its adaptability and the flexibility of ideas. As Herman Hertzberger points out: *"Time changes things. There are many buildings that are no longer used as they once were. We should design buildings that are not too specific and can be influenced by other uses. It is the same idea I have in my studio, that people can influence my work"*[2].

Flexible architecture is not a contemporary innovation; rather, it has been an integral part of the creative skills that communities have developed throughout history in constructing their habitats. Public space, is a place of transit and encounter, but it can also be a space for play, occasionally transform into a market, or be used for cultural events, political demonstrations, and more. As Jan Gehl describes:

"A street scene: any day on any street. Pedestrians walk along the sidewalks, children play in front of doorways, people sit on benches and steps, the postman makes his rounds with the mail, two passersby greet each other on the sidewalk, two mechanics repair a car, some groups converse"[3].

In domestic architecture, there are numerous examples of flexible spaces in vernacular architecture, the dwellings of nomadic populations, and traditional Japanese housing, all of which would go on to significantly influence the conception of contemporary domestic space, starting with Frank Lloyd Wright[4] (Figure 1). Similarly, the *casa patio* typology, which has shaped many of our historic centres, is another notable example. In Spain, particularly in Andalusia, this typology is characterized by a sequence of spaces with similar proportions that allow for interchangeable uses.[5].

To understand how flexibility allows for the incorporation of participation, we can distinguish between flexibility of use, flexibility of design, and flexibility of execution.

Flexibility of Use

Flexibility of use refers to the ability of a space to adapt to different ways of living and activities. This adaptability can be achieved through the inherent design of a generic space or by incorporating specific elements or mechanisms.

Public spaces, for instance, are *generic environments* that can accommodate a wide variety of uses, but their degree of flexibility depends on their design, including the shape of the space, street furniture, paving, vegetation, and lighting. However, the prioritization of private traffic and safety concerns in contemporary cities have limited the flexibility of public spaces. Nevertheless, recent initiatives aimed at reducing the carbon footprint of cities are attempting to reverse this trend. Programs such as the *Superblocks* and *Green Axes* in Barcelona (Figure 2), as well

p.17 as recent remodeling projects in nearby areas funded by the Sustainable Urban Development Strategies (EDUSI), like the recent coastal edge intervention in Conil de la Frontera, Cádiz (Figure 3), are examples of this transformation.

In the case of a built space, its degree of flexibility may depend on its shape. An orthogonal floor plan, for instance, as opposed to irregular or arbitrary shapes, allows for better mechanisms for transformation and more versatile uses, as Stewart Brand argues[6]. However, it also depends on the design of the elements that support and enable it: the structure and service components, such as installations, wet cores, and access points.

The idea of a generic space capable of accommodating different configurations has precedents in traditional housing across various cultures, though these were often limited by the construction systems used in their construction. The introduction of new materials like concrete and steel after the Industrial Revolution significantly expanded the possibilities for creating larger and more flexible spaces.

A paradigmatic example of this can be found in the work of Mies van der Rohe. In the Neue Nationalgalerie, the structural definition and the placement of service areas within a basement level free up the main hall above, allowing for flexible configurations. This approach—a generic space that, by virtue of its structure and the positioning of service cores, allows for different configurations—was also applied by Mies in domestic projects like the Tugendhat House and the Edith Farnsworth House, as well as in proposals for collective housing and office buildings (Figure 4). In the 1960s, the High-Tech movement further expanded the exploration of architectural flexibility through the exposure of structure and services, prefabrication, and the use of lightweight industrial materials. The Pompidou Centre, designed by Piano and Rogers, is a prime example of this approach, with its radical externalization of services to create open, flexible floor plans. This project approach was later adopted by avant-garde Japanese architecture; the Sendai Mediatheque by Toyo Ito is a recent example, also exploring the concept of free, adaptable floor plans by integrating structure and services in innovative ways (Figure 5). p.19

In the field of collective housing, the 1960s also saw the emergence of innovative methodological proposals aimed at empowering users, allowing them to participate directly in the construction and configuration of their environment. In the Support Theory developed by Habraken and later expanded by the Open Building movement, a specific arrangement of structure and the positioning of wet cores allowed for the creation of flexible dwellings, configurable in various ways according to the needs of each family, within a collective housing building[7]. p.20

Another fundamental strategy for achieving flexible spaces lies in the incorporation of mechanisms that allow for instant adaptability through direct manipulation. Pioneering examples of this approach can be found in the proposals by Le Corbusier for the construction of modern domestic space. In the house he designed for his mother on Lake Geneva, he introduced fixed furniture integrated with sliding panels, enabling various spatial configurations to adapt to different uses and times of day. This same idea was also explored in the Weissenhof dwellings, aiming to optimize functionality through interior reconfiguration (Figure 6). Other pioneering examples that reflect this early concern for flexibility in the design of modern domestic spaces are also notable. The E-1027 house, designed by Eileen Gray for herself and Jean Badovici in Roquebrune-Cap-Martin, incorporated movable and multifunctional elements, allowing for different ways of experiencing the spaces. The Rietveld Schröder House in Utrecht, designed by Gerrit Rietveld, is a paradigmatic example thanks to its sliding walls on the upper floor, which allowed spaces to be joined or separated according to the needs of its inhabitants. Similarly, the Maison de Verre in Paris, designed by Pierre Chareau, is notable for its movable partition elements, large-scale sliding doors, and versatile lighting systems, all of which contributed to remarkable spatial flexibility. These early 20th-century examples demonstrate an active quest to integrate the capacity for transformation within the very design of modern domestic spaces.

However, adaptability through internal mechanisms is not the only way to achieve a flexible space. Elasticity, understood as the ability of a building to grow and transform gradually over time, represents another fundamental strategy. This characteristic has been a constant in vernacular architecture and in self-managed or self-built housing processes, known as progressive housing, where inhabiting is an evolutionary process that unfolds over the years. Numerous examples of vernacular housing demonstrate this capacity to be expanded and modified over time to adapt to the changing needs of its inhabitants. In fact, for many families living in certain cities without access to housing in the regular market, inhabiting such spaces is the beginning of a long-term process, often based on self-building, that can last for years[8]. An illustrative example is the evolution of Sahrawi housing, where nomadic populations become sedentary after settling in refugee camps on land provided by Algeria. From the original structure, based on the versatile *haima*, the dwelling evolves and expands through the addition of new modules, adapting to family growth and changing spatial needs (Figure 7). The concept of progressive housing, as a strategy for achieving the elasticity of residential space, has been explored and tested in countless variations and adaptations across diverse cultures and socioeconomic contexts around the world[9]. p.21

Under the influence of John Turner's theories from the 1970s, which advocated for the empowerment of users in accessing housing in resource-scarce contexts[10], the PREVI (Experimental Housing Project) pilot project was launched in Lima in 1970. This Peruvian government initiative, co-financed by the UNDP and advised by Peter Land, was conceived as a laboratory for ideas to address social housing through three complementary proposals aimed at low-income families with some purchasing power. The best-known of these, Pilot Project 1 (PP1), involved the construction of a new residential neighborhood based on designs submitted to an international competition. Most of the proposals, including those from prominent architects of the third generation of the Modern Movement, were built, offering a rich catalogue of solutions for a low-rise, high-density urban model, with pedestrian-friendly, human-scale p.22

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public spaces managed by the residents themselves[11]. A key aspect of this project was the development of progressive housing typologies, as specified in the competition, designed with the capacity to grow and adapt over time through self-construction. The proposal submitted to the PREVI competition by architect James Stirling is a good example of these modular growth strategies (Figure 8). This pioneering experience in low-cost industrialization had a significant influence on later projects, such as the innovative housing complex at Quinta de Monroy in Iquique, Chile, designed by the architectural studio ELEMENTAL (Figure 9).

However, this strategy of elasticity in the pursuit of flexibility is not limited to the residential sector. A notable example in a different building type is the previously mentioned project for the Central Beheer in Apeldoorn, the Netherlands. This office building, designed by Herman Hertzberger within the structuralist movement of the 1970s,
p.24 was conceived around a three-dimensional structural grid that not only allowed for flexible workspace configurations but also enabled gradual expansion over time, allowing the building's form to evolve as a result of this additive and transformative process, contributing to what would be known a decade later as *Structuralism*[12] (Figure 10).

Flexibility of Project

Flexibility of project is a fundamental strategy for conceiving architecture that responds optimally to the realities it serves. It can be defined as the intrinsic capacity of project ideas to adapt dynamically to the various contributions of the stakeholders involved, ensuring their active participation in the evolution and refinement of the proposal. Essential mechanisms for implementing this flexibility include making initial decisions that allow for future development, viewing the final project as the culmination of a genuinely participatory process, and recognizing the input of various actors as a critical component for achieving design excellence.

The methods used to foster project flexibility closely align with participatory design methodologies. Indeed, effective participatory design inherently requires project flexibility. To take the example of the Centraal Beheer office building by Herman Hertzberger: While the individual offices had specific dimensions and functions, the design encouraged workers to freely arrange their interior spaces and personalize their work environments, seeking to reflect
p.25 the identity of each individual within the building's structure[13]. Centraal Beheer exemplifies how a project can integrate elastic flexibility into its structural conception, allowing for growth and formal adaptation over time, while also fostering active user participation in the configuration of their workspaces.

The project flexibility strategy advocates for the inclusion of the various stakeholders involved in a habitat proposal aat all scales of intervention, from the city and the neighborhood to the dwelling and related infrastructure. The participation of end users is particularly important, as they often face the greatest challenges in influencing decisions that will directly impact how they use the spaces they will inhabit, work in, or receive services in. This principle applies equally to urban projects as well as to those that define everyday architectural spaces.

User participation in a specific architectural project can manifest at various levels. It can be as limited as the reception of a finished product, such as a house or an office, or as broad as obtaining a service or information. However, this participation can scale up to more active forms, such as direct consultation, participation through their technical representatives, co-management of the project, or even the self-management of their own proposal.

There are numerous participatory planning methods applicable at different geographic and thematic scales. At the urban scale, Popular Urban Plans, such as the Santa Coloma de Gramenet Popular Plan[14], and the Plan Barrio[15] methodology, implemented in various contexts, are important references. These participatory tools can also be used for neighborhood improvement programs, mobility plans, and risk mapping (Figure 11).

Specific methods have been developed for the creation of participatory architectural projects, particularly in the context of building or improving housing for low-income communities. These methods are based on the premise that access to housing is a gradual process for many urban dwellers, especially in self-managed neighborhoods. Methods like Option Generation, Participatory Proposals for Residential Cores, the Livingston Method[16] , widely used in Cuba for the rehabilitation of heritage housing, and experimentation with Participatory Prototypes like the 10x10 Program from HABYTED, CYTED[17] , aim to involve users from the early stages of project decision-making.

These participatory approaches are also currently being applied, in our immediate context, in the development of housing cooperative programs and in the design of *cohousing* and *coliving* models, where new forms of coexistence and shared collective spaces are being explored. In these cases, participation is not limited to the design of individual dwellings, but also extends to the configuration and construction of common areas and collective spaces. The La
p.26 Borda cooperative housing building in Barcelona, designed by LACOL arquitectes and awarded the Mies van der Rohe Award 2022, exemplifies this approach, integrating user participation even in the construction phase through the use of prefabricated wooden elements (Figure 12).

Flexibility of Execution

This refers to a project's capacity to allow for evolution over time, incorporating the ability for users to actively participate in its ongoing development. We have mentioned projects like PREVI or the Quinta Monroy housing by ELEMENTAL as examples of this approach. However, flexibility of execution also includes the ability of a project to adapt to different eco-social contexts. For this, the project should be constructible with different materials and employ technologies that are both *appropriate* and *appropriable*. Appropriate for a given context, as they take advantage of locally available
p.27 resources, resulting in more environmentally sustainable construction, and appropriable by the people who inhabit

them, as they allow for the use of local human resources and knowledge for their realization. They therefore allow for user involvement in the production process, using their own knowledge, or in the evolution and improvement of these skills through education and training. In other words, this approach also takes into account social sustainability.

"All technology is a means, a tool. It must serve a purpose; it should not be an end in itself. It should not be considered in isolation. It must be linked to design and production methods within a socio-economic and cultural framework.

Technology is not neutral; it has intent. It can serve development or create dependency.

All technology is the materialization of knowledge with a specific intention."[18]

The UNNE-UNO system, developed by Víctor Pelli in Argentina, is a notable example of flexibility of execution[19]. This progressive housing prototype is designed to be built using various technologies, providing each family with an initial core with a roof and supporting structure within a predefined module. From this base, residents can complete their homes using different materials and components, following modular guidelines that facilitate future expansion (Figure 13).

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Flexibility of execution operates on several levels. In the implementation of habitat improvement projects, it is common to encounter changes in technical and economic conditions, requiring adaptations in technologies or materials. A flexible and well-coordinated project makes it possible to respond effectively to these new circumstances. In progressive housing and urban projects, evolution over time may involve the replacement of initial technologies due to changes in their availability or cost, or the improvement of construction solutions to achieve higher quality or greater qualitative flexibility. An analysis of how PREVI evolved reveals that, although the initial proposals included specific technologies, the actual evolution of the housing depended largely on the resources available to the users. In contrast, projects like Elemental's Quinta Monroy and the UNNE-UNO system integrated from the outset the possibility of using a variety of technologies for expansion, considering each family's economic capacity and access to materials over time.

CONCLUSIONS

Architecture emerges as the tangible result of the collective actions of a society, a complex process that intertwines rational considerations related to construction, economics, and organization with biologically rooted impulses embedded in the fundamental relationships of human existence. This process involves diverse actors, and without a deep understanding of their interactions, the approach to architectural projects will be limited in its ability to address essential problems. Do we understand how the city functions from anthropological and biological perspectives, in terms of the organization of human relationships, and with an awareness of the aspirations and needs of its inhabitants? The most effective way to integrate these dimensions into the architectural project lies in the active participation of users and other key stakeholders.

The objective of flexibility in architecture is to enable users to actively participate in the configuration of the spaces they inhabit, use, or enjoy. As we have seen, this has long been part of the creative skills that communities have developed throughout history when building their habitats. But it is also a key concern in the construction of contemporary architectural space. From this perspective, there are various ways of applying flexibility that allow for different degrees of participation. Flexibility of use, the most well-known and widely applied, refers to the capacity to adapt space and can be achieved through the dimensions, shape, and design of a generic space or support space, as exemplified by Mies, through mechanisms of immediate adaptability, as in the proposals of Le Corbusier, or through designs with the capacity for temporal and spatial evolution, such as the elasticity found in progressive housing. Project flexibility is achieved by integrating the contributions of various stakeholders in the design definition through participatory methods. Finally, execution flexibility allows construction to adapt to the eco-social conditions of the site and incorporates the skills and capacities of the users themselves in the materialization of their spaces.

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Flexibility in architecture significantly contributes to greater sustainability in its broadest sense. It enables users to participate in the construction, modification, expansion, or improvement of the spaces they inhabit or use, incorporating their contributions alongside those of other actors involved in the definition and execution of the project. In doing so, it ensures that architecture is more intrinsically adapted to the demands and needs that give rise to it, as well as to the ongoing evolution of these needs and the economic and social context in which it is embedded, promoting greater social sustainability by empowering users to shape their living environments. In a future where uncertainty and change are constant, flexibility stands as a fundamental principle for resilient, people-centered architecture.

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FLEXIBILIDAD, PERMANENCIA Y CAMBIO EN ARQUITECTURA

FLEXIBILITY, PERMANENCE AND CHANGE IN ARCHITECTURE

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INTRODUCTION

When we say that a certain architecture seems *rigid*, we mean that it cannot be changed or adapted to a specific need or desire, or respond to a changing reality, either immediately or over the longer term. And perhaps we understand its opposite by way of contrast. That is to say, the *flexibility* of any particular architecture is usually understood as a device associated with change and permanence. Thus, it is associated with time, which – unlike in the case of other disciplines – is part of its essence. From this point of view, flexibility is a means of survival for those architectures that want to overcome the barrier of time (figure 1).

To say that architecture changes is to state the obvious. Temporality is an inevitable condition of architecture. In contrast, timelessness is an aspiration. The need to prolong the life of a building, to avoid it becoming obsolete or to incorporate new uses, partially explain why architecture changes. Architecture often has to make the best use possible of existing structures, building on and changing what is already there (figure 2). The ramifications of this confrontation over time go far beyond those resulting from the building itself (whether it is a new or existing construction), to affect the dialectic between the new architecture and the existing city.[1]

Our way of understanding architecture also shifts over time. The cultural, social or political significance of architecture – and the interests of architecture criticism – change faster and more often than the way we perceive or use buildings.[2] Every building is framed in a shifting social and cultural context which feed into part of its meaning
p.34 and the readings we make of it. Sometimes these meanings and readings change slightly – or a great deal – along with the different social and cultural contexts that arise in each era. By this we do not mean to endorse falling foul of some kind of "presentism" in architecture. Nor are we referring to the problem repeatedly addressed by historians and critics of the relationship between a past architecture and the present time from which we understand, see or use it, describing it as we do through a contemporary gaze. Rather, we mean to say that it is unsurprising that our perspective of architecture is affected by its permanence.[3] Any historical-critical method will always be faced with this complex relationship between past and present. And this relationship is undoubtedly a rather more complex expression of change in architecture than the ideas we associate with the concept of flexibility (figure 3).

Authors who have dealt with this concept frequently, such as Robert Kronenburg, explain that flexibility architecture "*consists of buildings that are designed to respond easily to change throughout their lifetime*"[4] For these authors, a
p.35 more flexible architecture has its advantages: *"it remains in use longer, fits its purpose better, accommodates users' experience and intervention; takes advantage of technical innovation more readily; and is economically and ecologically more viable*". That is, a flexible architecture is one designed for "*changing situations in their use, operation or location [...] It adapts, rather than stagnates; transforms, rather than restricts; is motive, rather than static; interacts with its users, rather than inhibits".* And *"it stems not just from desire and possibility but also from economy and necessity"*.[5] That is why flexibility, mobility and adaptability are such common terms in the field. According to Ewald Bubner, an adaptive architecture has specific features of form and use that allow for changes in interior spaces. It can also be used in a different place or position to respond to different human needs.[6]

As we can see, the scope of the concepts and considerations interwoven with flexibility is quite broad. But of all the possible approaches, we want to focus on two that are seemingly disparate. Both are operational strategies more conducive to change and permanence that consider architecture to be an "open project" (figure 4).

ARCHITECTURE AS AN OPEN PROJECT: SUPERPOSITION

The strategy that considers flexibility as a constant change, with space for new realities and relationships over time, has been thoroughly outlined in recent French literature. This approach understands architecture not as something static; rather, it results from *"a series of physical transformations that take place over time (and not only through movement or through the different forms of perception and imagination)"*.[7] Architecture is in permanent flux, it is always a "moving *project*" that takes variables such as its transformation by its users, or its deterioration, as given, natural aspects
p.36 from the outset, in line with the theories of Bruno Latour and Albena Yaneva.[8] This condition is incorporated into the design process. And seen like this, architecture acts as the agent of other, perhaps unforeseen changes that could even be the opposite of what we might expect. The French authors include indeterminacy as part of the project, as Rem Koolhaas did when he stated that "*[f]lexibility is not the exhaustive anticipation of all possible changes. Most changes are unpredictable. [...] Flexibility is the creation of a capacity with a wide margin that enables different and even opposing interpretations and uses"*.[9]

Indeterminacy as a contemporary principle contained within the notion of flexibility is clearly present in the work of Lacaton & Vassal when they declare that they design with the concept of "temporality" in mind. Paradoxically, they propose an architecture that becomes timeless insofar as it is capable of undergoing constant change. In this respect, as they explain in one of their seminal writings, *Structural Freedom, a Precondition for the Miracle*, their building designs usually incorporate a supporting structure that displays a certain "hugeness". It is calculated with load capacities well

above the recommended levels, which gives the user "*freedom to move about, to instigate an activity wherever he happens to be".*[10] This flexibility is complemented by lightweight and independent construction systems and materials that can be varied and replaced. The structure becomes a support for relationships of different scale – what they term *superpositions* – that permit the changes that will, sooner or later, envelop the building. It is an architecture that attains its true meaning through permanent change. More than that, it celebrates temporality.

Perhaps the most lucid example of this approach can be found in the designs for the Nantes School of Architecture (2009). The "programmed space", the "appropriable free space" and the "exterior space", are superimposed on a four-level supporting structure in a grid of supports measuring 11.66 by 10.71 metres. The "scheduled space" (that is, the space set aside for each use of the School) is allocated to classrooms, auditorium, workshops and services as considered strictly necessary. There is also a "deprogrammed" interior and exterior free space, an oversized "*extra space"*[11] that can be used for various functions and evoke new relationships, adapting to the interests of the user. And the routes through the building, with transitions between inside and outside, undetermined routes, undefined empty spaces at single and double heights and with diagonal visuals, trigger an open dialogue of transformation, leaving comprehension of the architecture to the user at all times (figures 5 and 6). **p.37**

But this same strategy can also be detected in existing architecture, such as the renovation plans for the Palais de Tokyo (Paris, 1999-2014) as a "place of contemporary creation". In this case, the provisional, temporary and uncertain nature of a very prolonged and very low-cost construction process, and the indefinite and hierarchical use of the space for art exhibition, are elevated to the level of project strategies. This was the result of a failed tender process in 1999 and subsequent multi-phase development over more than twelve years. The Palais, originally erected for the International Exposition held in Paris in 1937, had undergone various transformations over time, for example to house the National Museum of Modern Art and the Palais du Cinéma. The architects were confronted with a flawed building, but at once an architecture *"that was already there"*. Thus, there was little for them to do: consolidate the minimal operations happening there as a result of the economic context, and take advantage of the possibility of creating "porous" spaces.[12] There was sufficient space for spontaneity[13] and it could certainly be appropriated by the users (figure 7).

Indefinite use and space make way for an optimistic relationship with the building's own and current times: "*This attitude blurs the project's relationship with time*".[14] It suspends that connection and so the supporting structure – either designed as in Nantes or found as in Paris – is neither an element that comes before occupation, nor one that comes after it; rather, it is a frame within which the unexpected can be woven. It shows how architecture responds to the starkest reality, without abstract or theoretical mediation, indifferent to the mechanisms of disciplinary composition. **p.38**

A similar stance is exhibited by French architects of a younger generation – for example, in the work of Studio Mutuo, which explores capacity to adapt to a changing programme, or in that of Philippe Rahm, which introduces climate and environment as factors with a decisive influence on flexibility. The work of the Bruther team takes the idea further by stating that in the open plan, adaptability, flexibility and neutrality "*are not designed to respond to static functions but rather to satisfy an open brief"* that can accommodate future events. Once again, a search for flexibility is sustained by a structural system conducive to "*programmatic indetermination and flexible usage".*[15]

More than buildings, these are "*equipped economic structures"* whose life cycle affects their structural components, their maintenance and durability, and their economic and social viability. Aspirations for a long life cycle call for adaptability and changing uses. This cannot be improvised; formal and design decisions must be taken from the outset to guarantee control over financial matters and energy consumption at all times.[16] This is strongly reminiscent of the well-known principles of "open building" proposed by N.J. Habraken in *The Design of Supports* in the 1960s. These dictate that we must separate the immovable, the support, from what can change according to the user's needs at any given time.[17] Examples of this can be found in the Student Residence and Reversible Car Park in Palaiseau (2016) designed together with the Baukunst studio, where the neutral structure of the building promises to be able to host any planned future changes of use – in this case, partly programmed in advance (figure 8).

In short, architecture is imbued with flexibility, change and permanence in the independent relationship between the programme of needs and the built surface, in their *superimposition*. This manifests itself first and foremost in a construction system based on oversizing the load-bearing capacity of the structure. What is more, this system has to set aside its visual values, to a certain extent, being content to provide a support and tool for change. For these architects, the change comes with the disconnect between the structure and the lightweight construction systems that accommodate current and future uses. It also depends on an understanding of the particular time in question. We are not referring to a before and an after, but to two temporalities, neither of which prevails over the other, which are born of new intentions and, in turn, give rise to a different temporality: a third space for unexpected phenomena. "*This third reality, stemming from the superimposition of strata and of temporalities, of a place within a place, is miraculous."*[18] **p.39**

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Secondly, this change is expressed in a certain indifference of use, in a programme of needs that is either not considered entirely relevant, or is assumed to be changing and unspecific, or both. This yields an architecture that is transformed into a relational system, open to different views and dialogues. As Nicolas Bourriad, first director of the Palais de Tokyo, points out, it is "*the realm of human interactions and its social context*"[19] that end up defining architecture, as opposed to the independent object or some reaffirmation of the private space. The structure extends as far as regulations or economic factors allow. And the programme is circumvented with neutrality, as well as with the clear intention of bestowing architecture with the greatest possible relational capacity. Architecture is absorbed by
p.40 the economy of the possible, in the celebration of the everyday. Architectural design is changing: it is an expression of each moment and develops over the long term (figure 9).

So is it the physical alteration that allows the architecture to be flexible and endure over time? Is it the indeterminacy of the programme? Could change be understood from other perspectives? Are there other ways to extend the life of buildings so that we can define them as flexible?

ARCHITECTURE AS AN OPEN PROJECT: THE LIFE OF BUILDINGS

"La vida de los edificios. Las ampliaciones de la mezquita de Córdoba" ("The Life of Buildings: The Extensions of the Mosque in Córdoba"), is the title of an article written by Rafael Moneo and published in 1985 in the magazine *Arquitectura*.[20] A few years earlier, in May 1977, he had given a lecture on Spanish architecture with the same title at the Harvard Graduate School of Design. That talk and the article that followed aimed to respond to the structuralist approaches that were emerging from the sphere of language to take the centre stage of academic and disciplinary debate.[21] Transferred to the field of architectural analysis these approaches – which, according to Moneo, all critics were obliged to submit to – worked to identify the deep formal structure of architecture.

Based on the example of the Mosque of Córdoba, and by means of a fairly detailed narration of the history of the project and a meticulous analysis of its constructive elements throughout its more than eight centuries of evolution, Moneo concludes that the building is imbued with a timeless essence. Recognizing a set of initial values sustained over time by each architect through a careful analysis of the built architecture would allow us to appreciate and propose the following changes (figure 10).

Each building would have an essence, logic and formal features of reading so evident that any change would come
p.41 about in a natural way. And the architecture would allow for such change, thereby extending its lifespan, propagating "*the miracle of its evolution over time*".[22] To put it another way, "*the life of buildings is supported by their architecture, by the permanence of their most characteristic features and, although it may seem paradoxical, it is this permanence that allows us to appreciate the changes*".[23]

This notion of continuity reveals itself with different nuances in his work, which has on several occasions involved
p.42 expanding or intervening on existing architectures. To name just a few of these projects, we have the expansion of the Atocha Station (1984-1992), the Museo Thyssen-Bornemisza (1989-1992), the Museo del Prado (1998-2007) and the expansion of the Banco de España building (1978-2006) in Madrid; the expansion of the City Council headquarters in Murcia (1991-1998) and the General and Royal Archives of Navarra (1994-2003) in Pamplona. In these projects, the architect implicitly or explicitly acknowledges a previous reality and its principles, its historical and constructive analysis, and anticipates a future change through its extension or by promoting a change of use. In other words, this is an architecture that "*must accept continuity as a norm*".[24]

Moneo also pointed out during his talk that "*the desire to take into account continuous change, thus ensuring that a work of architecture responds adequately to the passage of time, has led to the introduction of the concepts of* flexibility *and* multifunctionality".[25] In short, the permanence of architecture, its *flexibility*, makes it necessary to identify its "*deep formal structure"*, its original disciplinary principles. These have to remain "sufficiently solid" over time, be defined with equally sufficient clarity and be recognized (and therefore respected) at each moment of change and by each architect. By relying on these intelligible and logical formal principles, and on firm categories and attributes of the design processes, architecture can "*prolong itself in other architectures"*.[26] Architecture is subject to the passage of time, but unlike other disciplines it can also age – be flexible – in a unique way, through extensions, reforms and repairs. This would be another way of understanding flexibility as change.

THE INTERPRETER

Taking things a step further, perhaps what we propose can be better understood in the light of what Moneo said during the same presentation in relation to the "life of the building". Firstly, the architect "*would ensure their work withstood the passage of time whenever their project could be qualified as 'open'"*.[27] At the height of popularity of structuralist theories of language, Moneo pointed out this parallel between open architecture and language and Umberto Eco's *Opera aperta*, a work at the time the subject of much academic debate. The structure of the *text* (here we might substitute *architecture*) is not fixed; rather, it can sustain many other readings, open to each reader, who would thus rewrite the same *text* (*the same architecture*) each time, perpetuating it over time:

"[T]he poetics of the 'open' work tends to encourage 'acts of conscious freedom' on the part of the performer and place him at the focal point of a network of limitless interrelations, among which he chooses to set up his own form without being influenced by an external necessity which definitively prescribes the organization of the work in hand. At this point one could object [...] that any work of art, even if it is not passed on to the addressee in an unfinished state,

demands a free, inventive response, if only because it cannot really be appreciated unless the performer somehow reinvents it in psychological collaboration with the author himself. Yet this remark represents the theoretical perception of contemporary aesthetics, achieved only after painstaking consideration of the function of artistic performance; certainly an artist of a few centuries ago was far from being aware of these issues. Instead nowadays it is primarily the artist who is aware of its implications. In fact, rather than submit to the 'openness' as an inescapable element of artistic interpretation, he subsumes it into a positive aspect of his production, recasting the work so as to expose it to the maximum possible 'opening'."[28]

Secondly, the passage of time would be supported with meticulous analysis of the previous architectural work, turning each subsequent architect into an *interpreter* who must "agree" with the previous one to identify those formal principles that allow them to implement the change while respecting the origins. A sort of lucid chain would thus be established, as Igor Stravinsky recalled: "*the first condition that must be fulfilled by anyone who aspires to the imposing title of interpreter, is that he be first of all a flawless executant".*[29]

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Perhaps at this point we should return to Umberto Eco. It is not difficult to paraphrase how the three types of possible intentions of the interpretation can be applied, in part, to architecture. Eco states:

"*(a) what its author intended to say or*
(b) what the text says independently of the intentions of its author.
Only after accepting the second horn of the dilemma can one ask whether what is found is
(i) what the text says by virtue of its textual coherence and of an original underlying signification system or
(ii) what the addressees found in it by virtue of their own systems of expectations."[30]

The interpretation of the text as a search for the *intentio auctoris* (a) has a parallel in the reading Moneo advances for the Mosque of Córdoba. Even the search for the *intentio operis* (b) might also be understood in this way, either in the case of the formal principles of architecture (b)(i) or those that the interpreter is able to find with their own gaze (b)(ii). To the previous classic opposition between author and work, Eco adds a third intention, the *intentio lectoris*. Under this interpretation, the alternative to a flexible architecture such as the one proposed in Córdoba ((a) and (b)) would lie in a "flexible author" who abandons the original roots of the received architecture to initiate an interpretation open to a new temporality.

If Moneo undertakes this quest to find the received work that its author wanted to originate (if the author is inflexible at the root), then there is an alternative that still yields flexibility in the interpretation of the work. The architect achieves this flexibility when he looks for what the work has to say in light of a contemporary time and culture. This would be the case, for example, of how the architect working on the expansion of the Museo del Prado might understand that project. The new design was pinned to a particular point in time within a historical "chronicle" to "*maintain the identity and integrity of the Villanueva building*", giving "*a series of spaces whose continuity hardly allows us to distinguish between them"*, where we are "*shown that buildings, by unfolding their life over time, dilate, extend and undertake growth [...] without losing their most valuable attributes"*, where as architects it is interesting "*to understand what the previous chapters of the life of a building have been in order to draft a new one*", in a new reading.[31] According to this vision, the interpretative approach to a previous work is what allows change and, in turn, reveals the flexible quality of an architecture (figures 11 and 12).

CONCLUSIONS

In this article we have examined two ways of understanding flexibility. One identifies the original root of the built architecture to propose each new reading that extends it over time. Another is rooted in time, with time as a design variable. Both allow us to understand flexibility less as a physical condition and more as a solution to withstanding the passage of time. Permanence, a commitment linked to change and flexibility, can be achieved through a project that Moneo (in the case of architecture) or Eco (in the case of language) call *open*, a project that can adapt to a variable reality. Architecture changes so it can endure

In this respect, in the text we draw upon Moneo claims that "*experience shows that the life of buildings manifests itself to us through the permanence of their most characteristic formal features over time. And that, therefore, it is not so much about the project process as the autonomy that a building acquires once it is built".*[32] Solid formal mechanisms allow change without changing essence. This makes an architecture flexible, and these mechanisms provide a solution to architecture's permanence and validity.

p.44

In contrast to these firm, formal mechanisms as guarantors of flexibility, we have seen other architectures that guarantee flexibility in their innate capacity for different interpretations and changes. For these – exemplified in the work of the French partnership Lacaton & Vassal and in Bruther – flexibility and capacity for change are signs of an architecture that aims to comply with the passage of time and its new uses. The mechanism of change is the root that sustains an architecture over time. Its permanence resides there, architecture becoming a tapestry permanently open to new interpretations. Permanence lies in the interpretation that the architect makes of the architecture received or in an original work to which their designs will contribute new interpretations. Architecture's continuity resides in its flexibility, in those volumetric, structural or organizational attributes that provide the capacity for change. Flexibility is a mirror reflecting durability over time.

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Postscript: Against interpretation

Umberto Eco would eventually distance himself from what he called "overinterpretation". He would recognize that we do not have to "*necessarily [be] able to prove that one interpretation is the right one, or even [cling] to any belief that there must be one right reading*",[33] thus more likely placing the accent on the *intentio operis* as opposed to the intention of the author or the defence of a "literal" meaning.

Likewise, a work of architecture would therefore contain what is necessary to make a correct reading of it – which would nevertheless not be a unique reading, of course. According to Richard Rorty, instead of looking for an intention or an origin, our concepts are instruments for a certain purpose. In short, a new gaze would be more useful and
p.45 profitable to our purpose, because "*[i]nterpreting something, knowing it, penetrating to its essence, and so on are all just various ways of describing some process of putting it to work*",[34] of using it.

And sometimes things are exactly as they seem. There are architectures in which we cannot find any intention to bring about change. They are rigid, inflexible; they are just as they were designed, and for the purposes they were designed for. That is their historical *iter*. Yet, they seem to share a fate with those other architectures that we call flexible; namely, permanence in time. And they change, too. This would be a third way of understanding flexibility, one which Aldo Rossi identified in some of the great historical buildings, unrelated to any operational change strategy, after noting the effects of several decades of reuse: the form is always stronger than any use attributed to the construction.[35] The formal logic of these buildings, Rossi said, endowed them with a capacity for constant use, passing naturally from use to another. In other words, maximum architectural precision will often permit a maximum indifference of use. The indifference in the way of some historical buildings have been reused of late – in contemporary terms, the *neutrality* of an architecture –[36] allows any function to be accommodated in time, thereby achieving the ultimate goal of flexibility: permanence.

Finally, as Susan Sontag lucidly reminded us in a similar line of thought: *"Our task is not to find the maximum amount of content in a work of art, much less to squeeze more content out of the work than is already there. [...] The function of criticism should be to show* how it is what it is*, even* that it is what it is*, rather than to show* what it means*".*[37] Or as Josep Quetglas pointed out, "*architecture, like everything that lives in time, lacks definition, or possesses it in the crisis of its successive definitions".*[38] After all – and paradoxically – we can understand Moneo's words: "*I must say*
p.46 *that I see ever more clearly that buildings shift in time, that they do not have the permanence, the immobility that we sometimes desire for them, and that they are diverse at each moment in time".*[39]

In contrast to flexibility and change, permanence and immutability are terms that do not make as frequent an appearance in contemporary architectural discourse. But to a certain extent they also guarantee architecture endures over time. And is this not the ultimate goal of flexibility?

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Both authors declare that there is no conflict of interest in the results of the work.

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A. GUAJARDO-FAJARDO CRUZ, J. J. SÁNCHEZ RIVAS "En busca de la flexibilidad: el cuadrado y la retícula en la vivienda contemporánea" Proyecto, Progreso, Arquitectura. Mayo 2025. E. Universidad de Sevilla. ISSN 2171-6897 / ISSNe 2173-1616 – RECEIVED - 15-09-2024 / ACCEPTED - 09-03-2025

EN BUSCA DE LA FLEXIBILIDAD: EL CUADRADO Y LA RETÍCULA EN LA VIVIENDA CONTEMPORÁNEA

IN SEARCH OF FLEXIBILITY: THE SQUARE AND THE GRID IN CONTEMPORARY HOUSING

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p.49 INTRODUCTION

The idea that certain geometries favour flexibility of use in domestic space has become common topic of reflection in the field of housing architecture[1]. It is often argued, for example, that geometries tending towards symmetry and proportion give rise to non-hierarchical spaces that promote flexibility. Among geometric figures, the one that provides the greatest degree of symmetry is the circle. However, except on rare occasions, it is seldom used in residential architecture due to its constructive complexity and the difficulty it poses for aggregation in the process of filling space. The square, by contrast, has emerged in recent years as a figure capable of generating a certain consensus among architects and researchers, due to its potential to enhance flexibility of use in housing. This is supported by the constructive simplicity of the right angle and its ability to fill space through repetition within an isotropic grid.

Reflection on the use of the square as the foundation of a typological scheme has a long-standing tradition in the history of architecture. Thus, since classical times, the square has been a fundamental figure for all those projects that have made geometry the main argument of their architecture. This tendency is clearly evident in the Renaissance, a period that also produced one of the earliest texts theorising the role of geometry in domestic architecture: *The Four Books of Architecture* by Andrea Palladio (1570). The treatise includes numerous examples of villa plans whose geometric structure is based on the square. However, it was not until the twentieth century that the demand for flexibility in domestic space introduced a new analytical dimension to this typological strategy, which had historically been focused on compositional and formal concerns.

In contemporary architecture, the idea that certain geometries ensure flexibility in housing had traditionally been
p.50 limited to the scale of the individual room. That is, it was argued that rooms with a suitable surface area and a shape tending towards the square would allow for varied furnishing configurations and, therefore, diverse uses—thereby increasing their flexibility[2]. However, over the past decade, a number of projects have decisively extended this theory from the room to the entire dwelling, conceiving the residential design as a pure grid of squares—a sequence of identical rooms with no spatial hierarchy or interruption. This elementary approach to addressing flexibility in contemporary housing design calls for critical reflection[3].

Indeed, the issue of flexibility in housing has been the subject of architectural debate for more than a century. So much so that some critics have not hesitated to identify it as one of the core objectives of modern housing[4]—or even of architectural modernity itself[5 6 7]. It was during the 1920s, with the rise of the Modern Movement, that flexibility began to be seen as a necessary attribute for ensuring that small-scale dwellings remained habitable[8]: if a dwelling was to be minimal, it had to be flexible enough to allow the most efficient use of space. Since then, flexibility has remained central to the discourse of architects and scholars engaged in housing design, taking on different nuances in meaning and objectives over time[9].

This article understands flexibility as the capacity of a space to adapt to different uses, needs, or conditions over time. In summary and drawing on the insightful classification proposed by Bernard Leupen[10], we can identify two basic strategies that promote spatial flexibility: alterability and polyvalence. The first refers to all actions that involve architectural modifications to the space—from the movement of a movable partition to construction solutions that allow for its replacement. Polyvalence, by contrast, is based on a space's ability to accommodate different uses without the need for architectural intervention. The effectiveness of this latter strategy lies particularly in the degree of spatial ambiguity it enables —an attribute widely highlighted by researchers as one of the most significant in achieving architectural flexibility[11].

p.51 This research aligns itself with those studies that argue the use of the square and the grid as a compositional strategy in housing design effectively increases spatial ambiguity—and, consequently, flexibility[12]. This system conceives the dwelling as a sequence of rooms without any preassigned function: spaces equal in size, shape, and fittings, open to multiple functional interpretations. The aim of this article is to analyse the implications of this strategy for domestic architectural design. Throughout the text, this model—based on the additive composition of square (or nearly square) spaces—will be referred to as grid-based housing.

From a methodological standpoint, this article begins with a brief reflection on the possible reasons behind the strong visual appeal of the square and the grid, analysing their foundations in purely compositional and formal aspects. A selection of contemporary architectural examples is reviewed and complemented by critical reflections on the role of the grid in today's visual culture. The discussion then turns to the nature of polyvalent and ambiguous architectural space, as well as to the characteristics it must meet in order to ensure flexibility of use. We argue that the convergence of these deep, compositional and formal motivations with those of a more pragmatic nature—related to flexibility of use—may be what accounts for the grid's enduring visual and conceptual appeal.

Finally, the article presents a case study analysis of some key features found in dwellings that adopt this compositional approach. The selection of case studies involved a comprehensive review of the entire digital archive

of the EUmies Awards (Mies van der Rohe Foundation), in both the collective and single-family housing categories (1,050 projects), from its inception in 1988 to the 2024 edition, as well as all housing-related issues and yearbooks of *AV Monografías*[13] (47 volumes in total), spanning the period from 1985 to 2025. This dual approach accounts for those projects that have achieved a high level of recognition, either through publication in internationally renowned journal or by receiving awards in acknowledgement of their architectural quality. A total of 23 projects have been identified that follow the strategy of conceiving the dwelling as a grid of squares (Table 1). Notably, although the study covers a period of forty years, all of these projects were developed within the past two decades—highlighting the growing prevalence of this compositional system in recent years.

Our analysis focuses on a detailed study of six projects—three collective housing developments and three single-family dwellings—with the aim of demonstrating that grid-based housing is compatible with both residential typologies. All selected projects have been redrawn and graphically analysed according to consistent criteria for their better study and understanding.

Year	Author	Project	Place	Type
2024	MAIO	40 social housing units for rent	Sant Feliu de Llobregat, Spain	Collective
2023	Pezo von Ellrichshausen	Casa LUNA	Yungay, Chile	Single-family
2022	TEN	Avala House	Belgrade, Serbia	Single-family
2022	Harquitectes	136 social housing units in Gavá	Gavá, Spain	Collective
2022	08014 arquitectura	24 public housing units on Playa d'en Bossa beach	Ibiza, España	Collective
2022	Vivas Arquitectos Pau Vidal	La Chalmeta cooperative housing	Barcelona, Spain	Collective
2022	Sophie Delhay Architecte	"Unité(s)+" - 40 modular social dwellings	Dijon, France	Collective
2022	Matthew Barnett Howland	Cork House	Eton, United Kingdom	Single-family
2022	BIG - Bjarke Ingels Group	79 and Park	Stockholm, Sweden	Collective
2021	Tuñón y Albornoz Arquitectos	Casa de ladrillo	Madrid, Spain	Single-family
2020	José María Sáez Vaquero Taller General	Casa Pitaya in Mindo	Mindo, Ecuador	Single-family
2020	Peris + Toral arquitectes	85 social dwellings in Cornellá de Llobregat	Cornellá del Llobregat, Spain	Collective
2019	COBE	The Silo	Copenhagen, Denmark	Collective
2019	Space Popular	Casa bóveda de ladrillo	Godella, Spain	Single-family
2018	Tuñón y Albornoz Arquitectos	Casa de Piedra	Sierrilla, Spain	Single-family
2017	MAIO	110 ROOMS. Collective Housing at Provença Street	Barcelona, Spain	Collective
2017	Dorner\Matt	Residential building St. Gallenkirch	St. Gallenkirch, Austria	Collective
2017	Playa Arkkitehdit Oy	Kotisaarenkatu Housing	Helsinki, Finland	Collective
2017	MAIO	22 dwellings in Provença Street	Barcelona, Spain	Collective
2017	SV60 Cordón & Liñán arquitectos	317 social housing units in Loma del Colmenar	Ceuta, Spain	Collective
2015	OFFICE	Villa Der Bau	Linkebeek, Belgium	Single-family
2014	Pezo von Ellrichshausen	Casa Meri	Florida, Chile	Single-family
2012	OFFICE	Villa Buggenhout	Buggenhout, Belgium	Single-family
2007	Sadar + Vuga	Apartment House Gradaska	Ljubljana, Slovenia	Collective

Table 1. Identified cases in the complete digital archive of the EUmies Awards (Mies van der Rohe Foundation) and in the 47 housing-related issues and yearbooks of *AV Monografías*, spanning the period from 1985 to 2025.

FORM AND FUNCTION: A DUAL APPROACH TO THE SQUARE AND THE GRID

Before delving into the case study analysis, this article begins with a review of the role of the square and the grid from a twofold perspective: first, as a formal and compositional argument, and second, as a functional strategy that promotes spatial flexibility.

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The Square and the Grid as a Formal Strategy

The square as a shape and the grid as a compositional system have played a notable role in both contemporary architecture and art, gaining particular prominence since the avant-garde movements of the twentieth century. The painting *Black Square on White Background* by the Ukrainian artist Kazimir Malevich (Figure 1) synthesises early explorations of elemental geometry and formal abstraction initiated by the Suprematist avant-garde, which have since inspired numerous formal investigations of the square within the visual arts.

p.52 Sculpture has also participated in this radical current of abstraction. Driven by the spatial engagement introduced by conceptual art and land art, the American sculptor and poet Carl Andre created floor pieces—such as *10×10 Altstadt Copper Square* (Figure 1)—based on the compositional logic of the square grid. These works, which are framed within the artistic minimalism of the second half of the twentieth century, made explicit use of elementary geometry as a strategy for spatial appropriation—allowing the viewer to move across them.

In architecture, the square as a basis for spatial composition also gained prominence throughout the twentieth century, initially driven by the formal refinement of the early Modern Movement, and later by the conceptual cross-pollination between minimalist art and the steel-and-glass architecture of the post-war period. This connection did not go unnoticed by the American artist and writer Dan Graham, who argued that aesthetic formalism and architectural functionalism were closely aligned, as both shared an abstract materialism and a primarily self-referential attitude toward context[14]. These two characteristics have consistently appeared in certain strands of contemporary architectural production—as well as in other cultural expressions[15]— and remain latent in several of the case studies discussed in this article (Figure 2).

The use of the grid thus raises a fundamental question: Is it a decision grounded in rational principles—economic, constructive, or functional—or, rather, a poetic gesture tied to its associations with timelessness and formal restraint?

Regardless of the motivations behind its adoption, the square has usually been explored as the basic module of
p.53 Cartesian space, whose most immediate representation in architecture and the visual arts is the grid. The American art critic Rosalind Krauss, in her seminal essay "*Grids*", argued that within modern aesthetic production as a whole, the grid is the form that has most relentlessly asserted itself while being the least susceptible to transformation[16]. This
p.54 assertion is supported by the enduring presence of this formal structure in contemporary architectural production, from spatial organisation to façade composition. The case studies analysed in this article show how this formal operation has been applied to domestic architectural space in a literal way.

The Square and the Grid as a Functional Strategy

The strong formal appeal exerted by the square and the grid on many artists and architects since the early twentieth century was further reinforced from the 1960s onward by a new line of reasoning—this time from a functional perspective: neutral and generic spaces, such as those defined by the square and the grid, proved useful in promoting flexibility in the use of architectural space.

In his seminal book *Complexity and Contradiction in Architecture*, Robert Venturi put it this way:

'Is not Modern architecture's characteristic separation and specialization of program functions within the building? (…) The multifunctioning room is a possibly truer answer to the Modern architect's concern with flexibility. The room with a generic rather than a specific purpose, and with movable furniture rather than movable partitions, promotes a perceptual flexibility rather than a physical flexibility, and permits the toughness and permanence still necessary in our building[17].

In other words, Venturi advocated for the creation of neutral, homogeneous, ambiguous, and polyvalent rooms—what he called "generic"[18] spaces—capable of accommodating different uses without the need for architectural modification or recourse to mechanisms such as movable partitions, the epitome of alterability. The square, as the neutral geometry of the room, and the grid, as the homogeneous compositional mechanism of the dwelling, proved easily adaptable to such requirements.

Two studies have further explored these ideas and sought to demonstrate that the square is the most suitable geometry for achieving spatial flexibility. One originates from Europe, and the other from North America. The first was conducted by Josep María Montaner, Zaida Muxí, and David H. Falagán[19] (Figure 3). The authors analyse modules of different sizes with various furniture layouts, concluding that for a room to be flexible, it should have a square geometry with proportions that allow at least a 2.80-metre-diameter circle to be inscribed. The second is presented by Avi Friedman in his book *The Adaptable House*[20] (Figure 3). Friedman also advocates the use of square geometry, arguing that it imposes fewer limitations when organising furniture within the space.

We consider that all the projects analysed below can be interpreted through a twofold lens. From a formal perspective, the square and the grid express the strength of a pure, essential geometry, connecting them with the notion of timeless architecture; from a functional perspective, the neutrality of their forms supports the configuration of ambiguous spaces, thereby increasing the flexibility of use within the dwelling.

CASE STUDY ANALYSIS

This section of the article aims to identify and examine some of the key characteristics—those we consider most
p.55 significant—of grid-based housing. The analysis is based on the study of six housing projects (Table 2; Figures 6a and 6b). Three of the cases are drawn from the sample previously presented (Table 1), while the remaining three have been

selected from monographic publications by architectural firms. The selection criterion focused on identifying projects that most clearly exemplify the use of the grid-based housing system. The time frame of the study spans the past two decades, a period during which the number of such projects has noticeably increased (Table 1). No geographical restrictions were applied in the selection process. The analysis is organised into six concise subsections, each of which synthesises an architectural condition that emerges from this compositional system.

Case	Year	Author	Project	Place	Type
1	2018	Tuñón y Albornoz Arquitectos	Casa de Piedra	Sierrilla, Spain	Single-family
2	2014	Pezo von Ellrichshausen	Casa Meri	Florida, Chile	Single-family
3	2012	OFFICE	Villa Buggenhout	Buggenhout, Belgium	Single-family
4	2020	Peris + Toral arquitectes	85 social dwellings in Cornellá de Llobregat	Cornellá del Llobregat, Spain	Collective
5	2018	Carles Enrich	Habitat Fluvial. 56 social housing units	Sant Adrià del Besós, Spain	Collective
6	2018	Pau Vidal	Subsidised housing	Sant Just Desvern, Spain	Collective

Table 2. Selected case studies

Hello and Goodbye: On the Entrance to the Home

The entrance to the home can become a point of conflict within this type of system. Small entrance vestibules—a classic device in residential architecture used to mediate the transition between exterior and interior—are not part of the logic of grid-based housing, where all rooms are of equal size.

This does not appear to pose a problem in the detached dwellings analysed. Thanks to their generous spatial availability, a full module can be allocated to the entrance (Figure 7). This is the case in *Casa de Piedra* (Case 1) and *Villa en Buggenhout* (Case 3), with the former featuring an exterior access and the latter an interior one. In contrast, *Casa Meri* (Case 2) completely discards the idea of a fixed "entrance to the home," turning every room into a potential point of entry.

This issue is more complex in collective housing projects, due to the need for greater space efficiency and the boundary conditions that restrict it. Among the cases analysed, two solutions can be identified for addressing the entrance. The most immediate is using the kitchen as the entry space (Case 4). Another approach is the subdivision of the entrance module, as seen in *Hábitat Fluvial* (Case 5) and the *Sant Just Mas Lluí* housing development (Case 6). Although this partially disrupts the grid, it avoids the drawbacks of direct access without transitional space.

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Status in Crisis: The Living Space

One of the most immediate characteristics identified through the formal analysis of these dwellings is the declining importance of the living room[21] in relation to the other rooms. It can be argued that, at least since the rise of the modern tradition—when the dwelling as we know it today began to take shape—the living room has been consolidated as the most important room in the house, both in dimensional and symbolic terms. It is typically the largest space, the best positioned (in terms of views, light, and ventilation), and the one most strongly associated with the representation of family status.

From a formal and compositional perspective, grid-based housing challenges the traditionally privileged role of the living room. When examining the six selected floor plans in their unfurnished versions, only in two cases (Cases 1 and 5) can one clearly infer which room is intended to serve as the living area (Figure 8); in the remaining four, this is notably difficult.

This is a formal, not a functional, disruption. Form is the responsibility of the architects; how that form is used depends on the occupants. The grid-based housing is flexible enough to accommodate a traditional living–dining configuration—two or three adjoining modules can simply be allocated to it. The novelty of the system lies in the fact that it is the inhabitant, not the architect, who determines where and how to position it.

Football Is Played in the Street: The Disappearance of the Corridor

The corridor has long been an almost intrinsic element of residential architecture. Even in projects considered archetypes of spatial fluidity, such as Villa Tugendhat (Mies van der Rohe, 1928–1930), transitional zones appear to provide access to the more private areas of the home. The logic of grid-based housing, with direct connections between adjoining rooms, challenges the need for dedicated circulation spaces. As a result, the entire floor plan is allocated to habitable rooms; in return, many of these rooms also serve as passageways[22].

In the collective housing cases analysed, the common areas (kitchen, living room, dining room) typically function as circulation routes to the bedrooms (Figure 9). In detached dwellings, by contrast, one or more modules are devoted

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almost exclusively to circulation. This removal of transitional space leads to direct connections between rooms that have traditionally remained separate—such as bedrooms and kitchens.

Function Resists: The Kitchen and the Bathroom

Functional determination is, by its very nature, at odds with the principle of spatial ambiguity that underpins grid-based housing. As a result, kitchens and bathrooms tend to be less compatible with this system. Due to their fixed fixtures and smaller dimensions—particularly in the case of bathrooms—they require specific architectural strategies in order to be integrated without occupying an excessive share of the available space.

In situations where space is abundant, assigning a full module to these functions resolves the issue. However, in most collective housing projects, this is not a viable option, making the subdivision of a module a practical solution[23].

In the detached housing examples, two distinct approaches to the bathroom's spatial role can be observed: one treats it as a smaller space (Case 1), while the other gives it the same size and importance as any other room (Cases 2 and 3). This dichotomy between equipment and habitable space also applies to the kitchen (Figure 10). In cases where dedicating a full module to the kitchen is not feasible, a common solution is to integrate it with another room (Cases 4, 5, and 6). This approach appears in all three collective housing examples, where the kitchen is merged with the living–dining space. In all three cases, this combined living–dining–kitchen unit occupies the central modules and functions as a circulation zone leading to the bedrooms—connecting rooms that, in traditional corridor-based layouts, were not directly linked. This continuity raises questions from a functional standpoint.

Back and Forth: Doors and Furniture

One of the typical requirements of flexible rooms is the lack of fixed furnishings, with storage ideally placed in the shared areas of the home. However, the very nature of grid-based housing significantly limits the presence of such spaces—corridors, hallways, or foyers. As a result, most of the projects analysed avoid built-in wardrobes altogether[24]. All furniture is potentially movable, which contributes to a high degree of flexibility within the dwelling.

Although this is a positive attribute for the dwelling, there are two issues to consider. First, the juxtaposition of rooms—and therefore the number of doors required (it is common to find rooms with two or even three doors)—tends to limit furnishing options. This is due to inevitable circulation paths and the limited availability of usable wall surfaces. A natural solution appears to be the use of island furniture—that is, placing furniture at the centre of the room.

p.62 Secondly, and as a consequence of the above, corners become particularly important when it comes to furnishing rooms[25]. They are often the only areas free from circulation and with sufficient uninterrupted wall surface to accommodate furniture. As a result, shelving units, wardrobes, and auxiliary pieces are typically—if not inevitably—located in corners (Figure 11). The configuration of the dwelling as a strict square grid, with numerous doors and circulation routes, appears to compromise both flexibility and ease of furnishing.

Two Compositional Mechanisms: No to Zoning, Yes to the Enfilade

One of the main consequences of the rationalisation of housing initiated at the beginning of the last century was the functional zoning of the home into day and night areas. Grid-based housing challenges this traditional division. Uniform rooms preclude any predefined functional separation and open up the possibility for alternative configurations—such as work versus living zones, or formal versus informal areas—without excluding the more conventional distinction between day and night uses. More importantly, the design of the rooms and the way they are grouped do not determine their role in advance; it is up to the user to decide how to inhabit them. This marks a major conceptual break from the domestic architecture inherited from the modern tradition.

If the grid dwelling discards the compositional mechanism that functionally sectorises it, it recovers another much older one which, except in the last century, has been profusely employed in the history of residential architecture: the *enfilade* (Figure 12). This is a resource in which a succession of concatenated spaces gives spatial attraction to the whole. All of the case studies analysed—without exception—align their doors in this way, deliberately reinforcing this spatial continuity.

CONCLUSIONS

This article has analysed the relationship between the geometric form of the square, the grid as a compositional
p.63 strategy, and spatial flexibility in contemporary housing. It has also examined the main characteristics of dwellings designed as square grids through six case studies—three single-family and three collective housing projects.

We argue that the recent proliferation of residential designs based on square grids stems from the convergence of a dual design approach: one formal and one functional. The former is rooted in the powerful aesthetic appeal of the square as an elemental geometry and the grid as an organising system, as well as in the role both have played in contemporary architecture and visual culture—particularly since the artistic avant-garde and the Modern Movement. It is important to recall that geometry has long served as a classical tool in architectural history. As such, formal experimentation with pure geometries creates subtle links to classical architecture and lends these projects a sense of timeless value. In this regard, Colin Rowe, in his 1947 essay *The Mathematics of the Ideal Villa*, argued that the mathematical principles underlying Palladian composition could be found in the architecture of the Modern

Movement—specifically in the work of Le Corbusier—thus revealing the structural and compositional continuity that connects different periods of architectural history[26].

On the other hand, a functional justification for these systems can be established, based on the idea that the square and the grid contribute to the spatial ambiguity of the dwelling and, therefore, to its flexibility of use. Among the cases studied, some place greater emphasis on the formal dimension, others on the functional; however, there is reason to argue that all draw from both approaches. p.64

Secondly, following the case analysis, it becomes evident that—despite the difficulty of evaluating how these projects are inhabited and transformed over time, a limitation that naturally constrains our ability to understand the interaction between spatial order and lived experience—the grid of squares, from a theoretical perspective, introduces ambiguity and, by extension, flexibility into the housing project.

What can be stated with confidence is that dwellings composed using this system help to decode more traditional housing models and pave the way for a greater degree of experimentation in how we inhabit domestic space. From an essentially formal perspective, their compositional clarity and geometric order are closely linked to constructional simplicity, and are often expressed in façades through rational design schemes—an aspect that also enhances economic efficiency. This clarity is particularly evident in the collective housing cases studied, where the spatial structure of the whole resonates with the internal organisation of the individual dwelling units.

From a functional standpoint, the surfaces of the dwelling are fully optimised, with no residual or wasted space. Moreover, spaces traditionally associated with domestic work—such as the kitchen—are seamlessly integrated into everyday life, avoiding their relegation to secondary service zones dedicated to solitary household tasks.

However, like any system, certain limitations can also be identified. The most significant stem from the strict imposition of geometry, which may at times conflict with available resources—be they economic or spatial—and with the functional requirements of the dwelling itself. Among the first, a dimensional issue stands out: in its most elementary expression, the grid-based housing assigns the same spatial conditions to a toilet as to a living room or a kitchen. While this may not pose a limitation in projects with no spatial or economic constraints, it becomes a real challenge in those with tight budgets and limited floor areas. Among the second, one can highlight the emergence of direct connections between rooms—such as kitchen-to-bathroom or kitchen-to-bedroom links—which can become functionally problematic due to habits, noise, and odours. Lastly, furnishing limitations arise from circulation constraints and the lack of uninterrupted wall surfaces suitable for furniture placement.

In any case, the grid-based housing represents an appealing strategy for addressing the contemporary domestic project. Its appeal ultimately lies in the convergence of the poetic and the rational—of form and function. It is undoubtedly a system with considerable potential for continued exploration within residential architecture, and one that may offer effective responses to some of the key challenges facing our society today: spatial scarcity, the diversification of household models, and the ongoing transformation of the ways we inhabit domestic space.

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1 PARICIO, Ignacio; SUST, Xavier. *La vivienda contemporánea. Programa y tecnología*. Barcelona: Institut de Tecnología de la Construcción de Catalunya-ITeC, 1998, p. 77. ISBN 978-84-7853-396-1.

2 FRIEDMAN, Avi. *The adaptable house: designing homes for change*. New York: McGraw-Hill, 2002, p. 129. ISBN 978-0-07-137746-1.

3 In Spain, it was the architect Xavier Monteys who, in 2013, advanced this way of approaching housing design in a thought-provoking article published in the journal *Quaderns d'arquitectura i urbanisme* entitled *La casa de habitaciones iguales (The House of Identical Rooms)*. In it, he reflected on the relevance and contemporary nature of dwellings organised through homogeneous spaces, juxtaposed without distinction: '*The house of identical rooms (...) is today one of those formulations that best express what a good house should be. Such a house does not distinguish its rooms by their pre-assigned function; in fact, its main virtue lies in leaving it up to us to decide what to do with them. Floor plans structured through similar rooms, without a well-defined hierarchy, demand our attention today more than ever*'.

4 MARTÍN HERNÁNDEZ, Manuel. *La Casa en la arquitectura moderna: respuestas a la cuestión de la vivienda*. Barcelona: Reverté, 2014, p. 313. ISBN 978-84-291-2124-7.

5 COLQUHOUN, Alan. *Essays in architectural criticism: modern architecture and historical change*. New York: MIT Press, 1981, p. 161. ISBN 9780262530637.

6 GILI GALFETTI, Gustau. *Pisos piloto: células domésticas experimentales*. Barcelona: Gustavo Gili, 1997, p. 13. ISBN 84-252-1716-4.

7 TILL, Jeremy; SCHNEIDER, Tatjana. *Flexible housing*. Oxford: Architectural Press, 2007, p. 17. Available at: DOI:10.1017/S1359135505000345.

8 In this sense, it is particularly significant to note how Walter Gropius, in issue no. 2 (1927) of Bauhaus magazine, pointed out that the '*variable floor plan*'—one that could be modified at will—would be the solution to accommodate the changing needs of users. Marcel Breuer, one of the most forward-thinking architects of his time, echoed this in his illuminating 1928 essay *Metallmöbel und moderne Räumlichkeit*, where he wrote: '*Because today's external world affects us in the most intense and diverse ways, our lives are changing more rapidly than in the past. It is therefore clear that our environment will undergo a similar transformation. This leads us towards layouts, spaces and buildings in which every part can be altered, made flexible, and combined in different ways*.'

9 FORTY, Adrian. *Words and buildings: A vocabulary of modern architecture*. London: Thames & Hudson, 2000, p. 142. ISBN 978-0-500-28470-4.

10 LEUPEN, Bernard. *Frame and generic space*. Rotterdam: 010 Publishers, 2006. ISBN 978-90-6450-598-0.

11 TILL, Jeremy; SCHNEIDER, Tatjana, op. cit supra, note 7.

12 MORALES SÁNCHEZ, José; GILES DUBOIS, Sara de. Estancias. El espacio ampliado del habitar. En: *Proyecto Progreso, Arquitectura*. Más que arquitectura [online]. Sevilla: Editorial Universidad de Sevilla, 2019, n.º 20, p. 43 [accessed: 15-03-2025]. ISSN-e 2173-1616. DOI: https://doi.org/10.12795/ppa.2019.i20.02.

13 In addition to the monographic issues devoted to housing, the yearbooks have also been included in the review, as they feature works by various authors rather than single-architect monographs. These volumes contain a dedicated housing section that compiles annually selected projects considered particularly relevant.

14 GRAHAM, Dan. Art in Relation to Architecture. Architecture in Relation to Art. En: *Artforum*. New York: Penske Media Corporation, February 1979, no. 6, vol. 17, pp. 22-29. ISSN 0004-3532.

15 GONZÁLEZ CUBERO, Josefina. Paisajes contemporáneos de la abstracción geométrica: la retícula en el espacio escénico. In: *Proyecto, Progreso, Arquitectura*. Espacios del drama [online]. Seville: University of Seville Publishing House, no. 28, 2023, pp. 18-33 [accessed: 15-03-2025]. DOI: https://doi.org/10.12795/ppa.2023.i28.01.

16 KRAUSS, Rosalind. Grids. In: *The originality of the avant-garde and other modernist myths*. Cambridge: MIT press, 1986, p. 8. ISBN 0262610469

17 VENTURI, Robert. *Complexity and contradiction in architecture*. New York: The Museum of modern art, 1977 [1966], p.34. ISBN 9780870702822

18 Within the terminological debate, Herman Hertzberger, in his essay "Polyvalence: The Competence of Form and Space with Regard to Different Interpretation", published in his book *Architecture and Structuralism: The Ordering of Space* (nai010 publishers, 2014), contrasts polyvalent space with generic space. For Hertzberger, the former is actively designed with the intention of being flexible while preserving its architectural qualities, whereas generic space is stripped of meaning, constituted as a completely neutral form of architecture. This article does not draw such a distinction, and adopts Leupen's understanding of *polyvalence*: a space capable of adapting to different forms of use without the need for architectural transformation.

19 MONTANER, Josep María; MUXÍ Zaida; FALAGÁN, David H. *Herramientas para habitar el presente; la vivienda del siglo XXI*. Barcelona: Polytechnic University of Catalonia, 2011, p. 126. ISBN 978-84-614-7504-9. Available at: https://utp.upc.edu/es/shared/publicacions/vitrina-del-duot/fotos-vitrina-del-duot/2011_montaner-muixi-falagan_habitar-el-presente.pdf.

20 FRIEDMAN, Avi. *The adaptable house: designing homes for change*. New York: McGraw-Hill, 2002, p. 129. ISBN 978-0-07-137746-1.

21

22 In the graphic analysis accompanying this article, *circulation spaces* are defined as those which, if removed, would force the inhabitant to pass through a room with a higher level of privacy to reach one with a lower level. This evaluation is based on the functional layout proposed by the architects in their furnishing plans, applying the following privacy gradient—ordered from least to most private: living room / dining room / kitchen / other shared areas < bedroom < bathroom / toilet.

23 The entrance module is especially suitable for hosting functions that require less space.

24 An exception is Case 1, which notably adopts a clear distinction between service and served spaces, integrating built-in storage into the service zones.

25 PERIS, Marta; TORAL, José Manuel. 85 social housing units in Cornellà. In: *Tectónica. Monografías de arquitectura, tecnología y construcción* [online]. Madrid: ATC Editions, 2022 [accessed: 3-9-2024.]. ISSN 1136-0062. Available at https://tectonica.archi/projects/85-viviendas-sociales-en-cornella-de-peris-toral-arquitectes/.

26 ROWE, Colin. *The Mathematics of the Ideal Villa and Other Essays*. Cambridge, MA: MIT Press, 1976, pp. 1-28. ISBN 9780262680370.

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ESPACIOS DOMESTICOS FLEXIBLES: LAS ENVOLVENTES DE TRES EDIFICIOS DE LOS AÑOS CINCUENTA EN MILÁN

FLEXIBLE DOMESTIC SPACES: THE ENVELOPES OF THREE 1950S BUILDINGS IN MILAN

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INTRODUCTION: THE ENVELOPE AND ITS ABILITY TO PROVIDE FLEXIBILITY TO THE HOUSE

Shifts in occupancy groups and lifestyles have consistently underscored the need to assess the quality of our homes. It is imperative that houses be capable of adapting to specific conditions at any given moment. Montaner and Muxi state that "*the solution to addressing the necessary diversity of housing types lies in developing flexibility mechanisms*"[1] and, therefore, this characteristic must be understood as an indicator of quality, especially in the domestic realm, as a basic typological reference for defining our cities.

According to Ignacio Paricio and Xavier Sust, who describe flexibility as "*any constructive or formal arrangement that allows certain diversity in the ways of occupation*",[2] we can argue that the envelope constitutes a relevant architectural element for defining a flexible domestic space. Its fundamental condition establishes the relationship between the exterior and interior so that the spatial and functional definition of the dwelling are enriched by the contributions that the context offers to the definition of the architectural project. The envelope thus becomes an architectural compositional element requiring integration within the architectural organism alongside the other systems that compose it. This integration ensures that the structural, building services, construction, and compositional systems that collectively define the physicality of the object are implemented within the boundary conditions defined by its envelope as an independent system. In premodern dwellings, intermediate spaces that related to the exterior—such as patios, porches, or vestibules—defined by clearly established boundaries, contributed flexibility to the dwelling due to their ambiguous nature and lack of a specific use. From the 20th century onwards, architecture has evolved beyond the traditional closed spatial entity. The independence of the structure is key to interpreting the concepts of "free plan", "free façade",[3] and "*fenêtre en longueur*", three of the *five points of a new architecture* outlined by Le Corbusier in 1926. These ideas paved the way for interpreting the façade element as a set of spaces or layers capable of containing an activity within itself, thereby transforming it from a boundary to a threshold.

The ability of the envelope to provide flexibility to the house depends, in our view, on three factors: the geometry of its outline, i.e., the shape of the perimeter, the thickness and layers that compose it, and the attention to the opening in terms of size, proportion, and composition. Technical innovation will also add value to these three aspects. The selected examples will demonstrate increased flexibility in proportion to the number of parameters they possess, as outlined below.

The shape of the house's perimeter significantly affects its adaptability. "*Its exterior shape, whether prismatic, cylindrical, or other, has its own reasons or those that may be derived (...) from its proximity to other boxes, but that shape never explains what the contained object is*".[4] This suggests that the function is not solely determined by the shape, thereby implying that the envelope is not merely a plastic casing that adapts to its use, with the aim of optimising the more efficient volume.

The Romans emphasized the importance of wall thickness in the perimeter design of a space. Let us imagine dwellings as if they were an "*elemental primitive building, composed of a thick wall (…) with niches dug into the thickness: the Pantheon, for example, where the wall is smooth and continuous (with a thickness reaching nearly 7 metres), but not solid, rather hollowed out inside*", as Bettini said.[5] This awareness of thickness leads to the consideration of an internal and an external limit. The perimeter begins to contribute flexibility when the two lines are far enough apart to be filled with content, be it objects, technical services, climate control, or vegetation. In this regard, Yves Lion developed a theoretical proposal in collaboration with the Domus Demain housing project (1987), placing the house's equipment on its perimeter. Kitchen furniture, bathrooms, and desks form a thick and active envelope.

The liberation of the façade from its structural dependence has allowed the overlapping, superposition, or folding of layers of varying thicknesses, materiality, or opacity—some static and others dynamic—to become a highly suggestive strategy for the formation of the domestic threshold today, replacing the simple surface porosity represented by a window opening on an opaque, 30 cm-thick wall. These design actions in shaping the façade generate interstitial spaces without a defined activity. Through their independence and indeterminacy, these spaces have the capacity to promote the flexibility of the dwelling. They are "*the new vestibules, galleries, viewing platforms, patios (...), peripheral diaphragms for thermal and acoustic control, but they are also spaces that serve as extensions of the interior of the house, serving as chambers that free space from the interior for household activities*".[6]

In the cases studied favouring the flexibility of spaces, we find horizontal openings composed of two or more indeterminate layers, preventing the interior and exterior from touching; some casual or random, whose size and position are chosen by the users themselves and others whose modulation allows for their decomposition into equal parts—opaque and transparent—which are interchangeable. These approaches are far from the rigid composition of openings in a shell home, where each room has a window size determined by its purpose. Thanks to this open concept layout, the dwelling loses the precision and specialisation of its spaces, presenting the opportunity to establish flexible functional strategies.

THREE MILANESE COLLECTIVE HOUSING PROJECTS FROM THE 1950S. THICKENING, STRATIFYING, MODULARISING, OR FOLDING THE ENVELOPE AS STRATEGIES FOR PERIMETER FLEXIBILITY

Milanese collective housing from the second half of the 20th century serves as a relevant reference in this context. In the domestic sphere, postwar architects reconstructed fragments of the bombed city, responding to new ways of living and reinterpreting the urban landscape through the lens of the Modern Movement, while respecting the "*preesistenze ambientali*", a key concept in the theoretical thinking of postwar architecture, developed by E. Rogers in *Casabella.*[7] Similarly, Luigi Moretti reflects on the requirements of the moment in the physical and social context in which the three selected projects are framed:

"*One of the fundamental requirements today (...) is functional flexibility (...). The importance of this requirement derives from the fact that the central areas of a city attract very diverse categories of users (...). The demands for residential space range from the two-bedroom apartment (...), to luxury residences.* [Then, it presents the façade as a strategy to achieve flexibility, inviting one to] *leave a 1.4 m to 2.7 m overhang on the slabs so that the exteriors can be closed as desired, that is, with or without loggias and regardless of the division of the interior rooms*".[8]

In this reflection, the façades of the Lombard capital play a fundamental role: they are the envelope of the private realm, while also having a public vocation; an intermediary skin between the interior and the exterior; a lived boundary of variable thickness with an identity and social character. Their constructive flexibility, technological innovation, and prefabrication stand out, leading to façades capable of incorporating the factor of time. Asnago and Vender, with the thick façade of the *Condominio XXI Aprile*, Gio Ponti, with the stratification and overlapping of layers in the building on *Via Dezza*, and Mangiarotti and Morassutti, with the modulation and folding of the skin in the residential building on *Via Quadronno*, are able to translate these theoretical reflections into architectural practice. We analyse the three case studies through the creation of our own models and drawings. These models and drawings are constructed ideas capable of giving shape to thoughts. This is a method that, as Juhani Pallasmaa affirms, involves thinking with the hands.[9] This unpublished material has required preliminary work consisting of gathering sources and comparing basic project plans published with execution plans from the archives. As a result, we provide floor plans that accurately represent the constructed building, capable of considering the original typological innovation intentions and the development of the structure, building services, and construction aspects.

When discussing perimeter flexibility, it is essential, first and foremost, to understand and draw the constructive definition of the façade to the scale of the detail. Next, we shift scales to comprehend how the definition of the façade influences the overall flexibility of the plan and which other strategies could help to achieve it. During this process, it becomes even clearer that the building's overall flexibility is achieved from the definition of the envelope. In this regard, duplicating just a portion of the floor plan—that which defines the façade—is sufficient to understand the different distributions the house can adopt. Our objective was to graph the flexibility, that is, draw floor plans filled with gradients, traces, and shadows; aspects which we consider essential for defining the threshold. However, due to their **p.70** intangible or ephemeral nature, these aspects seldom appear in technical drawings. Finally, we move to the scale of the city to analyse how the response to the landscape is generated.[10]

Thickening the Envelope: Mario Asnago and Claudio Vender, Condominio XXI Aprile, Via Lanzone, 1951-1953

Located in one of the oldest areas of Milan's historic centre, heavily damaged by the bombings of the Second World War, according to Zucchi, the project resolves the antinomy between the closed building structure from historical urbanism and the open structure that responds to modern typological requirements.[11] A first, lower block of three storeys maintains the street frontage, while a second volume of eight storeys extends perpendicular behind the first, surrounded by the garden.

The position and shape of the various façade openings allow the functional overlap of offices and residences to be detected from the exterior. The vertical rectangular windows are generally located on the first three floors of the south and west elevations, indicating office use. In contrast, the *fenêtre en longueur* runs the entire length of the main façade with the highest volume from the third floor upwards, offering the main rooms of the residences a completely panoramic relationship with the greenery and sunlight. Le Corbusier's description of the elongated window of the house on Lake Léman (1923-1924) could be applied to this window: "*It extends over the length of the house (...) thanks to this, there is access to an incomparable view (...). It is a constructive innovation conceived for the potential function of a window: and has become (...) the main protagonist of the house*".[12]

The window designed by Asnago and Vender consists of a double skin formed by transparent glass panels— **p.71** similar to Piero Portaluppi's design for Villa Necchi Campiglio (1935)—with 60 cm pivoting aluminium vertical sashes on the exterior and sliding oak wood sashes on the interior (Figure 1). The use of an intermediate planter enables vegetation to be incorporated into the building material, thereby adding thermal mass to the envelope (Figure 2). The window effectively functions as a winter garden, enabling the capture of natural light and solar energy while controlling

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temperature exchanges, contributing to the energy efficiency of the building's west-facing façade. Furthermore, its thickness (80 cm) houses a strip of artificial light, a horizontal Venetian blind, and a shutter, all acting as filters to regulate natural light.[13] In essence, the window functions as a diaphragm for light, temperature, and airflow, while capturing and constructing the landscape that accompanies domestic life. It integrates its own spatial definition, capable of incorporating the surrounding vegetation into the observed landscape. Furthermore, it allows the passage
p.73 of time, the seasons, climatic conditions, and urban sounds to be recorded; components of the landscape and environment that collectively define the dwelling.

This horizontal opening, approximately 30 metres wide by 2 metres in height, diffusely displays the distributive and dimensional variety of the rooms across the different floors,[14] while simultaneously offering a homogeneous and abstract response to the landscape. In this way, the focus on the constructive detail of the window provides flexibility to the whole structure, absorbing the freedom of movement of the partition walls that intersect perpendicularly with the inner skin, the exterior line of the columns, and certain service ducts.

The simple rectangular shape of the perimeter gives the project the characteristics of a box house, providing flexibility to the domestic space (Figure 3), supplemented by other strategies related to the general distribution of the floor plan. The service rooms—closets, service bedrooms, laundry rooms, and typically kitchens—are grouped on the south side of the east elevation, giving this façade a more plastic and three-dimensional character, housing the loggias of vertical circulation cores and service terraces. This contrasts with a noble, two-dimensional façade that allows for greater freedom in the distribution of the living areas.[15]

Moreover, the inclusion of two or three entry doors per apartment—one of which is designated for service—currently provides dual circulation, as well as the possibility of dividing a flat into two or creating an independent area for remote work. In addition, the large size of the rooms makes them polyvalent.[16] "*It is undeniable that the abundance of space provides maximum flexibility (...). However the dwellings, for economic reasons, must limit their surface area*".[17]
p.74 The list of strategies concludes with an organised structure of concrete pillars and a distributed arrangement of the building systems, allowing bathrooms or kitchens to be located towards the main façade.

The configuration of the envelope, in addition to providing flexibility to the domestic space, in terms of its volumetric composition, materiality, proportions, heights, and placement of openings, successfully links the resolution of the typology with urban design. By respecting the pre-existing characteristics, the architects are able to construct an urban landscape. The façade responds to the street-garden dichotomy, using the most noble material—white marble—and vertically proportioned windows facing the street. The composition and proportions of the openings are aligned with those of the neighbouring historical buildings (Figure 4). However, the architects use a more abstract concept, using Clinker brick and elongated and horizontal openings that turn towards the garden and the city on the upper floors.

Overlapping inhabited layers. Gio Ponti, Antonio Fornaroli, and Alberto Rosselli, residential building, Via Dezza, 1956-1957

In 1956 and 1957, Gio Ponti, together with Fornaroli and Rosselli, designed a building that completes the street-facing façade of the closed-block urban layout along Via Dezza. Ponti lived with his family on the eighth and top floor. It was in this house, his last home, where he was able to condense and implement all his reflections on modern living.[18]

In this building, Ponti transforms the boundary into an inhabited threshold, 4 metres deep, defined by a succession of layers—both static and dynamic—of varying thicknesses. It consists of a 'continuous' spatial band with Modernfold[19] folding partitions (210 cm); fenestration consisting of hinged doors and fixed glass panels with a wooden frame that, in the architect's house (Figure 5), support cantilevered shelves, drawers, and desks (35-100 cm) (Figure 6); a brick wall (45-60 cm); a structural line of reinforced concrete pillars embedded in the wall; a continuous shutter box (45 cm)[20]; a continuous terrace (110 cm); a metal railing system; and, as a backdrop, the ever-changing urban landscape.

The stratified design of the envelope provides the residences with a series of mechanisms that generate flexibility in the layout. First, the inclusion of "mobile walls" allows for the creation of what the architect himself called "*a large, unique space*", which is fluid and expansive, thereby generating diverse associations between the rooms to adapt the house to the various demands of the day (Figure 7).[21] Le Corbusier and Pierre Jeanneret had already applied this strategy in the first half of the 20th century in houses 14 and 15 of the *Weissenhof* (1927), incorporating sliding partitions
p.75 into the façade space.[22] This strategy generates an auxiliary circulation between the rooms, complementing the main circulation area. In addition, the longitudinal terrace in the Milanese building introduces flexibility into the internal organisation of the dwelling, this time through exterior circulation paths. Furthermore, the concept of a "furnished window",[23] employed by Ponti in his house, serves to augment activity at the boundary, allowing for the placement of objects along the façade (Figure 8). This implies freeing the internal space, thereby facilitating the exchange of uses between rooms.

All of these mechanisms are the result of the precise design of the envelope and again require complementary strategies. These elements refer to the configuration of service spaces grouped on the north side (the only ones enclosed by doors); the inclusion of two entrance doors per dwelling; generously sized rooms; an ordered structure, where the two outer axes are absorbed by the thickness of the façade, and the central one becomes part of the circulation area without interrupting the day spaces; and lastly, a coherent distribution of the building services, spread across both façades. On the rear façade, the layout allows for exchanges between the service rooms or the inclusion of two dwellings on floors where only one exists—on either side of the stairwell. On the main façade, the distribution of

the electrical system, which supplies the lamps and computers placed in the furnished window, frees the perpendicular partition walls of plugs and switches, allowing for future transformations.

The design of the façade simultaneously addresses both the scale of the house and the scale of the city, i.e., the **p.77** different uses of the interior and how these daily activities are manifested externally. In this way, the exterior elevation contemplates the change in appearance between day and night,[24] as a kind of urban shelf that reveals to pedestrians the silhouettes of the everyday objects of those who live there, accentuated by the interior light in the darkness of the night.

In contrast to "*the refusal to conceive the housing complex as a uniform repetition of typical floor plans*", [25] in the words of Gloria Arditi and Cesare Serrato, Ponti designs "*a façade that adapts in 'spontaneous mode' to the desires of each owner*: [the size of the balcony grid corresponds to the size of each dwelling—one or two dwellings per floor]. *Each owner, in theory, is free to arrange the windows* [of any size or position they wish] *and to choose the colour* [of their façade and balustrade]".[26]

Folding the modulated skin. Angelo Mangiarotti and Bruno Morassutti, Edificio per abitazioni, Via Quadronno, 1956–1962

According to Orsina Pierini and Alessandro Isastia "*the project speaks of Morassutti's residential sensibilities, Mangiarotti's talent for modular construction, and the technical expertise of engineer Favini*".[27] Built at the request of a **p.78** cooperative, this residential building acts as a hinge between the public park—which creates more space within the density of the surrounding urban fabric—and the streets of Via Quadronno and Crivelli. The concept of "continuous elevations" (Figure 9), on which the project is based, proposes that "*the variations in the profile follow the functional needs of each case (orientation, views, urban planning, etc.)*",[28] increasing solar exposure and the angle of view towards the landscape. In other words, the form of the envelope, the result of a study of the relationships between the interior and the exterior, articulates the internal organisation of the dwelling, and not the other way around.

A vertical framework based on modulation and prefabrication helps define and give dimension to the building's perimeter, an approach previously employed by Jean Prouvé in his summer house in Nancy (1954). This allowed users to interchange solid wooden panels—made of 8 cm-thick Douglas fir (96.5 × 305 cm)—with glazed modules—wooden frames and 5 mm-thick glass, consisting of a top-hinged sash (92 × 215 cm) and a vertically-opening lower sash (92 × 95 cm); or even leave an open void incorporating a metal railing to create a loggia. With this strategy, the architects overcome the difficult obstacle of modifying the limits of an elevated dwelling, an intervention that undoubtedly increases the flexibility of the domestic space, as Moretti had already suggested. Furthermore, the inward fold of the envelope creates a private exterior space within the dwelling—primarily inhabitable in the spring and summer—resulting in an increase in the form factor. "*The original folded volume, with a low form factor, is better suited for winter, whereas the extended structure is much more appropriate for warmer seasons. The increased surface area of the envelope allows for better heat dissipation, and the sense of interior/exterior ambiguity is amplified through a space that is difficult to define*".[29] Similarly, Alvar Aalto and Elsa Kaisa fold the skin of the residential block in Hansaviertel (1956–1957), a contemporary project to the building under analysis. In the words of Josep Maria Montaner: "*To adapt it to optimal orientation and views, the block was given a slightly organic form (…). The interior space (…) functions as an internal landscape opening onto the external one. The perfectly proportioned terrace serves as a viewing frame for the Berlin landscape*".[30]

The freedom of movement exhibited by the panes is made possible by an anchoring system with a steel substructure—composed of vertical omega-shaped profiles at 1-metre intervals (Figure 10) and upper and lower horizontal profiles—anchored to the edges of the reinforced concrete slab floors that cantilever between 1 and 3.4 metres. The dry assembly system and the relative lightness of the materials define the structural flexibility of the envelope, allowing each user to freely modify the design of their façade. With this method, the architects have anticipated the future evolution of the façade.

All these technical characteristics confirm the direct impact of perimeter flexibility on the overall layout of the dwelling (Figure 11). The possibility of incorporating a private outdoor space or enabling the transformation and multifunctionality of daytime living areas becomes feasible through the interchange or omission of panels.[31] In addition, the grouping of the service spaces, along a more orthogonal and solid rear façade, grants greater freedom and organicity to the main rooms and lightness to their corresponding façades. Moreover, a service wall equipped **p.81** with integrated storage separates the service zone from the living area, creating circulation spaces that may serve alternative functions, and freeing the main rooms of heavy furniture, thus encouraging spatial adaptability. The open-plan layout, with a recessed concrete pillar structure, allows for an autonomous curtain wall envelope anchored to the slab edges. Strategically distributed building services even include the possibility of converting a single bedroom into a bathroom—by replacing the glazed panels with opaque ones—or different configurations in the service area. Finally, other noteworthy elements include the incorporation of two entrance doors per dwelling, a continuous floor finish that allows for the occasional appearance of a loggia, and the installation of underfloor heating that eliminates the need for **p.82** radiators along the façade.[32]

The city perceives a variable façade, with a casual and almost random appearance (Figure 12), subject to the inhabitant's control. Time becomes a factor in this variability. The interchanging of panels is complemented by the constant movement of the curtains and awnings,[33] which shift between day and night, summer and winter, and by the

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presence of deciduous climbing vegetation that drapes over the cornices that cover the edges of the slab. Thus, the flexibility of the envelope also contributes to its passive performance and, consequently, to the dwelling's sustainability.

CONCLUSIONS

The review of the case studies allows us to affirm that working with the building envelope is a relevant strategy for enhancing spatial flexibility in modern and contemporary housing. A construction approach grounded in technical
p.83 innovation, material experimentation, and prefabrication enables each façade to be distinct and unique—as it responds specifically to a particular location with its own constructive and formal characteristics—thereby ensuring its flexibility. This has been shown to exponentially increase the spatial flexibility of the entire ensemble, that is, both the individual dwelling and the housing complex. Moreover, it enhances the building's external appearance; in other words, the architectural detail contributes to the individualisation of the concept of urban landscape. Furthermore, a well-defined, flexible and adaptable construction system by the architect, and, above all, its proper use by the occupant, have allowed these homes to respond effectively to current climatic conditions. Milanese summers today are significantly warmer than they were 70 years ago. Simple interventions such as upgrading the glazing—from single to double glazing—already implemented by some residents in the Via Quadronno building; the addition of exterior shading devices in both this block and the Via Dezza building; or simply ensuring the proper use of thick window layers in the Asnago and Vender building; have sufficed to adapt the dwelling to this new and ongoing situation. As previously mentioned, ancient Roman architecture made use of intermediate spaces that connected the interior with the exterior to bring flexibility to the habitat. Additionally, as noted by Valentín Trillo and Fernando Amores in issue 26 of this journal, dedicated to "Architecture for Warm Climates", the placement of these spaces in the perimeter bay simultaneously facilitated passive conditioning of the dwelling. This is exemplified by the Roman house typology in Itálica (Santiponce, Seville).[34]

Given that the projects examined in this article are designed for the upper-middle class, it is pertinent to assess their feasibility in the realm of minimum housing. In much of our country, the minimum habitability standards for such houses are based on rigid and outdated regulations. We therefore propose that one way to achieve flexibility is through spaces not governed by mandatory design standards. We refer to ambiguous peripheral spaces. A priori, one might assume that the greater the developed perimeter of the façade in plan, the higher the floor area ratio (gross floor area/useful floor area). This, in turn, leads to higher construction costs. However, as we have observed, the dwelling becomes flexible when the façade width is reduced to the minimum possible (8 cm) or, conversely, significantly widened until its thickness becomes usable space. Likewise, while optimising the ratio between the usable and built area has been a key factor in controlling and enhancing contemporary housing, it is necessary to introduce other factors that provide greater capacity and dynamism. One such factor could be establishing a relationship between the building envelope and the usable area of the dwelling, as demonstrated by the examples provided. This relationship enhances the quality of the domestic space by increasing its dynamic adaptability to new requirements. The larger the perimeter in contact with the exterior, or the greater the functional capacity of that envelope as a threshold, the more capable the dwelling will be of adapting to the demands placed upon it by its inhabitants.

The housing units in La Barceloneta (1951–1954) by Coderch and Valls, contemporary to the case studies, serve as an example applied to social housing in Spain. Notable features include the modularity and innovative construction of the façade panels; the folding of the perimeter that generates intermediate and versatile spaces; and the increased thickness at certain points, incorporating storage spaces. Similarly, the apartments in Huerta del Rey in Seville (1967–1969) by Manuel Trillo, feature deep and continuous terraces equipped as filters of vegetation and shade.[35] In recent years, the housing transformation project in Bordeaux (2016) by Lacaton and Vassal has achieved, through
p.84 the inclusion of a new envelope, the creation of a "free space" perimeter. Albert Cuchí, in issue 219 of *El Croquis,*[36] invites readers to reflect on the need to align architecture to climatic, cultural, and social conditions with projects such as the 42 social housing units in Son Servera, Mallorca (2024) by architects Peris and Toral. The authors refer to it as "living in lime". All of these contemporary examples have demonstrated the ability to generate flexible, sustainable, and habitable domestic spaces through a fundamental strategy that involves reflection on a boundary that becomes a threshold.

Each author's contribution CRediT:

Sara Fernández-Trucios (SFT); Tomás García García (TGG); Francisco Montero-Fernández (FMF). Conceptualization, methodology, analysis and preparation of the paper (SFT 33,3% - TGG 33,3% - FMF 33,3%). Authorship (SFT 33,3% - TGG 33,3% - FMF 33,3%)All of the authors declare that there is no conflict of interest with the results of the study

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1 MONTANER, Josep Maria; MUXI MARTÍNEZ, Zaida. *Habitar el presente. Vivienda en España: Sociedad, ciudad, tecnología y recursos*. Madrid: Ministerio de Vivienda, 2006, p. 24. ISBN 978-84-96387-23-2.

2 PARICIO, Ignacio; SUST, Xavier. *La vivienda contemporánea. Programa y tecnología*. Barcelona: Instituto de Tecnología de la Construcción de Cataluña, 2000, p. 49. ISBN 978-84-7853-396-1.

3 *"(...) lies in establishing ossatures that enable the interrelation between the exterior and interior. Ultimately, a sublimation of that free façade which separated the structure from the enclosure"*. COVA MORILLO VELARDE, M.A. *Objets proyecto y maqueta en la obra de Le Corbusier*. Directors: Amadeo Ramos Carranza, Caroline Maniaque Benton. Tesis doctoral. Universidad de Sevilla, Departamento de Proyectos Arquitectónicos, 2016, p. 302. Available at: http://hdl.handle.net/11441/42791.

4 Ibid., p. 77.

5 BETTINI, Sergio. *El espacio arquitectónico de Roma a Bizancio*. Buenos Aires: CP67, 1992, p. 29.

6 AA.VV. *Viviendas experimentales, estudio y proyecto de nuevos modelos* [online]. Seville: Government of Andalusia. Department of Development, Articulation of the Territory and Housing. February 2008, Vol. 6, p. 16 [enquiry: 15-03-2025]. Available at: https://www.juntadeandalucia.es/organismos/fomentoarticulaciondelterritorioyvivienda/areas/vivienda-rehabilitacion/planes-instrumentos/paginas/proyecto-viviendas-experimentales.html

7 *"Building in an environment already characterised by the works of other architects imposes the obligation to respect their presence"*. ROGERS, Ernesto. Le preesistenze ambientali e i temi pratici contemporanei. In: Casabella. Milan: Mondadori Media, 1954, n.º 204, pp. 3-6.

8 MORETTI, Luigi. Ricerche di architettura. Sulla flessibilità di funzione di un complesso immobiliarie. In: *Spazio*. Rome: Luigi Moretti, 1951-1952, n.º 6, pp. 43-44.

9 PALLASMAA, Juhani. *La mano que piensa: sabiduría existencial y corporal en la arquitectura*. Barcelona: Gustavo Gili, 2012. ISBN 9788425233920.

10 This methodological approach, operating across three scales and identifying three distinct design strategies, is what led us to select these three case studies. In our view, the conception of each project resulted from a specific focus on one particular scale, without neglecting the other two. Asnago and Vender paid closer attention to the scale of the city, Gio Ponti to that of the house, and Mangiarotti and Morassutti to the scale of detail.

11 ZUCCHI, Zino. *Condominio XXI Aprile a Milano (1951-1953). Mario Asnago, Claudio Vender*. Genova: Sagep, 1993, p. 10. ISBN 9788870585063.

12 LE CORBUSIER. *Una pequeña casa*. Buenos Aires: Infinito, 2008. ISBN 9789879393383.

13 In winter, the opening becomes a thermal buffer, trapping air that has been warmed by the sun, thereby protecting the domestic spaces from the cold exterior. In summer, however, the users open the exterior window and activate previously concealed layers. Shutters, blinds, and the now lush vegetation become visible, offering protection against solar exposure.

14 The close relationship between the architects and the users who would live and work there—executives from a steel company—resulted in the layout of each flat being tailored to each family's needs. Consequently, the partitions dividing the main rooms of the house were positioned differently on each floor.

15 On the floor plan, we can observe that the fourth level accommodates one dwelling, while the sixth accommodates two. This implies that the space occupied by the vestibule is replaced by a small living room and a kitchen two floors up. The living room and library are transformed into a combined living-dining area with an additional bedroom. Similarly, other transformations driven by the flexible positioning of the partitions occur on the remaining floors.

16 Polyvalence is not the same as flexibility. A polyvalent space can accommodate *"different uses without having to undergo changes itself, so that a minimal flexibility can still produce an optimal solution"*. HERTZBERGER, Herman. *Lessons for Students in Architecture*. Rotterdam: 010 Publishers, 2005, pp. 146-149. ISBN 978-94-6208-319-6.

17 PARICIO, Ignacio; SUST, Xavier, op. cit. supra, note 2, p. 25.

18 The text analyses the housing complex, with particular attention to Ponti's house, who designs fenestration elements that also function as furniture, thereby enhancing the dwelling's flexibility.

19 These are accordion-folding partitions with the capacity to absorb sound, addressing one of the main issues associated with movable enclosures: their acoustic resistance.

20 A continuous shutter box running along the entire length of the terrace allows for future modifications to the size and arrangement of the openings, thereby enhancing the flexibility of the façade.

21 In Ponti's house, the master bedroom and the living-dining area can be linked to the architect's study, creating a visual continuity from one exterior to another. The south-facing rooms can be unified into a single through-space, offering a unified view of the main façade from the interior; similarly, the living-dining area can be transformed into the architect's study.

22 In Weissenhof, the perimeter of the house is a well-lit "continuous space" that invites the user to arrange furniture within it, but without integrating it permanently into the window, as Ponti does.

23 *"A room naturally has four walls. A room with a large panoramic glass window, on the other hand, has only three walls and a void. A room with a furnished window, however, once again has four walls, one of which is transparent"*. PONTI, Gio. La finestra arredata. In: Domus. Milan: Domus, 1954, n.º 298, pp. 17-20.

24 *"As architecture has become luminous in itself, through transparency and reflection, we can regulate its nighttime appearance in a new, predetermined, and entirely different way from that of the day (...). For this reason, a design for the night is necessary, not just a design for the day"*. PONTI, Gio. Giorno e notte. En: *Domus*. Milan: Domus, 1956, n.º 320, p. 7.

25 IRACE, Fulvio. *Milano Moderna. Architettura e città nell'epoca della ricostruzione*. Milan: Federico Morra Editore, 1996, p. 67. ISBN 9788871791128.

26 ARDITI, Gloria; SERRATTO, Cesare. *Gio Ponti. Venti cristalli di architettura*. Venice: il Cardo, 1994, p. 162. ISBN 88-8079-014-5.

27 PIERINI, Orsina Simona; ISASTIA, Alessandro. *Case Milanesi, 1923-1973. Cinquant'anni di architettura residenziale a Milano*. Milan: Hoepli, 2020, p. 339. ISBN 9788820380915.

28 MANGIAROTTI, Angelo; MORASSUTTI, Bruno. Sul principio della continuità dei prospetti. In: Domus. Milan: *Domus*, 1960, n.º 367, p. 9.

29 TRILLO DE LEIVA, Juan Luis; MONTERO FERNÁNDEZ, Francisco Javier; LÓPEZ FERNÁNDEZ, Andrés, eds. *Viviendas experimentales, estudio y proyecto de nuevos modelos* [online]. Seville: Government of Andalusia. Department of Development, Articulation of the Territory and Housing, 2008, Vols. 2, 3, 4, p. 438 [enquire: 15-03-2025]. ISBN 978-84-691-3398-9. Available at: https://www.juntadeandalucia.es/organismos/fomentoarticulaciondelterritorioyvivienda/areas/vivienda-rehabilitacion/planes-instrumentos/paginas/proyecto-viviendas-experimentales.html.

30 MONTANER, Josep Maria. *La arquitectura de la vivienda colectiva: políticas y proyectos en la ciudad contemporánea*. 1.ª ed. Barcelona: Editorial Reverté, 2015, p. 69. ISBN 978-84-291-2126-1.

31 Currently, we can observe that some users have removed two of the four loggias that existed when the building was first constructed. Furthermore, there has been a slight increase in the number of opaque panels, generally coinciding with the bedrooms on the lower floors.

32 MARTÍNEZ ARROYO, Carmen; PEMJEAM MUÑOZ, Rodrigo. Las mil y una vidas en el edificio Quadronno de Mangiarotti y Morassutti. La fachada flexible. En: *En Blanco. Revista de Arquitectura* [online]. Valencia: Editorial Universidad Politécnica de Valencia, 2024, n.º 36, p. 130 [enquiry: 16-03-2025]. ISSN-e 2445-1215. DOI: https://doi.org/10.4995/eb.2024.20690.

33 The architects design a layered system consisting of two interior curtains: the first to reduce glare and protect the inhabitant from prying eyes, and a second, heavier curtain to prevent heat loss at night, along with an exterior canvas awning concealed behind the cornice. MANGIAROTTI, Angelo; MORASSUTTI, Bruno. Window wall: Flats, via Quadronno 24, Milan, Italy. En: *The Architects' Journal*. London: Emap. 1965, vol.142, n.º 9, pp. 505-506. ISSN 0003-8466.

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34 TRILLO MARTÍNEZ, Valentín; AMORES CARREDANO, Fernando. Itálica. Revisión crítica de cuatro casas romanas sin ventanas. In: *Proyecto, Progreso, Arquitectura*. Arquitecturas para tiempos cálidos [online]. Seville: Editorial Universidad de Sevilla, 2022, n.º 26, pp. 32-47 [enquiry: 16-03-2025]. ISSN-e 2173-1616. DOI: https://doi.org/10.12795/ppa.2022.i26.02.

35 RAMOS-CARRANZA, Amadeo; TRILLO MARTÍNEZ, Valentín. *Manuel Trillo de Leyva: Obra completa 1964-2005*. Seville: Colegio Oficial de Arquitectos de Sevilla, 2024, p. 26. ISBN 9788412809206,

36 CUCHÍ, Albert. Una experiencia necesaria. In: *El croquis*. IBAVI 2019-2023. Una investigación colectiva. Madrid: El Croquis Editorial, 2023, n.º 219, pp. 360-373. ISSN-e 2174-0356.

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ESTRUCTURAS ABIERTAS AL CAMBIO. LA TRASCENDENCIA DE LO RELACIONAL

STRUCTURES OPEN TO CHANGE. THE TRANSCENDENCE OF THE RELATIONAL

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p.87 INTRODUCTION

Contemporary society continually requires adaptive changes, an inevitable consequence of the adaptive progression in which we live. This was well expressed by those thinkers who addressed social change: the transition from a society of discipline to a society of control,[1] and from that to the current form, which still has many names: a liquid, elastic, data society, or perhaps an artificial intelligence society; a new society, but one with incipient (and already visible) consequences.

Architecture, despite being endowed by origin and nature with a will to permanence, is a product of its time: of the thought and feeling that is contemporary with it. As such, viewed from a certain perspective and from a certain distance, it may be said to be in constant change. It moves between that stable condition and the necessary incorporation of adaptive contingency through adjustable mechanisms, or, in a more abstract order, and of greater interest to us here, the contingency that manifests as a design premise through the inclusion or generation of open structures capable of establishing dispositions able to support and accommodate an architecture with a changing genetic makeup.

The apparent confrontation between the stable aspirations of architecture and of the city and the need for flexible adaptation to change determines the convenience of designing with all due respect for the weak elements (or those without a linear narrative, as Ignasi de Solà-Morales proposed)[2] that permeate society. Designing with an awareness of their existence–of the transactions, micro-narratives, activism… everything that invisibly supports or even gives meaning to urban life: acknowledging their existence and investigating it is part of architectural research and action.

THE CITY AND ITS CHANGES

'*The model of the homogeneous, discontinuous, and extensively defined city is exhausted. Only the heterogeneous, continuous, and self-sustaining city looks to the future*'[3].

p.88 The city, as a complex and sophisticated human construction, cannot escape the social reality of the present, which is increasingly indeterminate and, in a sense, self-organised. This reality derives from the progressive loss of hierarchy identified by Michel Foucault in describing disciplinary societies, or by Gilles Deleuze, when he took up the gauntlet and announced and detailed the transition from the disciplinary society to the society of control:

'*Foucault was one of the first to detect that we are leaving disciplinary societies behind, that we are already beyond them. We are entering societies of control, which no longer function through confinement but through continuous control and instantaneous communication*'[4].

Closely relating it to that characteristic, important for understanding the changes taking place in architecture and in the contemporary city, which is the rupture or loss of the enclosure. This is coupled with another idea that anticipated the contemporary hyperconnected society by many years:

'*Societies of control operate through machines of another kind, control machines, which interlink, interconnect, and have no beginning or end*'[5].

In the case of architecture, the difficulty arises when we try to imagine the effects of this de-hierarchical progression within a 'solid' organisation such as that of the urban space, in which the relative but limiting weight of its preexisting structures and frameworks makes it difficult to adapt to the new shifts in thinking. And yet, despite this difficulty, it is evident that this adaptation does indeed gradually occur through a certain dissolution of the former hierarchical order, not through the rupture of its forms or their physical structures –which would be costly and complex– but through the emergence of an invisible balancing system which reorients these 'solid' dispositions, contaminating them with weaker and more diffuse ones.

This adaptive balancing system can be thought of as a set of invisible networks, capable of overlaying and coexisting with the consolidated forms of the city, constructed, for example, by networks of circulating data, mini-transactionalities, or by the multiplicity of subjective interpersonal communications. These take the form of an imaginary network of sensitive connections whose detection and study can help to avoid the destruction of fundamental elements of urban cohesion in the process of lightening the burden of the past in favour of the social needs of the present.

To understand the functioning of these invisible urban networks it may be helpful to draw parallels with recent research[6], notably into the invisible labyrinthine connections continually taking place beneath the forest in the shared mycorrhizal fungal network that runs through the subsoil, connecting and transmitting vital information among all the trees[7] (Figure 1).

CIRCULATING DATA NETWORKS

'*Intelligence is not a subject but an environment or a system of resonance*'[8].

In contemporary architecture and urban planning, we are starting to perceive the changes that digital information is producing in the physical form of our cities. The pre-established boundaries and, of course, the zoning, identifiable in traditional urban organisation have scant connection with contemporary reality and needs.

The disconnect engenders a dysfunction that can be intuited contemporaneously in the presence of new ways of using space, and even in the 'spontaneous' dissolution of the deepest intentions of conventional planning. We are in the presence of new and unknown ways of using space in the face of maladaptive realities, which call to mind the urban remnants that Gordon Matta-Clark purchased at auction to highlight the contradiction posed by spaces outside the orderly. In that project, *Fake Estates* (Figure 2), Matta-Clark used a series of photographs and documents to make visible a multitude of small, unusable plots of land in the layout of New York City, thus highlighting–and this is the crucial point here–how far the city's urban fabric ignored reality[9]. **p.89**

Traditional planning, which prioritises stable, geometrically defined forms, finds its capacity weakened by its inability to adapt to fluctuating, even random patterns or to reinvent itself with sufficient alacrity in response to changes in society. What can and indeed does occur is the superposition on this formal structure of invisible layers capable of effecting continuous readjustments between the physical reality and the new needs. Or simply allowing the ordered and the unforeseen to coexist. **p.90**

Real-time interaction and the continuous collection of data via digital devices are among the current activities that directly (albeit unconsciously) influence the use and configuration of certain urban spaces. This state of affairs, produced by the network of data circulation, creates a new layer –or rather a multiplicity of layers– that transforms the planned city and invites us to reconsider how architecture and urban planning are affected by and involved in these changes. The virtual environment, quite independently of the previously defined geometries (except for the use of plans and maps as a basis on which to operate), constructs a new reality through the complex interaction between that real urban structure and the data.

Ever greater interaction (especially by means of the mobile phone) highlights and emphasises specific spaces in the city, turning them into sometimes unexpected or unforeseen poles of attraction, thereby determining new uses of the network. The information provided by users is accumulated and identified by the networks before being transformed into a cloud of specialised attractor points (by search terms). This produces an effect, registered on social media, which can be linked to the intersubjectivities, in Husserlian terms, in which collective empathy is replaced and commodified by the act of sharing and recording opinions and data via mobile phones. **p.91**

This multiplication of subjectivities is able to physically shift the location of certain urban functions. The search for these functions via social media produces, through the aggregation of information, a modification of the real physical order of urban locations and is thus capable of determining within the urban fabric new or contingent areas of interest, or *environmental units*[10].

The special order of an Amazon warehouse[11] (Figure 3) can serve to show, by analogy with this new interaction between data and urban structure, how a seemingly chaotic organisational system acts on a perfectly ordered structure (aisles of shelving). The company uses a 'chaotic storage' system in which items are placed in the first available location, thereby optimising space and efficiency. This system is managed by a central computer system that registers each location according to efficiency principles. In doing so it replaces the conventional ordering by typology, hierarchy and size with one based on data management.

This case highlights the contingent modification of closed organisational systems (such as the city) by means of an overlying weak structure (data) that can be dynamically adjusted and transformed in response to new social needs or uses in real time. The data circulating in information networks and systems (above all, today, on mobile phones), in constant flux, correspond and bear witness to the sum of events and individual behaviours, demonstrating, as Complexity Strategy indicates,[12] that what a system of order requires are instructions that are open rather than closed to allow for its continual adjustment, and highlighting how the weak acts as an organisational system capable of superimposing itself (often invisibly yet transformatively) on traditional hard structures. This common pattern of coincidences seems to support Samuel Prieto's claim: '*The appreciation of elements, configurations, or constructions that, a priori, we take for granted, in some cases reveals extraordinary situations that respond to a common pattern*'[13]. **p.92**

The new reality exists, and it leads us to a field of constantly changing and interconnected activities in which the role of the architect has shifted from the aspiration to a definitive vocation to producing an architecture that recognises and accepts concentrations or emergences of uses, even within a prescribed territory. The suggestion, then, is that our built environments become more open (through the invisible multiplication of data) to spontaneous change and a certain organic evolution.

This would underscore the importance of understanding architecture and urban planning as complex systems interwoven with invisible webs of information, data, and events –among others– that are a statistical reflection of contemporary life. This approach seems to herald a significant paradigm shift in architecture and urban planning, emphasising the adaptability and flexibility required by the real-time interaction between form and information.

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FIELD STRUCTURES

The contingency inherent in a less rigid urban order marks a significant turning point in the contemporary understanding of the architecture and urban design project. This is not an entirely new state of affairs, rooted as it is in earlier reflections that, since the mid-20th century, anticipated a more flexible and responsive urbanism. This approach is based on open, isotropic, and relational spatial organisations, far removed from hierarchical and rigid structures.

In the 1990s, Stan Allen studied and exhibited various contemporary organisational strategies, demonstrating an ordering of space that was essentially isotropic, even algebraic, as opposed to geometric: in other words, of a relational order as against a closed or compositional order. In his paper 'From Object to Field: Field Conditions in Architecture and Urbanism' he made visible[14], for contemporary critics and architects, certain organisations–field structures–that could be understood as diffuse spaces and as such less hierarchical and more adaptive to the changes of the present.

According to Allen, the choice of the term 'Field Conditions' stems from the geometry of the agricultural fields (Figure 4) and the architectures that make up much of the United States.

p.93 Allen incorporated various organisational realities into his explanatory diagrams of field structures (Figure 5): the modern or constructivist formally balanced composition, the evolution of mat-building and the aggregative systems of the 1960s, and, later, the reticulated spaces proposed by Koolhaas and Tschumi, among others, during the deconstruction of the 1980s and 1990s.

In the 1990s, Stan Allen anticipated the concept of field conditions, understood as spatial organisations capable of accommodating spontaneous variations thanks to structures open to subtle gradual changes. However, the further exploration of this model must incorporate contemporary approaches capable of engaging the complexity of the city today from a different perspective, integrating technology as a relational medium rather than as an end in itself.

The failings in the organisation of the routes of additive architecture or mat building in the 1960s had made it abundantly clear that dispensing with the hierarchical geometry of the past would require the emergence of an alternative order based at least in part on routes.

This is very much the case in the OMA project for Melun-Sénart, in which an organisational structure of permanent flows (control space) overlaps the continuous open field (indeterminacy space) of the rest of the new town, freely

p.94 arranged and changing, as seen in the model in the photo (Figure 6).

Years later, Allen himself, turning his attention to a structure capable of affording a project a real openness to change or conceptual flexibility, intuited the importance of indeterminacy. In 'Mat Urbanism: The Thick 2'[15], he proposes delving into the dichotomy between the drawing plane and the real world. In this sense, a 'thick' or 'dense' plane can be understood as a mechanism that, although essentially flat, contains multiple layers of activity, infrastructure, movement, and other aspects that are part of a more complex spatiality: *'a kind of loose scaffold that supports the adaptive ecology of urban life. Here the Smithsons' infrastructural ideas may be inverted to conceive of systems of movement, service, and support that give direction to program without overdetermining the use or meaning of individual spaces'*[16].

Such overdetermination can be avoided by means of high computational capabilities, as in the Amazon example considered above, which manifested the possibility of a weak order, but one with a structuring capacity.

In the realms of microeconomics or political activism, too, it is possible to identify linking structures such as those discussed when considering the role of the mycorrhizal fungal network in a forest's survival. Small-scale economic transactions and exchanges constitute a vital support element, especially in more informal economies. Cities are more and more complex and their actual behaviour difficult to truly comprehend, making it advisable to take these invisible linking structures into account. To a great extent, they are able to adapt and survive thanks to these invisible networks that intertwine actions which are sometimes beyond all control.

The Audi Urban Future Award event in Ingolstadt in 2012 was attended by a group of young and still little-known architects including Junya Ishigami, Höweler Yoon, and Prasad Shetty and Rupali Gupte, whose overall conclusions merit closer analysis. The two last-mentioned, in particular, presented their recent research for their home city of Mumbai, focused on a key aspect of the present study, which is especially concerned with the role of individual and marginal economic transactions[17].

Shetty and Gupte's approach sounded a warning against holistic readings: Grand narratives are not enough to explain the city, nor are the great successes or failures of economic or urbanistic interventions; and to explain this,

p.95 they turned to the failure of Charles Correa's looms project[18]. It is necessary to attend to–and respect–the fragile but dispersed and infiltrated fabric of actions capable of coexisting with solid structures and facilitating their existence from the fringes (Figure 7).

Clearly apparent in the previous case is the need to address invisible elements such as small transactions as

p.96 a strategy for facilitating adaptive capacity in the city. Much the same can be said for the importance of a political narrative capable of articulating the great challenges to be faced, between the official discourse and individual opinion. These challenges –climate change above all– call for a response of an infrastructural nature, with major investment, and carry a high environmental impact.

All of this engenders a dual effect: not only the paralysis of traditional politics –entirely unwilling to make the necessary sacrifice when it is most needed– but also the risk of individual inaction from a sense of impotence in the face of the magnitude of urgently needed collective decisions. Hence the special relevance of a political refocusing of

these issues through the vital reorganisation of social and political systems advanced by Bruno Latour, especially (but not only) in the face of climate change.

Social action becomes a real contingency when it is organised through the superposition of individualised actions, capable of self-organising with a greater degree of freedom through the increasing presence of correlated micro-activisms in the dispersed, and with a scientific basis that makes any proposed initiative less questionable.

A notable example of this dynamic is the Kreuzberg district in Berlin, where citizen movements have used digital networks and social platforms to resist gentrification and promote alternative forms of coexistence and use of public space. These initiatives, based on the direct interaction of the local population, have made it possible to reorient urban policies and partially halt speculative processes that threatened the neighbourhood's social cohesion[19].

In this way, informal adaptations of the space, temporary occupations, and everyday relational interactions constitute authentic latent adaptive structures. Far from technological determinism, they are supported by personalised technology that facilitates continual negotiations between citizens. The contemporary city here reveals its nature as a sensitive, fluid, and changing ecosystem in which urban life flows through a multiplicity of latent, flexible connections.

COINCIDENCES IN THE DISPERSED

The will to partial dissolution of a strong order that characterises field structures, as well as their contingent adaptation to processes of indeterminacy to increase their adaptability, is an important field in design strategies. Taking this to the limit, we might still ask whether these structures based on relational systems are susceptible to being represented and therefore fixed.

Would it even be possible –taking a further step toward uncertainty– to achieve the annulment of orderly systems? Is it possible to imagine a hidden system, based on scattered and seemingly unconnected events, a space for coincidence, chance, actions, the appearance of dispersed elements in the plot?

Investigating these aspects of contemporary architecture and urban planning brings to light how the multiplication of invisible events, which establishes a certain order and weaves together the existing city, is often shaped by weak actions.

These actions would operate in/on an open field, allowing for the existence of events and connections that do not follow a sequential or structured logic, but rather form and dissolve by way of coincidences and energy. As early as 1964, Fumihiko Maki seemed to sense that relational organisation could bring a greater resilience and continuity to the urban territory:

'*We must now see our urban society as a dynamic field of interrelated forces. It is a set of mutually independent variables in a rapidly expanding infinite series. Any order introduced with the pattern of forces contributes to a state of dynamic equilibrium–an equilibrium which will change in character as time passes*'[20].

The contemporary city, acting as a relational system, continues to function despite its discontinuities, indeterminacy, and entropy. These could be explained with three diagrams (Figure 8). **p.97**

As Evelyn Alonso showed in *Acciones infra-leves. Indeterminación, discontinuidad y entropía* [Infra-thin actions: indeterminacy, discontinuity, and entropy],[21] discontinuity can be represented as a map of fragmented events or discourses. It is in this intermediate space that we find the erratic and the spontaneous, but, above all, the unexpected force of that which interrelates. It is in the intermediate distances, the interstices, the thresholds, the borders, and the limits that the seemingly weak or invisible is hidden.

Unlike discontinuities, indeterminacy is a direct consequence of complexity. It is also a product of the openness and lack of definition of a system. The more complex a system is, the greater the variety of options that stem from it, thus increasing the degree of indeterminacy. In an isolated or closed system, everything has a specific, preassigned place and, to a certain extent, remains ordered and determined. As a system interacts with other systems it gives rise to a new order of instability and indeterminacy, thus multiplying configurations, relationships, options, etc. In this unstable environment, responses such as ephemeral architecture, nomadism, process-centred work, participatory action and all kinds of open initiatives arise.

The concept of entropy is also related to the dissolution of limits and boundaries, since in open systems, interactions with others necessarily take place. Perhaps the most interesting characteristic of entropy is its evolution toward disorder or instability; toward a weak amalgamation or fragmentation. It can be imagined as an additive state of bound and changing particles versus the stable state of a geometric and tied warp, comparable to the visual relationship between 'felt' or 'fabric' in Deleuze and Guattari. Entropy is understood as a process of energy loss and fragmentation in urban systems. This process is irreversible and results in the weakening of structures.

This last concept of entropy is the most abstract and points to the tendency toward chaos that inevitably occurs in the city. A new input of energy is needed to create cohesion between the fragments. Faced with the complexity and the information density of present-day urban life, these complex relational systems have become critical tools for understanding and reconfiguring the urban space, radically changing its interpretation. **p.98**

CONCLUSIONS

While architecture and urban planning have traditionally been disciplines of permanence, contemporary urban reality demands a perspective that incorporates contingency as a structuring element. The city is sustained not only by

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its physical layout and structures, but also by a network of actions and information systems that, although invisible, reconfigure its functioning.

Over the course of this study it has become evident that these weak or relational structures function as mechanisms of cohesion and transformation, enabling the city to absorb changes with the capacity to make the functional and hierarchical order of its components more flexible without strain. The coexistence of solid and dynamic structures is not only possible but also emerges as an essential process in the construction of the urban present.

However, the analysis also highlights the need to review the interpretive models used to address these processes. In contrast to the 20th-century examples that foreshadow the issue by questioning a global overdetermination, it is essential to incorporate contemporary references that reflect how current dynamics are redefining the relationship between architecture, information, and the city. Examples of this are transactionalities or grouped individualised actions that act as interconnecting surfaces, complexifying stable structures built for past orders and enabling them to adapt to new uses and accommodate alternative ways of life.

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Evelyn Alonso Rohner (EAR); José Antonio Sosa (JAS). Conceptualisation, methodology, analysis, and preparation of the document: EAR (50%); JAS (50%). Authorship: EAR (50%); JAS (50%).

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