

THE MORPHOLOGICAL ANALYSIS AS A SUPPORT FOR URBAN PLANNING.

THE CASE STUDY OF THE GATE OF CASCAIS

EXTENDED ABSTRACT

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ABSTRACT

The morphological analysis of the city has as its main objective the understanding of urban reality through the study of the relationships shown between the all urban elements. This analysis also sees the city as a product of an evolutionary and dynamic process, which ponders the different techniques and socioeconomic realities that over space and time are building and transforming the urban areas.

Taking these ideas, the urban morphology can be understood as a tool in the planning process, that through the relationships among the constructions, road system, the articulation of several centralities and the quality of the landscape, could guide the agents of change in their projective options and urban management.

Taking the Gate of Cascais as a case study, which spotlights a number of problems of articulation with the surrounding urban fabric, this paper, through a morphological study, seeks to be a tool for analysis and diagnosis of urban reality, peering into their problems and potential. This diagnostic process culminates with a SWOT analysis, which condenses all the positive and negative aspects, opportunities and threats, from which defined the central strategic objectives. From here, and using the crucial uncertainties as predominant factors for the Gate of Cascais, were defined four scenarios of intervention whose the major purpose is getting a better morphological relationship between the study area and the surrounding urban tissue.

1. INTRODUCTION

The morphological study of the city has as its central objective the understanding of urban reality, trying to understand the organization and articulation of its various elements and structures in terms of their physical characteristics. This analysis takes into account the urban fabric are the result of an evolutionary process, based on socioeconomic and cultural changes that succeed one another in space and time, so that these same tissues are adapted to the needs of society. Understanding the city as a dynamic space and habitat as human communities, planners, architects, landscape architects and engineers must, while inducing agents of change, seek to have a broad vision of urban reality, particularly on how it works and is organized.

The morphological analysis can be seen as a tools of the planning process, ensuring that the urban environment serves the development needs of communities, without compromising existing values. The study of the physical characteristics of the urban fabric should guide the agents of change in their interventions so that they are carried out accurately and integrated, collaborating with the urban management to understand the designs of the future without compromising the character and functioning of the city. It's about these designs that develop this paper, taking the Gate of Cascais as a case study, seeks to analyze the built environment in order to make a portrait of urban reality, diagnosing their problems and helping to define strategic lines of action.

Therefore, we seek to understand how the study of urban morphology can be a tool for understanding the urban reality, analyzing their characteristics by observing the relationships established among the constructions and the road system, the articulation of several centrality and their impacts on the legibility of the city. Through this analysis, which also includes a historical framework to the urban development of Cascais from the medieval period to the present day, we try to diagnose the problems and the potential of the urban reality of Cascais and their implications in the study area. Thus, it is possible a definition of scenarios of action, where wich

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scenario explores the potential of the space and try to mitigate/ solve problems. Accordingly, this paper it is organized into four periods:

- I. A theoretical account of the methodology developed by Karl Kropf for morphological analysis of the city;
- II. The morphological analysis of Cascais, considering the characteristics of the place and the urban evolution for apprehending their specificities;
- III. A Diagnostic phase of urban reality, exploring their potential and point out the existing problems in the Gate of Cascais through a SWOT analysis, from which will be defined the main strategic lines;
- IV. The definition of scenarios, drawn up from the main strategic lines.

2. THE URBAN MORPHOLOGY

The urban morphology is, according to Moudon (1997, p. 3), "(...) *the study of the city as a human habitat.*" This thought carries the idea that the form of the city should not just be seen strictly in the physical and material field of architecture, landscape architecture and urbanism, but also as a result of the activities and support, human relationships and experiences that shape and construct a function their aspirations. This idea comes from several reflections that marked the second half of the twentieth century, including Levi-Strauss, who by declaring that "*the city is the most complex of human inventions*" (cit. Moudon, 1997, p. 3), exposes this is an hosts of a vast and complex network of ideas, policies and relationships that overlap and add consecutively, without which it is impossible to understand the its essence.

This vision of urban morphology is the result of an evolutionary process that has developed since the nineteenth century, with different disciplinary approaches in divers cultural contexts. From archeology to geography, from architecture to the socioeconomic aspects who shape the societies, the approach to urban form should be viewed as the dissection of the processes of addition, juxtaposition and replacement occurring in the city over time. Therefore, it is not difficult to understand the fact that this is not an exact science, and is subject to a range of interpretations whose approach to the object of study is marked by diverse currents of thought and methodological frameworks.

Several authors have also developed over time morphological analyzes. Seeing the city as a landscape is an essential aspect, because it is a dynamic place, a repository of memories and past actions; is also the materialization of formal and symbolic interrelationships, composed of units whose coherence and uniqueness comprise a reference to a context (Cauquelin, 2008).

Due to the complexity of these relationships, the definition of methodological frameworks using the hierarchy and layout of the elements of the city proves to be an utilitarian instrument. They allow a greater capacity for abstraction and simplification of reality, bringing down the entropy and the complexity of the systems, making information more operative for the morphological analysis (Alfaiate, 2000).

In this way, it is important understanding the thinking about the city form, in order to achieve a better way for a coherent analysis of the goals of this paper.

2.1 THE METHODOLOGICAL FRAMEWORK OF KARL KROPF

In his PhD – *The Definition of Built Form in Urban Morphology* (1993) –, Kropf aimed to build a theoretical foundation for the urban form analysis, developing a methodological framework whose concepts could easily be applied to architectural projects, urban planning and design. Performing a comparative analysis of methodological approaches and concepts developed by M.G.R. Conzen and G. Caniggia, Kropf established a consistent and repeatable basis of hierarchical subdivisions that support the morphological analysis of the space through a new taxonomy (Osmond, 2010).

In his methodology, Kropf understands the conceptions of space, time and energy as basic aspects that contribute for a fuller description and understanding of the world and should be viewed in a logic of codependency in the study of urban phenomena.

However, Kropf focuses primarily on aspects of spatial order because they have a greater relevance in the morphological analysis of the city (Crespo, 2013).

On the spatial viewpoint, in his subdivision of urban form, Kropf establishes a differentiation between hierarchical levels like Caniggia did, based in relationships part-to-part and part-to-whole among all urban elements. This establishes a logical connection between different hierarchical levels, determining perspectival synthesis of urban morphology from the general to the particular (Osmond, 2010).

Observing Table 1, we can see that in his taxonomy, Kropf subdivides the urban form in nine levels of resolution, whose Latin names seek to rule out any ambiguities of language around the built elements observed, noting similarities with the framework developed by Caniggia, which shows two scales of analysis: the building and the city.

Table 1 > Taxonomy of urban developed by Kropf and its correlations with Conzen and Caniggia

	Kropf	M.G.R. Conzen	Caniggia
	<i>Taxon</i>	Townscape	Copresence
Specificity level	<i>Materia</i> Construction materials		Materials
	<i>Statio</i> Structural elements		Structures
	<i>Tectum</i> Rooms		Cells
	<i>Aedes</i> Buildings		Buildings
	<i>Fines</i> Combinations of buildings and open spaces, plots / parcels	City plan	
	<i>Sertum</i> Recognizable combinations of parcels (plot series, blocks) and the road system		Urban fabric
	<i>Textus</i> Combinations of blocks and roads, conforming different urban fabrics	Plan units	
	<i>Sedes</i> Combinations of urban fabric, shaping distinct urban areas	Plan divisions, Fringe belt	Regions and organisms
	<i>Complures</i> Combinations of elements of <i>Sedes</i> level; polycentric urban areas		

For the Gate of Cascais, the *taxa* most relevant are the *Sertum* and *Textus*. The *taxon Sertum* analyzes the relationships between the different plots, when combined, define different kinds of blocks. The *taxon Textus* makes reference to how combinations of plots and the road system network make up different kinds of urban fabric, based on their size and spatial organization. Thus each type of configuration results in a specific urban tissue, assuming here clear parallels with the tissues of Caniggia and plan units of M.R.G. Conzen.

3. CASCAIS: AN OVERVIEW OF ITS URBAN CONTEXT

During the fourteenth century Cascais had a strategic importance, associated with the surveillance of Tagus bar, fishing activities and as a small harbor. In this period, Cascais grows up to the outside of its castle walls to a suburb who became known as *Vila Nova* (Henriques, 2014). The *Vila Nova* was developed to the north, with an orthogonal structure adjusted to the morphology of the terrain, where the main streets follow the contours, featuring up the urban fabric to have some flexibility. Near the Praia da Ribeira there was the Praça Nova, one *rossio* corresponding to the actual Praça 5 Outubro, characterized to be the center of the medieval Cascais, where ended the major routes and was built the City Hall (Quintão, 2011).

In the sixteenth century the fabric of Vila Nova establishes itself and developed a new the urban core between the left bank of the Ribeira das Vinhas and Praia da Rainha. This east urban nucleus features an urban fabric adapted to the terrain and coastline, centered on the Largo da Misericórdia (SIPA, 2011).

In the nineteenth century and after the earthquake, many buildings had not yet been rebuilt. Having the village maintained its morphological structure, however, some changes occurred: the ancient castle originated a new urban area with an orthogonal structure consisting of regular and small blocks.

In the 1860s, Cascais became a seaside resort for the aristocracy and bourgeoisie, and the third residence of the royal family, forming an aulic triangle with Sintra and Lisbon. Thus, Cascais had a major economic and urban growth, with emphasis on the design and construction of villegiature architecture, especially along the coastline, taking advantage of the visual relationships with the sea.

Understanding the tourism potential of the region of Cascais, in the 1930s the government sought a better use of land for urbanization and tourist development associated with the construction of Marginal Avenue, between Lisbon and Cascais, developing an integrated plan with regional scale. Thus arises the *Plano de Urbanização da Costa do Sol* (PUCS), a master plan created first by Agache and later by De Gröer, establishing the general rules of the organization and management of soil between Lisbon and Cascais.

To Cascais, the PUCS proposed the zoning as a base for a functional logic of the place with a dual structure: the historic core as centrality, high density, with commerce and services; and residential areas based on the concept of Garden City. Although the PUCS was approved in 1948 and revised in 1959, was not completed in full, noting that most of the urban development came from changes in PUCS, converting rural soil into urban soil and favoring medium and high densities (Lobo, 2005). In 1994 the PUCS is revoked when developing Master Plano of Cascais (PDM), which established a framework for the whole of the municipality area.

4. MORPHOLOGICAL ANALYSIS OF CASCAIS

In order to perform the morphological study of the Gate of Cascais using the methodology developed by Kropf, it was necessary to enclose an area of analysis that not only comprehend the study area itself, but also includes the surrounding urban fabric, to a comprehensive and integrated reading of the space.

4.1 THE TAXON SERTUM

The definition of the study area took into account the classification of the space that creates a sense of identity that allows apprehending homogeneity and the singularities of urban reality; these concepts are crucial for a correct interpretation of the form of space (Alfaiate, 2000).

According to the methodology developed by Kropf, the *taxon Sertum* is the level of resolution that focuses on the relationships between the various plots - lots and blocks - to the road network (Kropf, 2005). There is a similarity with M.G.R. Conzen plan units, these combinations define homogeneous areas that take into account the specific characteristics of urban elements that comprise them, constituting different morphological-type units (UTM).



Figure 1 > The historic evolution of the study area | Cascais

According to Cohen (1999), the city, and more specifically its historic centers, are formed by a complex web of built spaces and circulation (buildings, streets, etc.) with different temporal and cultural backgrounds, which contribute for a definition of different sediment strata. This regard, the historical and urban environment of the place gives us clues to the reading and understanding of different urban forms, expressed in many UTMs with their specific characteristics .

Thus, it is not difficult to understand the fact that the centers of urban areas, older, being exposed to different morphological changes, by virtue of its successive adaptation to new ways of living and use of space, resulting in a greater typological heterogeneity in each UTM. In contrast, in areas of recent urban expansion, its growth is the result of a process of successive additions to the existing urban core, defining UTMs with greater homogeneity in terms of their types.

For the resolution level of the *taxon Sertum*, can be seen that the study area includes a large number of UTMs. This is explained by the physiographic features of the place, which associated with the processes of socio-economic and cultural development of the city, led to a greater typological diversity of urban space.

This typological diversity provides a high degree of integration of different UTMs, whose articulation through a well structured and hierarchical road network, led to the delineation of four units of urban fabric that constitute the *taxon Textus*. This morphological heterogeneity is also observed on architectural characteristics, highlighting the role that architecture of villegiature and other structures play on identity affirmation of the coast line, operating as points of focalization to the eyes which contribute to the legibility of the Cascais Bay and space.



Figure 2) *Taxon Sertum* | UTMs

4.2 THE TAXON TEXTUS

The urban fabric is a concept that has gained prominence with Muratori and Panerai, understood as a metaphorical term that expresses the reality of the city built at the level of the relationships existing between their various compositional elements (Choay & Merlin, 1988). For this concept contributes various aspects of urban reality, as physiography, the cadastral division and the relationship between the built environment and not constructed, which together, express the identity and diversity of the urban fabric.

Considering the typological heterogeneity inherent to the city, the reading of the urban fabric is processed by analyzing the configuration of its various elements - inherently, several of the UTMs - whose articulation allows us to identify areas with some homogeneity or distinctive features.

It is in this perspective that handles the delineation of the various types of urban fabric, which, according to the methodology developed by Kropf (1993), define the *taxon Textus*. Having defined *a priori* various UTMs, their combination allowed the definition of the different urban fabric by identifying common features. In this direction, for the case study of Cascais, the articulation of 15 UTMs identified to allowt he demarcation of four units urban fabric

Analyzing Table 2, it is possible observing that the index of soil occupation is quite similar in the urban fabric units 1, 2 and 4. However the values for the Index of land use increase as a result of a larger number of floors, which also justifies a higher housing density. The exception is given by the urban fabric unit 3, consisting mostly



Figure 3) *Taxon Textus* | Urban fabric units

of detached houses, which makes the values of their relatively lower than the indices for the other urban fabric units.

Table 2 } Index and parameters of the Urban Fabric | *taxon Textus*

Tecido urbano	Área (m ²)	Iu	Io	Pm	F	Pop.	D (hab/ha)	Dhab (F/ha)
1	660 548	0,8	30%	2	1133	1256	19	17
2	114 867	1,0	29%	3	359	508	44	31
3	468 730	0,6	23%	2	960	1346	29	20
4	62 470	1,2	31%	4	0	0	–	–

5. DIAGNOSIS

Forming the main entrance in the village, the Gate of Cascais is composed by a set of urban elements with a seemingly disconnected configuration based on a functionalist view of space. This view is expressed in an image set that does not seek to mitigate the consequences of the great barrier effect of the Avenida Marginal and the railway, where motor traffic, height differences and protective barriers break completely the possibility of formalizing links more consistent across the different urban elements. Also the relationships with the surrounding urban fabric units develops only at the traffic level, where the buildings (except the station) did not show a logical integration with adjacent UTMs, resulting in inconsistency not only aesthetic but also in aspects relating to urban indices and parameters.

Consequently, it was developed a SWOT analysis for the Gate of Cascais, trying to digest the main problems and potential for the development of strategic lines of action.

5.1 THE SWOT ANALYSIS

Strengths

- > The scenic value of the Cascais bay, through a good integration of the urban fabric with the sea;
- > The various urban fabric units identified in the subject region, though dissimilar in terms of their morphological characteristics, are well made, having a human scale and holding back a good legibility of the urban region where the structural road network operates as the primary element of articulation;
- > The structuring road network anchored on Praça Francisco Sá Carneiro and the Gate of Cascais works like the structuring element of the village, articulating itself with the primary axes of a council links;
- > The Interface of Cascais as the most important of the municipality, with a catchment area covering its western half , which addition to presenting well articulated with the main centralities of the city, establishes connections with neighboring municipalities;

Weaknesses

- > Spatial asymmetry in the socioeconomic distribution of the population, encouraged by PUCS;
- > The barrier effect formed by the Avenida Marginal and the railway, which break the continuity of urban space, contribute to isolation from the beaches of the Conception and the Duchess, marking a significant boundary between the historic core and areas of commercial character with residential space surrounding the Avenida de Sintra;
- > The purely functionalist organization of the Gate of Cascais, based mainly on road and rail traffic, with a absence of an image of the whole, neither verifying a smooth transition between road character of the Avenida Marginal to the urban character of the city;

Opportunities

- › Cascais as a tourist hub capable of attracting flows of regional scale;
- › The PETI - Strategic Transport and Infrastructure Plan - as a tool to modernize the railway of Cascais, through investment in its safety, replacing trains, interventions in the stations and the connections to the Waist Line by Alcantara node;
- › The construction of TLS - Transport Light Surface - as a potential answer to improve mobility at the level of relations between the seashore and the hinterland;

Threats

- › The loss of the urban character of residential areas, given by its mono-functionalism, accentuate the car use for journeys (increasing motorization rate in the municipality);
- › The economic and financial crisis that creates limitations to finance real estate and investment on public works;

5.2 THE STRATEGIC OBJECTIVES FOR AN INTERVENTION IN THE GATE OF CASCAIS

After the diagnosis stage, it is possible identifying the main problems inherent in the Gate of Cascais. For this it is important to have a better integration of the Gate of Cascais with the surrounding urban fabric, in which possible future interventions contribute to a better urban environment, performed in line with the various existing morphological features in the area. In this sense, the main strategic objectives for future intervention in the Gate of Cascais should:

- › Mitigate the barrier effect between the residential areas and the beaches and of Duquesa and Conceição, caused by the design of the railway and the Avenida Marginal, exploring potential points of contact and promoting a better environment of this infrastructure in the surrounding urban fabric;
- › Defining a smooth transition between the road character of the Avenida Marginal and the urban space, looking for a better qualifying entrance of the city associated with an image of whole and exploring possible links with the main architectural elements, centralities and equipment through main axes of the urban space;

As part of strategic planning, some of the threats and opportunities should be seen as critical uncertainties, ie, it is permissible the possibility of the occurrence, though no one knows its probability (Gonçalves, 2014). In this way, these uncertainties are understood as crucial driving to the scenario building for the urban development of the Gate of Cascais, constituting the axes where the various scenarios will be built.

In sight of the conceptual aspects of the definition of scenarios and the strategic ends of an intervention in the Gate of Cascais, four scenarios were developed seeking a visual modality for the study area in this paper.

The four scenarios presented attempt to define a set of relationships between the various urban elements, trying to mitigate the negative situations present and explore their potential. Due to the large impact that the Cascais railway shows in this area of the city, which results in a paradox of a barrier with a large gravitational effect, the four scenarios understand the railway station as the main anchor element, whose interventions will necessarily have a greater impact on the urban living image of the Gate of Cascais.

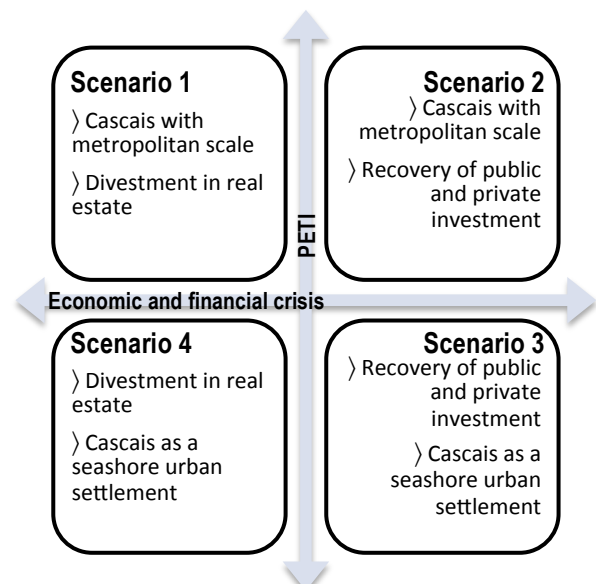


Figure 4 › Matrix for the definition of scenarios, combining two crucial uncertainties

Table 3 } The main projectual interventions of the four scenarios

<p>Scenario 1 } A new mall for Cascais Estimated cost: 3,4 M€²</p> <ul style="list-style-type: none"> > Railway modernization; > Construction of the north wing of the station; > The construction of the node of Alcantara and increase the of the influence area of the railway; > Reset the profile and arborization of the main roads using the railway public domain; > Morphological harmonization of some buildings with the subtraction of floors; > The opening and creation of visual links between Alameda Duquesa de Palmela and the Cascais Bay; > Construction of detached houses on unbuilt plots; 	<p>Scenario 2 } A new Gate for Cascais Estimated cost: 13,2 M€</p> <ul style="list-style-type: none"> > Railway modernization and Subtraction of two platforms at the station; > Construction of the station coverage and the north and south wings; > The construction of the node of Alcantara and increase the of the influence area of the railway; > Unevenness of the railroad and Avenida Marginal; > Building links and green spaces in coverage over the railroad; > Reset the profile and arborization of the main roads using the railway public domain; > Expropriation of the Jumbo hypermarket, urbanizing up its plot with detached houses; > Morphological harmonization of some buildings with the subtraction of floors; > The opening and creation of visual links between Alameda Duquesa de Palmela and the Cascais Bay; > Construction of detached houses on unbuilt plots;
<p>Scenario 4 } A modern railway Estimated cost: 2,4 M€</p> <ul style="list-style-type: none"> > Railway modernization; > Building links and green spaces in coverage over the railroad; > Reset the profile and arborization of the main roads using the railway public domain; > Morphological harmonization of some buildings with the subtraction of floors; > The opening and creation of visual links between Alameda Duquesa de Palmela and the Cascais Bay; > Construction of detached houses on unbuilt plots; 	<p>Scenario 3 } A new railroad station for Cascais Estimated cost: 5,9 M€</p> <ul style="list-style-type: none"> > Railway modernization; > Subtraction of two platforms at the station; > Construction of the north and south wings of the station; > Unevenness of the railroad and Avenida Marginal; > Building links and green spaces in coverage over the railroad; > Reset the profile and arborization of the main roads using the railway public domain; > Morphological harmonization of some buildings with the subtraction of floors; > The opening and creation of visual links between Alameda Duquesa de Palmela and the Cascais Bay; > Construction of detached houses on unbuilt plots;

6. CONCLUSION

Taking as a case study the Gate of Cascais, the goal of this paper stood in the way how the study of urban morphology can be understood as a tool in the urban planning process. For this, it was necessary to understand the essence of the morphological analysis of the city, as evolved in space and time, to philosophical and methodological level, exploring the concepts and principles developed by several authors who have dedicated themselves to this theme.

From the German and English historical-geographical approach, through vision of the city as architecture developed by the French and Italian schools, and culminating in the integrative methodologies by Kropf and Osmond, we observed that the study of urban morphology is an evolutionary process that has explored new ways and approaches of understanding the city. To this end, the historical analysis of the growth and development of cities proves to be a a determinant factor in the assimilation of the principles governing the realization of urban form, mirroring the events, concepts and techniques that build and settle the city over time. In the case study, Cascais, its historical and urban framework enabled the perception of guiding principles as to how the village grew, developed and transformed, allowing a more rational reading of the various types of relationships that are established between the various urban elements, and those with the landscape.

² M€ - Millions of euros;

Applying the methodology developed by Karl Kropf, which resulted in the delineation of different morphological-type and urban fabric units, we found that Cascais is composed by a mosaic of urban circumstances that mirror the evolutionary dynamics of the city. This morphological diversity has a direct impact on the organization and on the processes of reading the space, translated into different urban parameters and indices that have special relevance to the planning level.

This whole process of morphological analysis, centered in the historic nucleus of Cascais and in most areas of urban growth originated by the PUCS, proved be a gain on understanding the urban form of the Gate of Cascais, revealing the main problems and dysfunctions of this area of the city, peering into its relations with the surrounding urban fabric. Thus, the study of urban form has enabled progress to a SWOT analysis, which condensed the main characteristics of the urban fabric, seen as fundamental to the development of operating strategies in urban planning, based on two key uncertainties who allowed the composition of four scenarios of operation.

In summary, this paper, to perform a morphological analysis of Cascais, sought a better understanding of urban reality of this city. Through the perception of the intrinsic characteristics of the urban fabric, it was thus possible to develop strategic planning actions, which should guide the main agents of change in their urban intervention options.

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