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## **Views of Domesticity from Fascism to Democracy:**

**The shifting architectural paradigms of Portuguese public housing, 1969-1982**

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### **ABSTRACT**

The mass construction of public housing throughout the 20<sup>th</sup>-century across Europe had a great impact on the way cities grew. The urban and therefore social impact of housing estates has been thoroughly studied both within and outside the field of Space Syntax. However, decades after the first efforts within the field at deconstructing simplistic claims of deterministic relationships between architectural form and social problems, these continue to be used to justify dismantling public housing programmes and demolishing existing estates. This research searches to counter deterministic arguments by arguing that the architecture of 20<sup>th</sup>-century public housing is not a homogeneous paradigm, but rapidly transforming design ideas that translated similarly shifting social views of city, class, and domesticity. The paper focuses on 33 housing projects built in Porto between 1969 and 1982, accompanying deep transformations in Portuguese society, most importantly the shift from dictatorship to democracy in 1974. The results show clear differences at all scales of housing between the different housing programmes implemented during this period that are significant to developing a more complete understanding of the role of 20<sup>th</sup> century public housing in city-shaping, but also for re-examining the classic syntactic definitions of estates and of the soft and hard solutions.

### **KEYWORDS**

Housing estates, Portuguese architecture, Participatory architecture, Domestic environment

## **1 INTRODUCTION**

Buildings carry in themselves ideas of how society worked and projections of how it should. By limiting the ways people can spatially organise their lives, buildings impose, to an extent, those ideas and projections onto the future. Few examples translate this as clearly as the widespread



development of public housing policies across Europe in the 20th century, the reflection of growing welfare states. How these were materialised into built form defined how families lived, social groups and classes interacted, and cities grew.

In Portugal, public housing was first developed during a corporatist dictatorship and grew through a revolution. Public housing policies became dominant during the country's move towards democracy, but eventually withered away with the emerging neoliberal policies of the late 1980s and 1990s.

In particular, Porto's growth was to a great extent connected to housing development by public institutions. Today, Porto has a reported 13% of council housing ('Porto Ao Nível Da Finlândia', 2019). This represents a much higher percentage than Portugal's average of 2%, even without considering other forms of public or publicly financed housing in the city. The greater part of Porto's public housing stock was developed between the late 1950s, when a large-scale plan for the construction of council estates was implemented, and the mid-1980s, before the implementation of 'Right-to-Buy'-like reforms and of an institutional reorganisation that withdrew from the state its role as housing developer. Throughout these decades, the city sustained substantial growth, often connected to housing policy.

How mass public housing construction may affect those who live in these spaces is a question that has often been raised regarding the resulting estates of the welfare states that developed during the twentieth century across Europe, frequently giving rise to simplistic claims of deterministic relationships between architectural form and social problems. Since its earlier days, Space Syntax has been concerned with offering a counterpoint to these conclusions through the development of its methodology for the description and quantification of spatial attributes and has contributed to the systematic deconstruction of deterministic arguments (Hillier, 1986; Hillier et al., 1987; Hanson and Hillier, 1987; Hillier et al. 1989; Hillier, 1996, Westin, 2011).

If, by today, it has been clearly established that architecture has an influence on people's lives but cannot be solely to blame while socioeconomic conditions and public policies are not accounted for, the architectural properties of housing estates remain the frequent scapegoat of spatially coincident social issues. In Porto, claims of inadequacy of architecture with no scientific back-up have provided the reason for the demolishing of public housing estates and the eviction of thousands of families (Carvalho, 2009; MAVAA, 2011; 'O Fim Do Aleixo', 2011; 'Porto Ao Nível Da Finlândia', 2019; Pinto, 2015).

This paper originates from doctoral research which looked at public and cooperative housing in Porto with the objective of deconstructing this narrative by using syntactic analysis to understand the transforming design patterns from the set of built housing estates between 1969 and 1982 (Ruivo, 2021).



Spatial patterns are compared across housing programmes to identify shifting or contrasting attributes that may be indicative of “genotypical” (Hillier and Leaman, 1974; Hillier et al, 1987) themes among different programmes. Following Hillier and Hanson’s (1984) definition of a soft and hard solution in housing projects, as well as Hanson’s (2000) exploration of the relationship between the interior and exterior of housing estates, the research studies the different scales of housing, from the dwelling to the city, as well as the relationships between them.

Finding clear stable trends, or design paradigms, within each historical moment, the paper examines how these may reveal transforming dominant ideas about family, community, and class.

## 2 SPACE SYNTAX, HOUSING ESTATES AND THE QUESTION OF DESIGN

Space Syntax originated in close relation to an explicit concern with the development of new housing estates in the 1960s (Westin, 2010), as a response against normative theories of architecture which, in the authors’ views, failed to correspond in reality to the set of principles they followed in theory. When Hillier et al. (1987) studied the encounter rates in housing estates, spaces were verified to be underused, some of them some of them registering the same encounter rates during the day as residential streets did during the night (Hillier et al. 1987, p.247). These results were seen to be dependent on the relation of the spaces of the estate to the outside more than that between the spaces of the estate itself, a conclusion which assigned further importance to Hillier and Hanson’s syntactic definition of a housing estate. In opposition to a street, “an open and distributed local event in a larger open and distributed system,” the city (Hillier and Hanson, 1984, p.263), estates were described as “discrete local domain with some degree of segregation from surrounding streets”.

This definition is integrated in the postscript for *The Social Logic of Space* (Hillier and Hanson, 1984), where the authors apply the theory of space that is developed throughout the book to the spatial organisation of modern capitalist society. Arguing that there exists a contradiction between capitalism’s need for workers to be spatially concentrated where there are jobs, and simultaneously for them to be organised in asymmetrical, non-distributed social relationships - such as hierarchies, the authors oppose two different spatial solutions for this contradiction as had been historically seen throughout the 19th and 20th centuries: 1) the soft solution, of which Howard’s garden cities are the paradigm, “works by meaning rather than syntax” (Hillier and Hanson, 1984, p.266), by building ideological order over a small community, disaggregating cities and fragmenting them into noninterchangeable zones, “ordered by a strong exogenous model expressing a conception of social order”; 2) the hard solution, represented in housing estates, arises from the mode of production itself, reproducing in space the essential syntax of relations of the social system: the separation of workers through hierarchical forms of space. This solution is defined by a clear outer boundary with few entrances, separate blocks and separate staircases: spatial mechanisms that first group a large number of people together to then separate them into smaller and smaller units by using non-distributed syntaxes.



Implicit to the idea of the soft and hard solutions is that there exists a relationship between spatial configuration and the social structures that build it. In this sense, it is not just that the syntactic separation of estates from nearby streets make it less likely for passers-by to use their interior spaces, but that this separation is in some way connected to the context that created the housing estates and that this spatial separation carries in itself a larger social meaning. Elaborating on this idea, Hillier and Hanson argued that space is not a reflection of society, but the result of a process that both restricts and is restricted by social forces, by building “into patterns of space and action complexes of noninterchangeable relations which ensure, through the ritualisation of life, the reproduction of the systems of categories required by that society” (Hillier & Hanson, 1984, p.222).

As such, as Hillier and Leaman (1974) affirmed, the action exerted on the environment may appear to architects as a simple result of design as an autonomic process, guided by preconceptions and assumptions that are unconscious to the designer. The action exerted on the environment may appear to architects as a simple result of their agency, but, because it carries an embedded knowledge of social relations, it will produce a coherent result that would not appear as random individual action to the anthropologists of the future.

In this way, inseparable from the context that produces it and that it tendentially re-produces back, the built environment has the capacity to tell us something about this context, It is a privileged field for the understanding of social processes in history. In particular, space syntax’s capacity to detect and describe spatial patterns in terms that are quantitative and as such can be related to empirical data and compared across cases, is an invaluable tool for developing in-depth readings of the relationship between space and society throughout time.

### 3 DATASETS AND METHODS

The idea of configuration at the core of Space Syntax reflects an understanding of the built environment not as a set of local elements, but as a global system in which all parts are connected. As translated in Hanson’s (2000, p.97) affirmation that “all of these properties, even when applied at the neighbourhood scale, are global not local”, understanding domestic experiences means not only looking at the house, but also understanding how families relate to the city as a social system, to their neighbours and to each other. As such, domesticity must be viewed as something that carries across scales. It is impacted by the organisation of domestic interiors, but also by the configuration of the estate, its urban insertion and relation to the surrounding city.

In this sense, analysis was conducted at three scales, with the objective of examining how transformations in spatial patterns may be indicative of shifting societal views of the family, its role as part of a community, and the roles of its members within it.



### 3.1 The urban system

Angular analysis was conducted on a segment map of Porto and its adjacent municipalities. The boundary effect was accounted for by applying metric radii to the analysis (Turner 2001).

Additionally, all studied estates are located within Porto, and are the closest to the edge when it is defined by a natural boundary - the ocean - at approximately 2900m. The estate closest to an artificial boundary is at over 8km away from it, making the largest radius used (5000m) viable for analysis. The analysis considered the variables of integration and choice, at 800m, 1500m, 3000m and 5000m radii. Additionally, the location of nearest retail and services, playgrounds, sports facilities, and schools were registered in a QGIS model.

### 3.2 The estate

In syntactic terms, an estate can be defined by high and successive levels of hierarchisation that work towards separating people into smaller and smaller groups - first by removing them from the main city fabric, then by further splitting its inhabitants throughout a deep, asymmetric and non-distributed system. These characteristics can be expressed quantitatively by the measures of, respectively, integration and control.

Additionally, Hanson (2000) has demonstrated the importance of depth measures in understanding housing projects, developing six syntactic measures of depth, specifically to explore the urban transformation from street to estate layouts. These measures converged with this research's objectives and were adopted, and in some cases adapted, to explore the relationship between the estates and its urban exterior, between the internal spaces of the layout, and between the estates' dwellings, the estate, and the urban exterior (table 1).

<b>Table 1. Depth measures (Hanson, 2000)</b>	
<b>Mean depth from the exterior</b>	Mean depth from the nearest streets completely exterior to the system.
<b>Functional interface decomposition</b>	The value of the convex mean steps between dwellings in the shortest path that links all dwellings in the layout together.
<b>No-neighbours score</b>	The mean depth of the convex system from the dwelling entrances.
<b>Mean convex depth</b>	Mean depth between all convex depth.
<b>Maze and separation indexes</b>	Defined by Hanson (2000) as the mean depth of the axial system from the surrounding streets, constructed from the measure of axial step-depth from the exterior of the system, the maze index is used in order to understand how inviting or intimidating the layout might be to outsiders. The opposite relation, that of residents to the exterior of the estate, is given by Hanson's separation index: the mean convex depth of surrounding streets from the nearest dwelling entrances.

This information was found to be intuitively read in radar charts where the kinds of relations favoured in each estate are made visually clear: of the urban exterior with the estate, neighbourhood relations within the estate, or relations between the family and the city that are not controlled by an intermediate scale. This is illustrated in Figure 1. The six axes represent,

starting with the superior vertical axis and proceeding to the right: the number of steps between the exterior urban arteries and the interior of the residential buildings; between the interior of each residential building and all others; between the exterior spaces of the estate and the interior of the residential buildings; between all internal spaces to the estate and all others; between the main urban arteries and the interior of the estate and, finally, the minimal depth between the exterior urban fabric and the interior of the residential buildings.

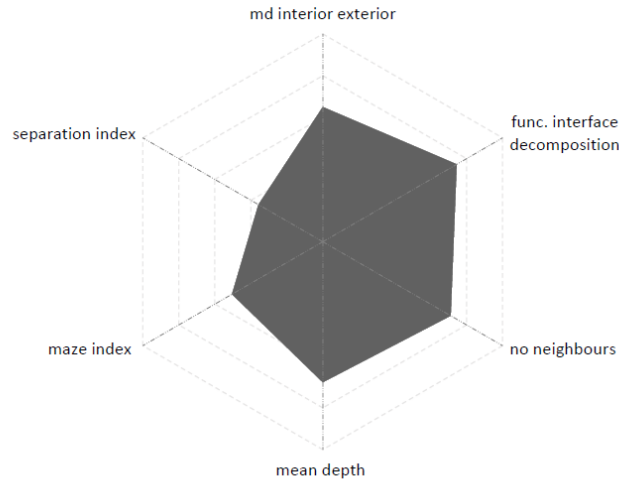


Figure 1. Depth measures used in the analysis

Axial and convex maps were modelled individually for each estate and analysed with DepthmapX (Turner, 2001b; Varoudis, 2012) and Grasshopper’s plugin Syntactic (Nourian and Rezvani). These maps consider streets, sidewalks, and pathways in each housing scheme, as well as the surrounding streets. Functional spaces were modelled as one convex space, regardless of their shape. Non-functional spaces were divided according to major shifts and turns, as well as other design mechanisms to signal boundaries, such as landscaping or pavement changes that would cause spaces to be perceived as separate. Other characteristics of these spaces were integrated into the analysis, as exposed in the following table 2:

Table 2. Other attributes	
<b>Integration of functional spaces</b>	The integration values of each functional or labelled space.
<b>Density</b>	A function of area and number of inhabitants, where each apartment is considered to have the as many occupants as its number of rooms plus one.
<b>Urban equipment and infrastructure</b>	Whether essential urban functions exist within the estate or in its vicinity, favouring a system of activities that is interior to the estate or that develops in its locality. Whether the estates are provided ease of accessibility to educational, cultural, institutional, health or sports equipment. The existence or non-existence of functional spaces such as sports equipment, local retail, playgrounds or clothes hangers within the estate that may encourage the creation of neighbourhood relations.
<b>Type of distribution in building, number of neighbours</b>	In addition to the number of houses sharing the same access, this should provide an understanding of the likeliness of daily encounters between residents in the same building.
<b>Traces of use</b>	Traces of use were registered during field visits as a complement to quantitative analysis. These were categorised as either programmed: where traces of use correspond to planned features of the estates, such as clothes drying in hangers and people gathering around benches; or non-programmed: space appears to be used despite or beyond the intentions of its designers, such as when clothes hangers are improvised between trees, or the small patches of grass in front of residential buildings are appropriated for vegetable gardens.



### 3.3 Domestic space

Analysis was conducted for one type of apartment per housing development, when apartment plans could be found, unless differences in size translated in relevant configurational alterations.

Apartment graphs were modelled in Rhinoceros and calculated with Grasshopper’s plugin Syntactic. Each labelled space was modelled as a node in the graph, regardless of its shape. When labels are unclear, spaces are divided where there exists a sharp division (in the form of doors, steps, difference in heights, or other clear separations such as fixed furniture) between them. Labels were favoured due to this research’s purpose to understand underlying views present in house design. As Bafna and Chamber (2014, p.37) propose, “Labels are significant not so much because they identify specific activities associated with space, but because they give evidence of a culturally determined segmentation of spaces.”

Additionally, labelled spaces were considered as belonging to functional sectors, according to the type of activities they are expected to hold, and defined as collective, private or services, as has been done in various studies of the configurational aspects of domestic spaces (Amorim, 1997, 1999; Bafna, 2001; Ramos, 2006), and genotypical signatures were examined in the ordering of integration of these sectors. The analysis of each apartment scheme considered the variables in the following tables 3 and 4:

<b>Table 3. Global attributes</b>	
<b>Total useful floor area</b>	The total area of all enclosed spaces measured to the internal face of external walls.
<b>Density</b>	Calculated through the division of the house’s TUFA by the number of bedrooms plus one, density corresponds to the area per resident when a house presents ideal occupation.
<b>Mean depth from the exterior</b>	The number of steps between all rooms and the exterior.
<b>Integration and difference factor</b>	Integration values were registered for all spaces, both functional and transition, to detect similarities and differences in the ordering of functions in the house and identify consistent genotypical patterns where there might exist. The Difference factor, an entropy-based measure adapted from Shannon’s H-measure that was developed by Hillier et al (1987), was used to quantify the degree of difference between the integration values of functional spaces. It can be any value between 1 and 0, 1 corresponding to weak inequalities in a sample and 0 to strong ones.

<b>Table 4. Attributes of labelled spaces</b>	
<b>Areas of labelled spaces</b>	The useful floor area of each labelled or functional space.
<b>Relative size of labelled spaces</b>	The relative size of the common, services or private areas of the house, normalised between 0 and 1, as well as the percentage of the house’s area occupied by these areas.
<b>Mean depth and relative mean depth of labelled spaces</b>	The mean depth between different sectors, as well as the relative mean depth of the common, services or private areas of the house, normalised between 0 and 1.
<b>Integration of labelled spaces</b>	The integration values of each labelled or functional space.

## 4 TRENDS AND DIFFERENCES

To understand whether and in what ways different public housing programmes constructed housing with different spatial patterns that might relate to changing views of domesticity, it was found necessary to first examine how results varied between them.

The coefficient of variation (CV) was calculated for each of the examined variables to assess which of them presented enough variation to be useful in finding differences between programmes. The rule of thumb used was that the amount of variation should be at least 20% (Hanneman et al., 2012). It was found that all variables, with the exception of mean depth and difference factor at the scale of the apartment, have a variation superior to 20%. The coefficient of variation of each variable was then calculated for the different programmes and compared with the global result to verify whether variation is smaller within programmes than across them. The results consistently confirmed this hypothesis, showing that domestic and estate layouts are more similar to domestic and estate layouts developed by the same programme than to those developed by others.

Cohen's *d*, an effect size used to indicate the standardised difference between two means, was calculated to see which programmes showed stronger differences in the values of the examined variables. Cohen's *d* is a standardised measure where  $d=0.2$  can be considered a 'small' effect size, 0.5 represents a 'medium' effect size and 0.8 a 'large' effect size. When *d* is smaller than 1 it means that *d* is smaller than one standard deviation. This means that if two groups' means do not differ by 0.2 standard deviations or more, the difference is trivial. The average value of *d* was then calculated for the relationship between each pair of programmes. The results showed no marginal differences between programmes at any scale. Effect sizes were the smallest at the urban scale, ranging around medium values. At the scales of the estate layout and of domestic interiors, differences between programmes are sharp, varying from medium values to well above the 0.8 threshold for large<sup>1</sup>.

## 5 CASE STUDY

The greater part of state intervention in housing development in Porto took place between the late 1950s, when the council invested in the construction of a total of 13 housing estates, and the early 1980s, when the set of national housing policies implemented during the revolutionary period of 1974-1976 started being abandoned. The paper focuses on a period roughly limited by the creation of a governmental department of social housing (Fundo Fomento da Habitação, FFH) in 1969, and its extinction 13 years later. This corresponds to an exceptional moment in the

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<sup>1</sup> Complete results can be consulted in the doctoral thesis whose research was conducive to this paper. Reference to be provided after the blind reviewing process.





history of Portuguese social housing, both for the multiplicity of typological and morphological solutions which emerged from research, multiple programmes and experiments, and for the particular relevance it had in the development of Portugal's major cities, being in great part responsible for the current urban configuration of Porto and its adjacent municipalities. The social, economic, and political conjuncture of the revolutionary period gave place to the reorganisation of existing institutions and public housing policies and resulted in the most productive moment for housing development in the country. Benefiting from an increase in financing and with a practice that was connected to the normalisation of constructive processes, development of social studies, data collection and statistical procedures, the FFH developed a series of different policies and programmes that reflected the multiple forms of the housing shortage felt in the country.

This paper looks at public housing in Porto between 1969 and 1982 through the examination of thirty-three housing developments constructed with the state's total or partial funding within the municipality of Porto. This set includes:

- 1) 7 council housing schemes developed between 1969 and 1975. These were part of a municipal plan (Plano de Melhoramentos da Cidade do Porto, PMCP) that was the first instance of a clear public programme of housing development in the city, thus providing the historical urban, methodological, and typological context for the development of new enterprises, in particular due to the integration of many of the same actors as later programmes. With the objective of improving the living conditions of *ilhas*<sup>2</sup>, this plan was responsible for roughly 34% of public housing production in Porto during the studied period, and so for the main spaces to where populations from the city centre were relocated during those years.
- 2) 10 housing schemes developed within a participatory programme (Serviço de Apoio Ambulatório Local, SAAL) during the revolutionary period of 1974-1976. This programme was created to serve the populations living in the overcrowded city centre, promoting the initiatives of ill-housed communities by creating incentives through the municipalities to their collaboration in the transformation of their own neighbourhoods, through direct discussion between architects and residents' associations.
- 3) 6 housing schemes developed for organised residents' associations within legal frameworks other than the SAAL - often either with council aid or as housing cooperatives - after its dissolution in 1976.
- 4) 11 housing estates of public development after 1974. The FFH invested in systemic planning policies and partook in direct development of housing across the country. In Porto, it worked with the municipality for the construction of new housing developments planned both centrally and locally.

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<sup>2</sup> *Ilhas* were small shelters in the backyards of Porto's deep but narrow lots, built by industrial capitalists to house their workers. These dwellings were overcrowded and unsanitary, effectively removed from the urban space, hidden behind the façade of bourgeois buildings, and connected to the street only through an exterior corridor which went through the main building.

## 6 RESULTS AND DISCUSSION

### 6.1 Council housing, 1969-1974

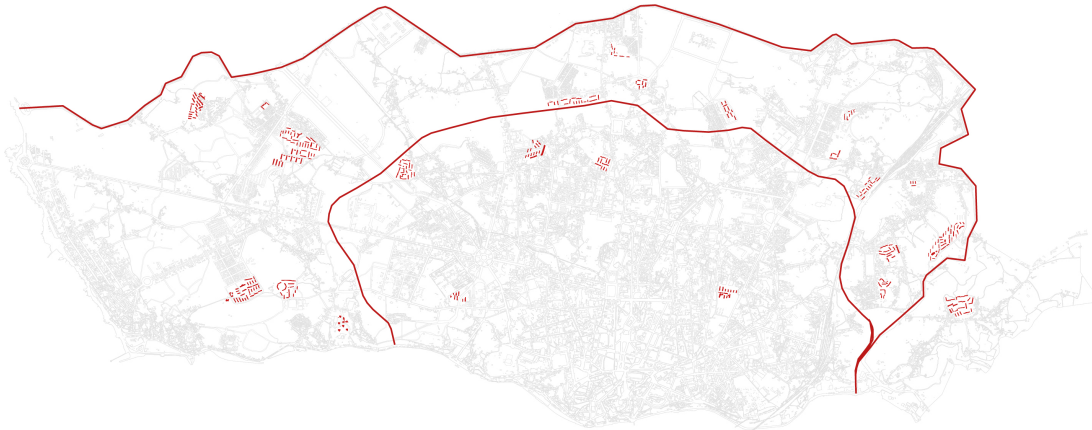


Figure 2. Plan of Porto in 1960 with PMCP housing

Between 1956 and 1966, the implementation of the PMCP resulted in the construction of thirteen housing developments. As shown in figure 2, in most cases, these were developed in areas outside the planned inner radial of the city that were mostly non-urbanised at the time. They were often connected to earlier public housing to profit from existing infrastructure and to industrial areas, where their residents should find employment. For the relocated populations, this meant that communities were fragmented and scattered to peripheral areas without access to the urban functions they knew.

Today, most of these housing developments have seen the city grow around them, and some are even located in well-integrated areas both spatially and socially. As such, when examining the results in table 5 which present contemporary values of integration and choice, it is important to consider that the city sustained substantial growth since then and that values would have been lower at the time of construction.

Table 5. Integration and choice values of council estates						
	#houses	area (m <sup>2</sup> )	NaIN5000	NaIN800	NaCH5000	NaCH800
Nuno Pinheiro Torres	428	70000	0.68	0.73	0.78	0.86
Monte da Bela	179	34395	0.83	1.1	0.86	0.8
Falcão	236	46482	0.56	0.88	0.76	0.87
Lagarteiro	397	89669	0.53	0.96	0.79	0.92
Bom Pastor	446	38189	0.84	0.92	0.84	0.93
Aleixo	247	31560	0.77	0.81	0.91	1.08
Contumil	329	10841	0.85	0.93	0.81	0.81
av.	323	45877	0.72	0.9	0.82	0.89

However, if urban growth resulted in increased integration of these estates, depth measures are notoriously large in most council estates (table 6) As seen in the examples in figure 3, housing layouts were often placed to take advantage of vacant land in the interior of existing blocks and distanced from the surrounding city by existing buildings in the front of lots. A few openings connected the estates to the surrounding city, making them invisible from the primary street grid.

Table 6. Depth values of council estates						
	mean depth exterior	funcional interface decomposition	no neighbours score	mean convex depth	maze index	separation index
Nuno Pinheiro Torres	2.91	2.59	2.52	2.40	2.44	2,00
Monte da Bela	5.04	4.59	4.32	4.03	4.29	2,00
Falcão	3.58	4.06	3.91	3.65	3.14	2,00
Lagarteiro	3.19	4.20	4.07	3.91	2.56	2,00
Bom Pastor	3.34	4.31	4.13	3.96	2.86	2,00
Aleixo	3.50	2.91	2.67	2.35	1.34	1,00
Contumil	1.13	3.40	3.29	3.36	1,00	1,00
Contumil	2.70	2.91	2.68	2.78	1.79	1,00
av.	3.17	3.62	3.45	3.31	2.43	1.63

This is reflected in large maze index values, indicating that non-residents with no local knowledge are unlikely to pass through the layouts. Inversely, separation index is low for all layouts. There are not complex systems of transition spaces between the street and the houses, which means people reach inhabited spaces nearly after entering the spatial system. Contrarily, most of these developments' residents do not reach the street shortly after leaving their houses, being on average more than three convex steps away from the primary city grid.

On the one hand, the depth and hierarchisation of these layouts clearly reflect the strict moral and political regulations that were implemented in public housing during the dictatorship, simplifying the task of dividing a large population into smaller groups and monitoring their behaviour. On the other hand, the enclosure of the layouts in themselves, along with the design of collective spaces within the estate, is reflective of modernist design paradigms that were never accomplished due to the fall-through by the municipality to construct the planned infrastructure and equipment.

In this sense, if exterior spaces often provided the potential for collective use, the lack of associated social facilities and other necessary equipment, associated with tree-like spatial systems and large depth values within the layout, resulted instead in clusters removed from the city that did not facilitate the establishment of neighbourhood relations.

The relocation of families to council estates, where these are removed from community bonds while simultaneously abandoning shared apartments or rooms in the historical centre, or small, low privacy houses in *ilhas*, for their own, significantly larger, houses, meant families could



develop familial relationships very different from those allowed for in previous conditions of overcrowding.

<b>Table 7. Spatial attributes of domestic interiors in council housing.</b>						
	<b>TUFA m2</b>	<b>Density m2/r</b>	<b>Integration</b>	<b>Difference factor</b>	<b>Mean depth exterior</b>	<b>functional orientation %</b>
Nuno Pinheiro Torres	57.3	14.3	0.85	0.75	2.60	20.0
Monte da Bela	56.0	14.0	1.05	0.72	2.27	18.0
Falcão	61.9	20.5	1.45	0.74	2.75	18.0
Lagarteiro	60.8	15.2	1.05	0.76	2.60	20.0
Bom Pastor	39.3	13.1	1.83	0.38	1.75	12.5
Aleixo (A)	65.7	16.4	1.28	0.61	2.80	23.0
Aleixo (B)	75.3	15.1	1.15	0.74	3.00	28.5
Contumil (phase 1)	71.5	17.9	1.07	0.72	2.90	18.0
Contumil (phase 2)	70.4	17.6	0.95	0.81	2.80	16.0
av.	62.0	16.0	1.19	0.69	2.61	19.3

These layouts remain the smallest in the studied sample, with area economy appearing to result in ringy and functionally ambiguous schemes. Transition spaces are reduced to a minimum (1 for 5 functional spaces as per table 7), with around 35% being c or d types. These often connect functional spaces from different functional sectors, resulting in an ambiguous functional division of the apartments. This is clear in the relationship established between kitchens and living-rooms, where spaces are not functionally separated as services or collective but articulated in a pole that integrates both. Similarly, bedrooms are in some cases not organised in one clear private pole, but instead, articulated with different areas of the house and, even when a private sector is clear, it often establishes a close relationship with collective areas.

A common and stable genotype was identified across council estates, where collective spaces were always the better integrated and bedrooms the more private, with kitchens often showing large values of integration.

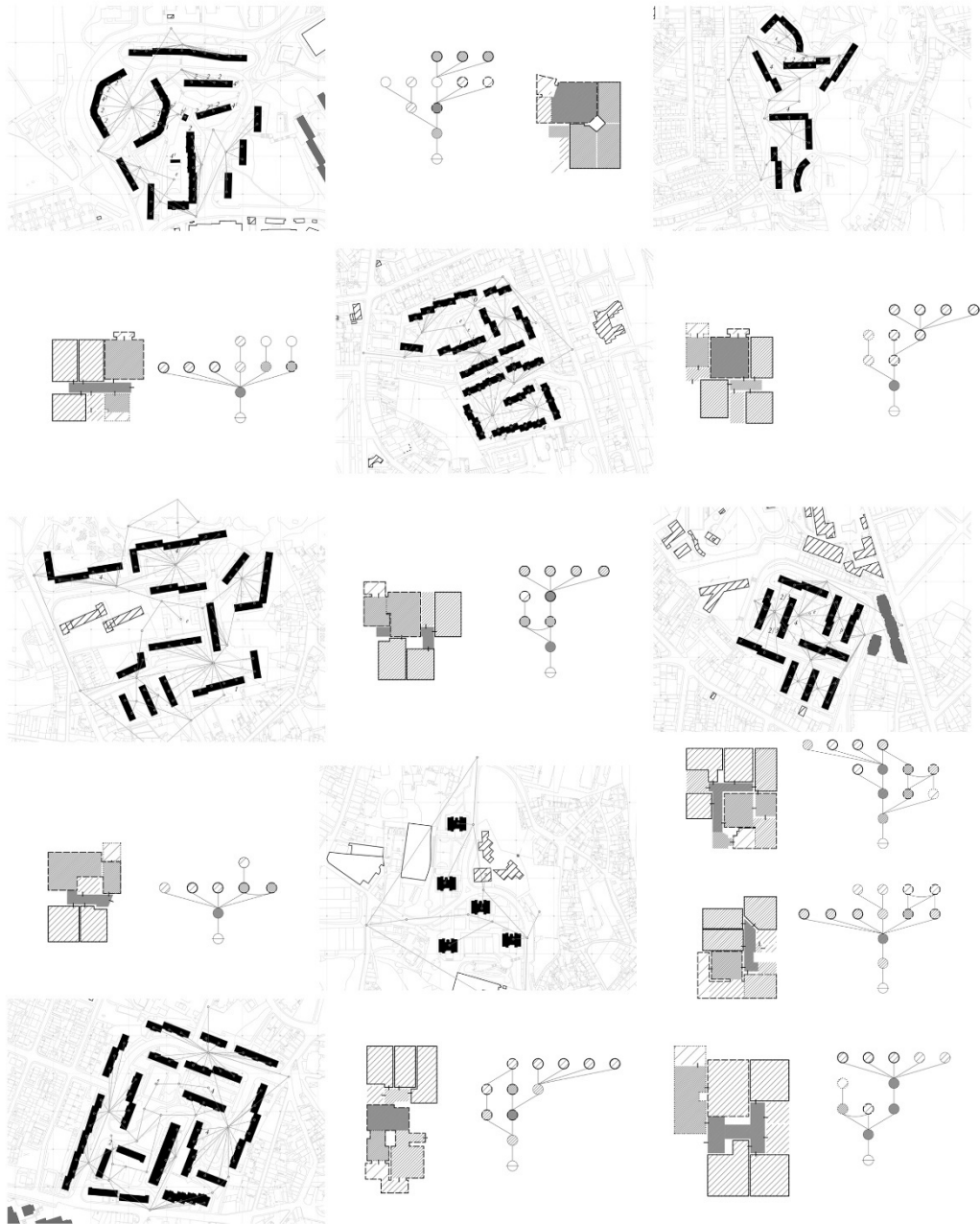


Figure 3. Estate and apartment plans of PMCP housing

## 6.2 SAAL HOUSING, 1974-1976

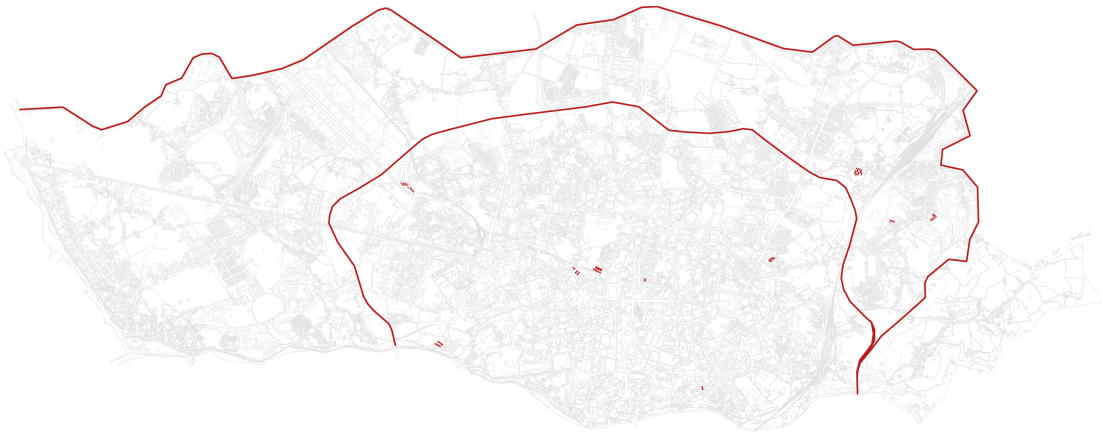


Figure 4. Plan of Porto in 1978 with SAAL housing

The location of SAAL housing schemes is reflective of a profound paradigm shift in public housing development and design after the overthrowing of the dictatorship in 1974 that is not expressed in their average values of choice and integration. In fact, while SAAL layouts do not present, on average, large values of global or local integration, it must be noted that half of them are in the integration core of the city, in areas already stable in the city's process of urbanisation at the time of construction. As such, 4 out of 10 housing schemes present global integration values that sit on the top 25% of all studied cases. Simultaneously, however, three SAAL layouts present global integration values that sit in the bottom 25%. What is translated in this variation is a strategy of maintaining communities on the areas of the city where they were rooted - in explicit opposition to prior public housing developments. In many cases, this strategy resulted in the permanence of the populations in a centre from which the plans developed during the dictatorship sought to evict them, but, in others, it prioritised the maintenance of existing ways of life in more peripheral, poorly integrated, areas of the city.

Table 8. Integration and choice values of SAAL housing						
	#houses	area (m <sup>2</sup> )	NaIN5000	NaIN800	NaCH5000	NaCH800
Antas	32	6027	0.77	0.84	0.75	0.79
S. Vitor	12	1740	0.81	0.80	0.63	0.67
Maceda	16	6898	0.65	0.68	0.26	0.26
Franco	44	12677	0.91	0.91	1.00	1.11
Lapa	68	17959	0.86	0.98	0.80	0.92
Leal	16	2415	0.91	1.21	0.87	1.03
Massarelos	80	11223	0.69	0.71	0.86	1.14
Contumil	62	12107	0.63	0.71	0.72	0.77
Bouça	126	18388	0.89	1.01	0.84	0.84
av.	51	9937	0.79	0.87	0.75	0.84



In their lot occupation, SAAL housing schemes appear more like previous council estates. In most cases, these housing developments, albeit small scale, low density and almost exclusively using single-family typologies, occupy inexpensive urban land in the interior of existing blocks. Large values of functional interface decomposition, no-neighbours score and mean depth are present in many of SAAL's layouts in Porto, in particular those whose exterior morphology consists on the placement of parallel blocks of single-family houses throughout the available lot. While creating a grid of parallel streets that are often connected in rings with one another, the constraints imposed by lots without a direct connection to the exterior urban space result in systems which are often deep. With an average of 3 points where permeability is possible between the interior of the lot and the primary urban grid, control over the layout is then concentrated on the few shallower streets that connect to the exterior city. Consequently, constituted spaces are often not likely to be used by others than their inhabitants. Additionally, while the typologies adopted in most SAAL layouts in Porto ensures that a large number of front-doors open directly to the exterior, most cases present less than 50% of constituted spaces, creating a combination of traditional street layouts - shared access arteries between several families, often connecting to front-yards which are visually permeable and of transition spaces establishing connections between them.

**Table 9. Depth values of SAAL housing**

	mean depth exterior	functional interface decomposition	no neighbours score	mean depth	maze index	separation index
Antas	4.17	2.69	2.90	2.76	2.55	3.33
S. Victor	4.75	1.83	3.08	2.46	3.11	4.75
Maceda Acácio	4.20	2.95	2.95	2.95	2.23	3.00
Franços	4.36	4.46	3.41	4.23	1.86	2.50
Lapa	4.01	4.29	3.60	4.17	2.73	2.67
Leal	3.23	3.16	2.97	3.07	2.31	3.00
Massarelos	2.33	2.03	2.00	2.09	1.57	2.00
Contumil	3.21	3.72	3.35	3.62	2.91	2.00
Bouça	3.13	3.98	3.29	3.90	2.07	2.00
av.	3.71	3.23	3.06	3.25	2.37	2.81

While inward-facing, SAAL layouts are not self-sufficient, in most cases not presenting any other functions. Instead, this absence of local equipment and infrastructure within the layouts is countered by all but one of SAAL's layouts being located within 500m of existing retain and services, most of them in the whereabouts of schools and sports facilities, and many within 1500m of cultural equipment and important public spaces.

If this creates opportunities for residents to contact with the surrounding city, the absence of collective spaces within the layout may individualize domestic work that was previously shared in the communal water basins and airers of the city centre. Simultaneously, the adoption of single-family typologies with windows and yards that open directly to exterior spaces where



neighbours circulate create the possibility for unintentional co-presence. Notably, it is kitchens that are usually shallow spaces from the exterior - often the only ones, as SAAL apartment schemes display the larger average values of depth, with a mean depth from the exterior of 3.6 steps -, while poorly integrated within the house. As such, domestic work is to be conducted inside the home, while creating the possibility of interacting with passing neighbours. In cases where yards are open to each other, this contact is elevated.

**Table 10. Spatial attributes of domestic interiors in SAAL housing**

Name	TUFA m2	Density m2/r	Integration	Difference factor	Mean depth exterior	functional orientation %
Antas	90.00	30.00	0.66	0.85	3.60	0.31
S. Victor	88.20	22.05	0.79	0.74	3.30	0.27
Maceda	130.30	43.43	0.72	0.87	3.80	0.31
Francos	57.20	14.25	0.67	0.88	4.60	0.31
Lapa	132.00	44.00	0.72	0.82	5.00	0.44
Lapa	113.80	37.93	0.69	0.79	4.20	0.40
Leal	57.30	19.10	0.64	0.90	5.40	0.31
Massarelos	51.30	13.00	0.82	0.74	2.50	0.27
Bouça	85.00	28.33	0.77	0.81	3.30	0.31
av.	89.46	28.01	0.72	0.82	3.97	0.33

The ordering of integration of functional spaces in SAAL layouts is similar to that of other programmes - collective spaces are the most integrated, followed by service areas and then by private spaces - while presenting the largest average difference factor, reflecting highly hierarchical spaces that are uncommon in the other studied apartment schemes. The largest difference is verified between the integration values of living-rooms and kitchens.



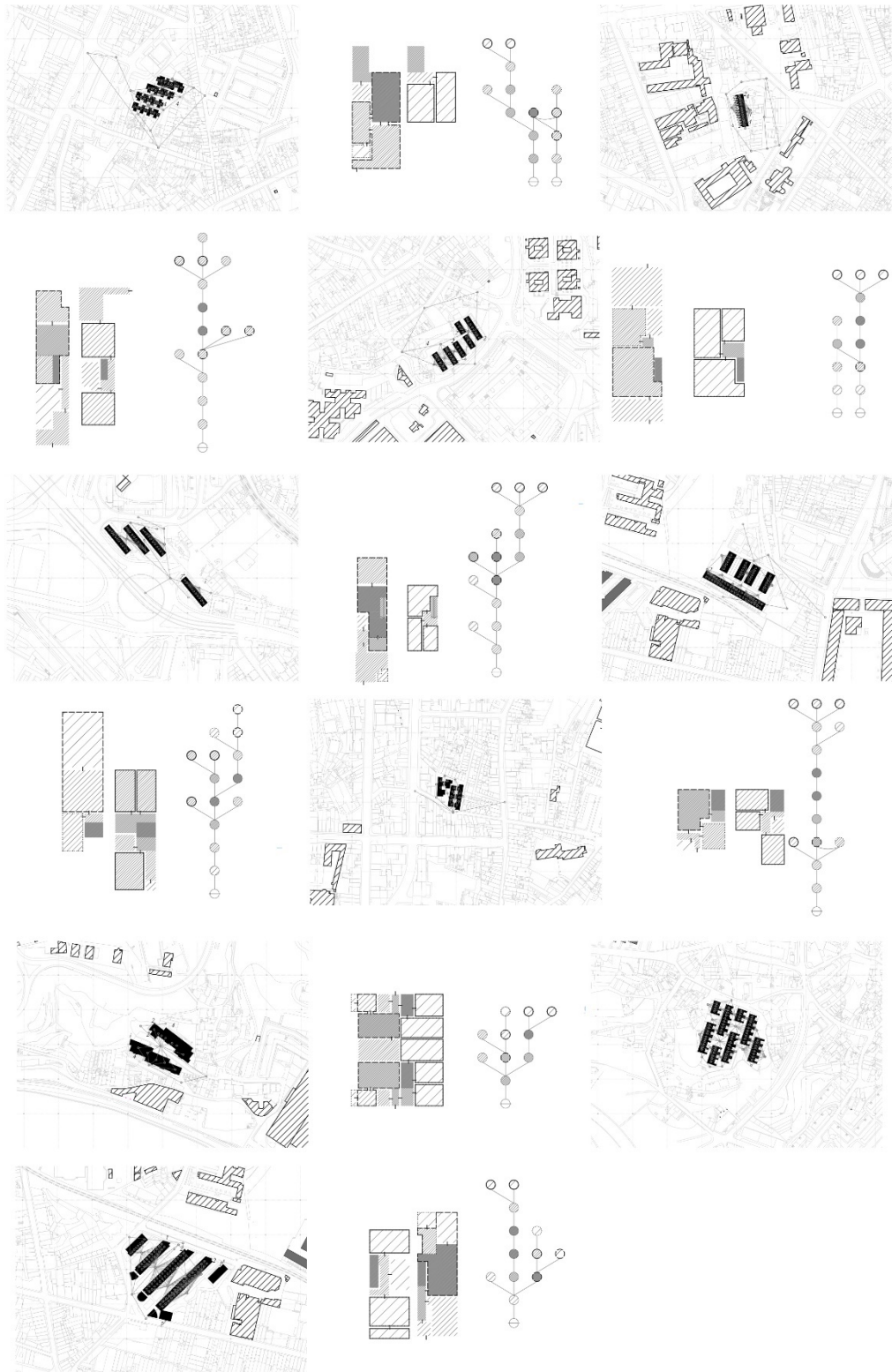


Figure 5. Estate and apartment plans of SAAL housing

### 6.3 Residents' associations, 1977-1982

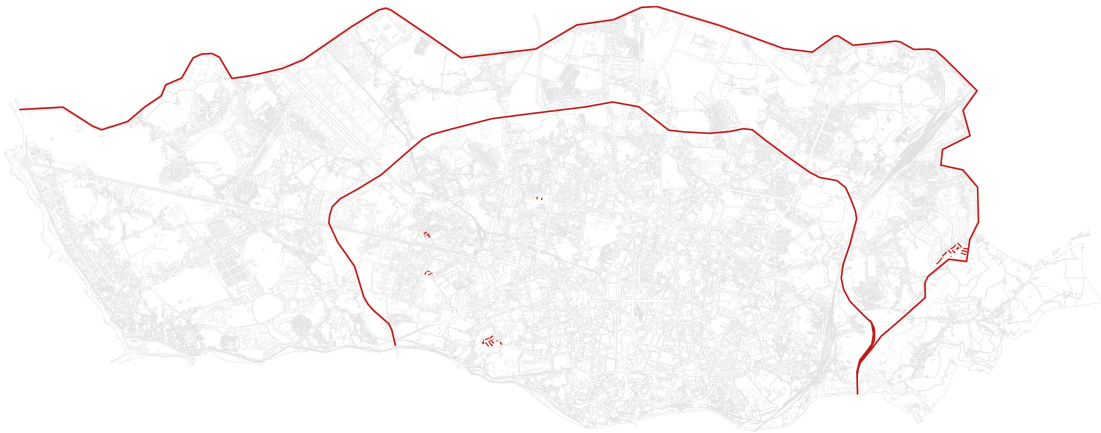


Figure 6. Plan of Porto in 1978 with residents' associations' housing

Table 11. Integration and choice values of housing for residents' associations						
	#houses	area (m <sup>2</sup> )	NaIN5000	NaIN800	NaCH5000	NaCH800
Vilar	144	11000	0.69	0.83	0.73	0.81
Campo Alegre	56	4800	1.00	1.10	1.05	1.00
Carvalhido	32	2900	1.44	1.50	1.36	0.90
Tirares	128	9360	0.61	1.04	0.84	0.91
Pego Negro	96	5680	0.61	0.76	0.87	0.93
Boavista	88	6470	1.02	1.05	0.77	0.87
av.	90.67	6702	0.90	1.05	0.94	0.90

Some residents' associations organised outside of the SAAL or reorganised after the programme was closed in 1976. The housing schemes developed for these communities present a set of identifiable characteristics that are significantly different from those developed by other programmes. The prior organisation of residents seems to have been able to maintain the principle of constructing new housing in the areas where these populations already resided. Located in the proximity of its residents' place of origin, these neighbourhoods either occupy areas inside the inner radial of the city that were fully urbanised at the time when they were built or are near PMCP and SAAL developments in the lesser integrated East of the city. Consequently, these housing estates present significant disparities in their integration values, encompassing both the better and the worse integrated developments that were built after 1974 (figure 6).

	<b>mean depth exterior</b>	<b>funcional interface decomposition</b>	<b>no neighbours score</b>	<b>mean convex depth</b>	<b>maze index</b>	<b>separation index</b>
Vilar	2.03	3.42	2.80	3.04	3.24	1.33
Campo Alegre	1.86	2.61	2.77	2.77	2.04	2.00
Carvalhido	1.60	2.50	2.29	2.12	2.11	2.00
Tirares	1.13	2.25	2.44	2.28	1.04	1.00
Pego Negro	1.56	2.72	2.63	2.48	1.54	1.50
Boavista	2.33	3.70	3.06	3.02	2.11	2.50
av.	1.75	2.87	2.67	2.62	2.01	1.72

Simultaneously, these housing developments are the first to step towards the main city grid. Depth measures are low across cases, in particular those that have to do with the estates' relationship to its surroundings, where larger values are often close to the lower values of SAAL and council layouts (table 12). Buildings are visible from the main surrounding streets and, even though there is an apparent logic of creating an extra step between the street and front doors by turning the buildings' entrances to gardened areas in front of buildings, this stepping back from the street does not seem to have an effective impact on the separation of residents from the exterior city or on strangers' perception of the estate, with maze and separation indexes being relatively low indicating strong accessibility between the street and the interior of the layout.

	<b>TUFA m2</b>	<b>Density m2/r</b>	<b>Integration</b>	<b>Difference factor</b>	<b>Mean depth exterior</b>	<b>functional orientation %</b>
35. Vilar	72.32	18.00	0.90	0.74	3.00	0.25
36. Campo Alegre	70.11	23.37	1.03	0.79	2.50	0.18
37. Carvalhido	72.32	18.00	0.90	0.74	3.00	0.25
38. Tirares	72.32	18.00	0.90	0.74	3.00	0.25
39. Pego Negro	72.32	18.00	0.90	0.74	3.00	0.25
av.	71.88	19.07	0.93	0.75	2.90	0.24

While urban insertion and local articulation with the surroundings indicates housing layouts that were thought for the places where they were located, at the domestic scale, however, existing schemes seem to have been generally adopted, adapted only insofar as it had to do with the estate's morphology and exterior configuration. Only two different apartment schemes were identified in the six analysed estates, which, as is seen in the next section, can be found in other public housing of the time.

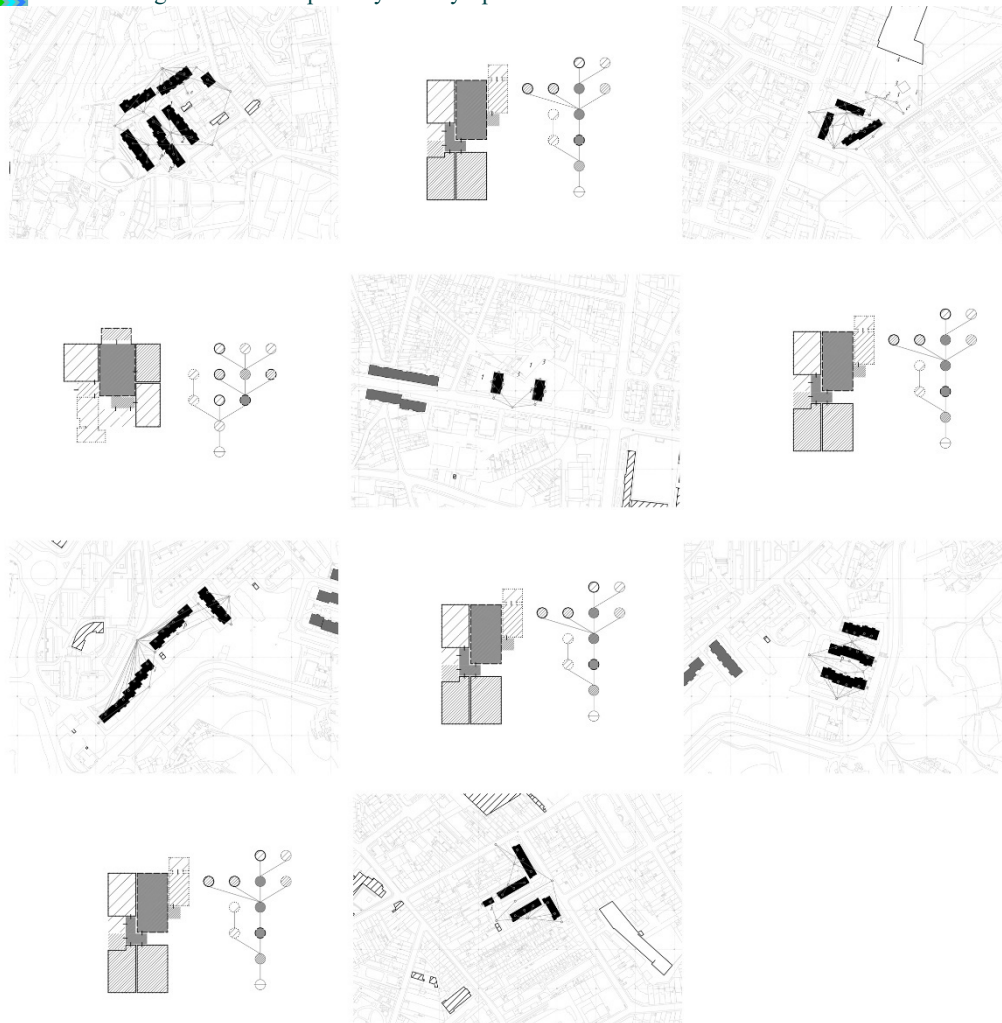


Figure 7. Estate and apartment plan of residents' associations' housing

#### 6.4 State and council housing, 1974-1982

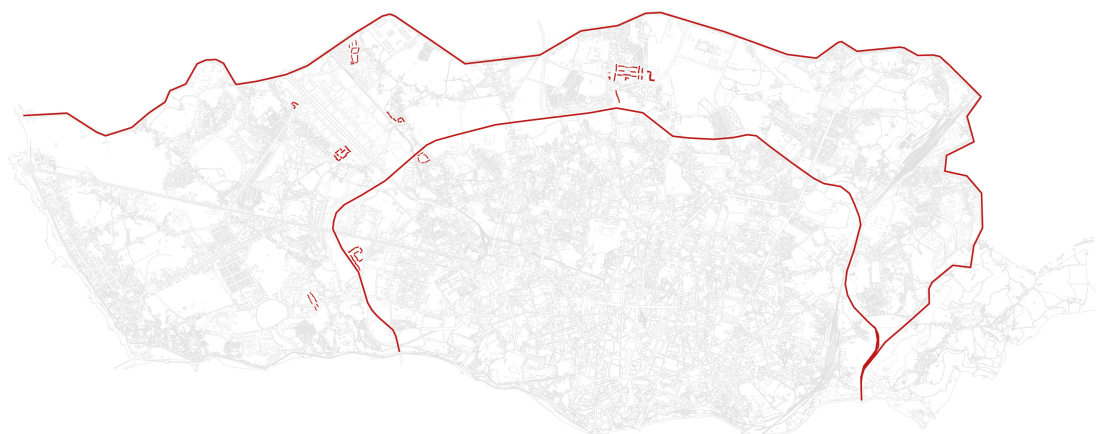


Figure 8. Plan of Porto in 1978 with post-1974 state and council housing



	#houses	area (m <sup>2</sup> )	NaIn5000	NaIn800	NaCH5000	NaCH800
S. Tomé	490	115000	0.88	1.11	1.02	0.86
Viso	545	42875	0.71	0.93	0.76	0.69
Ramalde do Meio	170	21168	0.78	1.07	0.92	0.78
Pereiró	80	10783	0.78	1.07	1.00	0.89
Vilar Formoso	64	2700	1.13	1.21	1.23	1.18
Amial	80	10000	0.84	0.85	0.91	0.83
Lordelo	168	18747	0.79	0.78	0.61	0.62
Paranhos	160	13810	0.68	0.74	0.69	0.74
Ramalde	272	23000	0.70	0.80	0.79	0.82
Central de Francos	256	13660	0.87	0.94	0.67	0.61
Beça Leite	328	46929	0.93	0.90	0.73	0.79
av.	237.55	28970	0.83	0.95	0.85	0.80

Most of state and council developed housing after 1974 is situated in the mostly residential area between the inner and outer radials of the city (figure 8), further out than any other programme presented so far. This does not always translate into low values of integration, as can be seen in table 14, where five estates present above average integration. However, even though this contributes to a mean NaIn (r5000) that is large in relation to previous programmes, several of these layouts are, in fact, located in poorly globally integrated areas of the city, often one or two topological steps away from important, high choice, connections between adjacent municipalities and the city centre.

	mean depth exterior	funcional interface decomposition	no neighbours score	mean convex depth	maze index	separation index
S. Tomé	4.34	4.43	3.73	4.07	2.16	1.75
Viso	2.40	3.33	2.67	2.89	2.12	1.00
Ramalde do Meio	2.78	2.40	2.35	2.38	2.97	2.67
Pereiró	2.00	2.39	2.00	2.24	2.07	2.00
Vilar Formoso	1.00	2.25	2.00	1.97	0.67	1.33
Amial	3.00	2.30	2.70	2.40	1.24	1.50
Lordelo	2.53	2.62	2.64	2.58	2.61	1.67
Paranhos	1.54	3.05	2.50	1.94	2.65	1.75
Ramalde	2.75	3.13	2.47	2.30	2.25	1.50
Central de Francos	2.40	2.81	2.58	2.60	1.80	2.00
Beça Leite	3.97	3.11	3.27	3.10	3.76	2.50



av.	2.61	2.89	2.63	2.59	2.21	1.79
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Turning outward towards the main urban greed, public housing built after 1974 shows a noticeable decrease in all depth values to previous developments: depth values are low even in the largest layouts (table 15). If design mechanisms that create depth from the street are present in all but three of these estates, assuring that there exists a distinction between the main city fabric and the estate as a separate entity, some of these developments also begin to counter the definition of an estate and to abandon some of the characteristics of the hard solution. The most recent of these housing schemes creates street-frontage and does not include collective spaces in its design, appearing not as a clearly defined local domain somewhat separated from the surrounding streets but, countering the syntactic definition of an estate, as an open event “in a larger and distributed system” (Hillier and Hanson, 1984, p.263).

The apparent idea of creating public housing as part of an existing, growing urban system, translated into the disarticulation of housing development from the construction of public services and equipment. If on the one side, this should counter the paradigm of public housing as a separate, independent system within the larger urban space, it also often resulted in the separation of housing from these urban - formerly communitarian - structures. In this sense, activities that had the potential of taking place outside of the house in previous estates do not have dedicated spaces within the surrounding city in post-1974 developments. As such, while these housing schemes are better integrated, both globally and locally than older council estates, fostering extra-spatial relations as well as allowing for local encounter and interaction, they forego the communitarian character of some activities, which are then transposed to either inside the limits of the domestic space or other areas of the city.

This removal of spaces for planned and unplanned clothes hangers, as well as the creation of a space dedicated to clothes-care associated to kitchens in apartment layouts, or the lack of exterior spaces for children to safely play in, may translate a greater domestication of activities traditionally conducted by women.

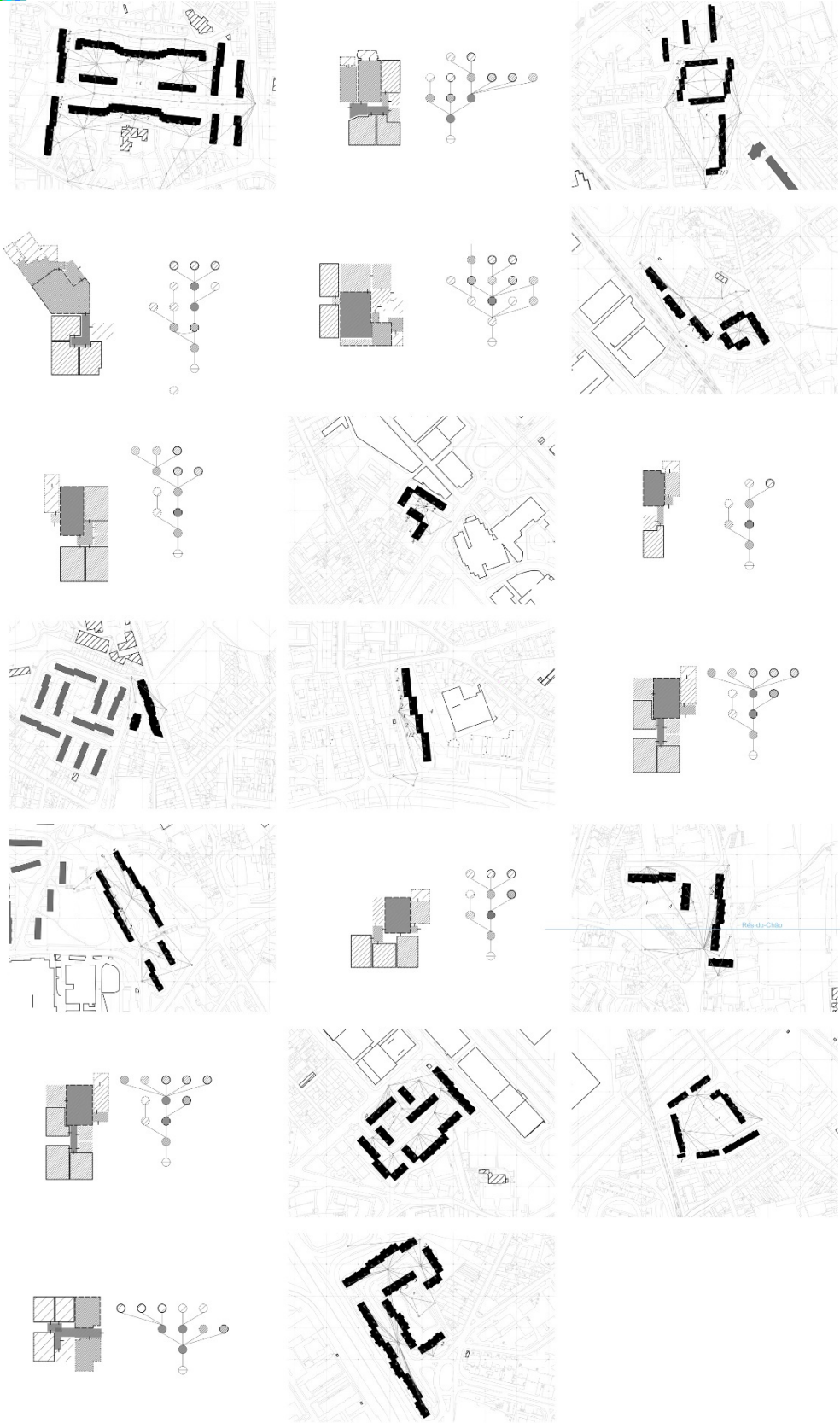


Figure 9. estate and apartment plans of post-1974 state and council housing

Table 16. Spatial attributes of domestic interiors in post-1974 state and council housing						
Name	TUFA m2	Density m2/r	Integration	Difference factor	Mean depth exterior	functional orientation %
S. Tomé*	67.50	16.90	0.91	0.80	2.69	0.23



Viso (A)*	92.70	23.17	1.07	0.71	2.73	0.27
Viso (B)*	94.90	23.70	0.86	0.79	2.77	0.33
Lordelo**	56.75	14.19	0.85	0.60	2.60	0.25
Paranhos	71.50	17.88	0.78	0.49	3.25	0.25
Ramalde do Meio	71.40	17.90	0.70	0.75	2.58	0.37
Pereiró	32.60	16.30	0.73	0.82	2.37	0.25
Central de Francos**	59.70	14.90	1.11	0.71	2.20	0.27
Amial	71.50	17.88	0.78	0.49	3.25	0.25
av.	68.73	18.09	0.87	0.69	2.72	0.27

Within the apartment, kitchens are small and present generally low values of integration (table 16). They are part of a clearly defined services sector, shallow from the exterior but disconnected from the rest of the house. This configuration results from the normalisation of constructive processes, economy of structures and means and defined design regulations that were the basis of state housing massification after 1974. These left little room for experimentation and apartment layouts, often repeated across developments, display less configuration complexity than prior examples. Functional sectors are evidently defined in apartment schemes that present only the fewest number of transition spaces possible for distancing the living-room from the exterior of the apartment and the bedrooms from the living-room (figure 9). This results in high levels of integration for living-rooms and highly functional-oriented layouts.

## 7 CONCLUSION

The research revealed that clear transformations in design paradigms can be found in the studied cases that can be linked to different socio-political periods of Portugal's history and that, in context, appear able to tell us something about shifting views of the city, class and domesticity.

Notably, a trend could be verified towards the abandonment of traditional estate layouts that, while not completely realised even by the most recent programmes, represents a distancing of the clear "hard solution" translated in pre-1974 public housing. It can be seen in the comparative radar chart in figure 10 that this trend was not linear. If post-revolutionary programmes present tendentially lower depth values, the PMCP's average separation index is on par with posterior programmes (meaning that entrances to dwellings or other functional spaces are shallow in the system), and lower than the SAAL's. In fact, if the post-revolutionary tendency is one of approximating public housing estates to the main city grid, creating street-frontage when possible and thus countering their traditional discreteness, SAAL housing appears as a significant exception. Building low density, single-family typologies in the interior of existing lots, SAAL housing lies somewhere in between the soft and hard solutions. Developments present clear outer boundaries and a logic of spatial correspondence, while their hierarchical, non-distributed character is minimised by how the predominance of single-family housing removes one level from its distribution tree. In parallel, likely encounters within the neighbourhood are minimised by the small size of each development, generating disperse, separated communities.





Similarly, a transformation can be verified regarding the location of public housing in the city from the first, purposely segregated council estates, to post-1974 housing. Notably, housing for residents' associations, within or outside the SAAL legal framework, managed, by struggling to maintain communities together in the places where they were rooted, to occupy, in many cases, more central and better integrated parts of the city. Posterior housing by the state or the council, however, went back to building in peripheral areas. However, as they sought connection axes to adjacent cities where new localities could be developed, many of these estates share high values of integration, both locally and globally.

This growing integration of public housing in the urban fabric, articulated with a tendency towards creating closer proximity to the street-frontage, appears to go together with the abandonment of an idea of the estate as a self-sufficient community. Collective spaces and equipment are absent from a large proportion of post-1974 public housing<sup>3</sup>, thus relegating communal activities to other areas of the city for those who can afford them (such as children and youth activities) or to the inside of the house, resulting on the individualisation of household work.

Inside the house, the necessary massification of public housing after the revolution resulted in the affirmation of functional sectors that effectively separated not only bedrooms from common areas, but also the kitchen from the living-room, furthering the spatial segregation of domestic work.

In this way, a domesticity grounded on the breaking up of existing communities in the city centre and the creation of enclosed, segregated neighbourhoods where communal living was still expected and designed for, gave way to a tendential countering of these working-class communities as discrete spaces in the urban environment. Housing developments were pulled to the street and further integrated in a city to which these families should belong and whose equipment, services and infrastructure they should benefit from. In parallel, as views of housing estates as enclosed working-class communities were abandoned, the urgency of mass construction made it so that so were complex domestic configurations that may incentivise a more collective living within the families.

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<sup>3</sup> Housing for residents' associations outside of the SAAL are a notable exception to this trend, as they maintain to this day several community-managed equipment and services.

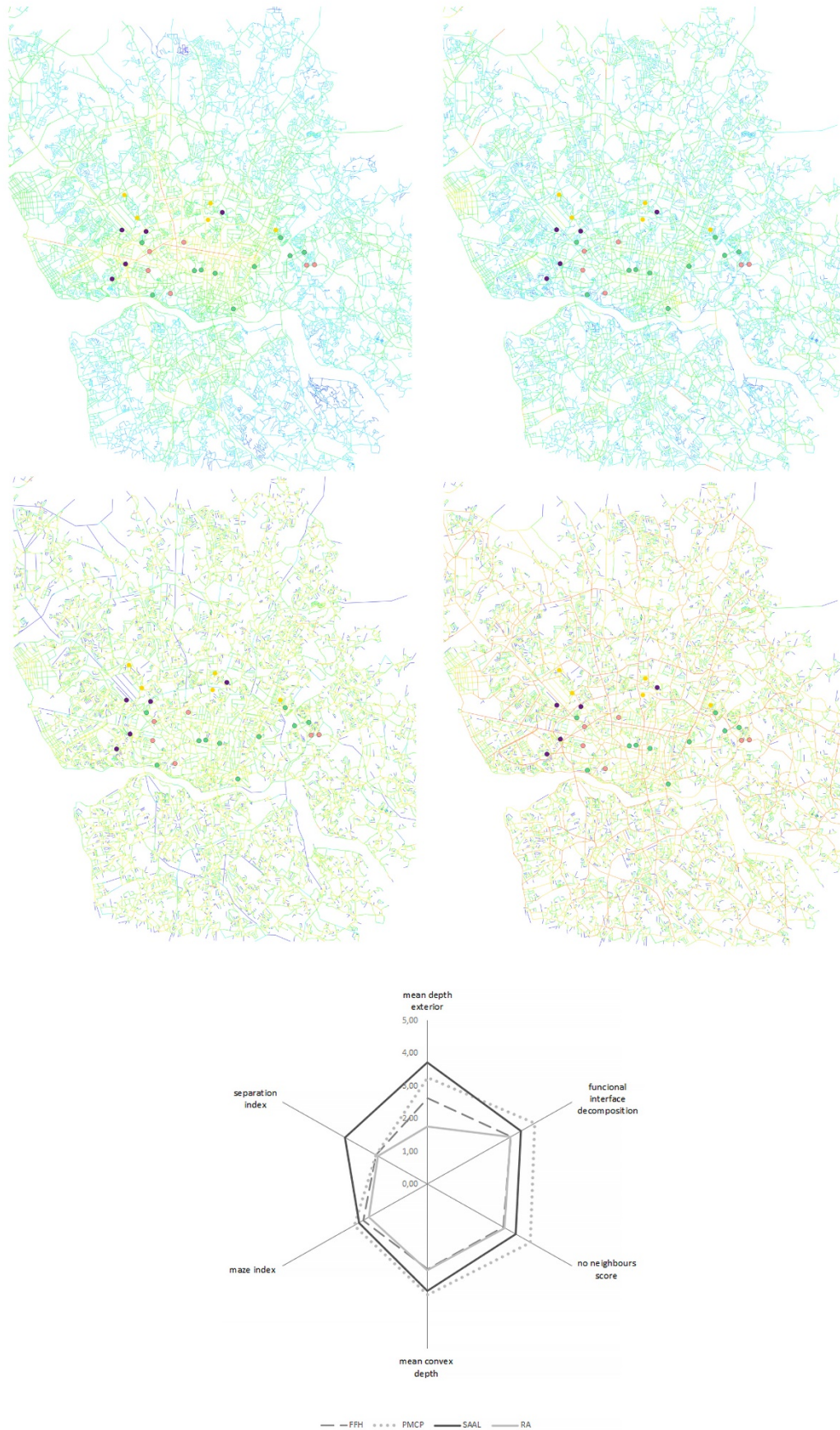


Figure 10. Representation of the results of analysis. Segment maps of Porto (NaIN r5000, NaIN r800, NaCH r5000 and NaCH r800) and radar chart of depth measures for all programmes.



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