

Article

From Reading to Design of the “[entra]mar”: The Role of Urban Morphology in Architectural Pedagogy and Design

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Abstract: This article presents the pedagogical process of reading and designing in the design studio course in the first semester of the fourth year in Architecture and Urbanism (2020–2021) held at the Lisbon School of Architecture of the Universidade de Lisboa. The research by design results are inscribed in the Embryo Project “[entra]mar Sea Intertwined City. Interpretation and Design of Portuguese Seashore Streets Vulnerable to Sea Level Rise”, funded by the FCT exploratory projects through CIAUD—Research Center in Architecture, Urbanism and Design at the Lisbon School of Architecture, Universidade de Lisboa (Portugal). The aim of this article is to demonstrate the usefulness of urban morphology in the reading and design process of an urban seafront vulnerable to extreme weather events. The approach to the “Sesimbra [entra]mar” in a pedagogical context confirms morphological interpretation as a key instrument for the formation of students and is consequently valuable for the practice of architecture and urbanism.

Keywords: urban morphology; elementary decomposition; emotional reconstruction; material urbanity; architectural pedagogy; public space



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1. Introduction

Urban morphology, in recent decades, has returned to the center of scientific debate regarding its application in urban transformation [1]. As [2] wrote, the study of urban form provides tools to intervene in the process of urban transformation, from planning to the design of public space. Indeed, [3] in his text *Urban morphology as a basis for urban design: The project for the Isola dei Cantieri in Chioggia*, wrote that the tools of urban morphology and building typology constitute a valuable basis for urban design projects.

Nevertheless, [4] reported that urban morphology is currently the subject of theoretical and scientific studies but rarely the subject of architectural and urban planning practices. However, a rigorous approach to the analysis and interpretation of urban form from an evolutionary perspective is nowadays relevant for interpreting the future of urban transformation more than ever [5].

The aim of this article is to demonstrate how urban morphology has been used as an operative methodological instrument in the pedagogy of architecture and urbanism at the Faculty of Architecture, University of Lisbon. We understand that in the different cycles of study, the formation aims and its usefulness tackle distinct challenges. In the first cycle, emphasis should be placed on providing the theoretical and instrumental bases for the interpretation and decoding of the urban form, thus allowing the second cycle of studies to explore the translation of the interpretation methodology of the urban form into innovative design proposals based on the codes of the existent urban form.

Therefore, at the beginning of the second cycle integrated master’s course, the main objective of teaching has been to enhance the students’ theoretical and empirical skills to

decode the underlying forms of a complex urban landscape within a context of contemporary challenges and provide a solid grounding for the design practice of a transformation of the city in continuity with the principles revealed by the previous interpretation.

According to urban morphology theory, the city may be addressed by studying its form and it is considered that a decomposed approach to the shape of the city allows reducing its complexity when we aim to interpret it. An example is the Urbanism course founded by Manuel de Solà-Morales, in which the objective was, through the implementation of urban morphology methodologies, the study of the city and its evolutionary and transformative phases, as an interpretative and operative framework for architectural and urban design [6,7]. Indeed, the focal point of morphological research is still an attempt to gain an understanding of the city as an artifact [8].

The development of the design studio was inscribed in the research project “MAR—As Marginais Atlânticas Portuguesas. *Leitura interpretativa e Projecto em contexto de Alterações Climáticas*./The Portuguese Atlantic Seashore Streets. *Interpretative reading and Design in Climate Change context*”, and the Embryo Project “[entra]mar. *Sea intertwined city. Interpretation and Design of Portuguese Seashore Streets vulnerable to sea level rise*”, funded by FCT exploratory projects through CIAUD—Research Center in Architecture, Urbanism and Design at the Lisbon School of Architecture, Universidade de Lisboa (Portugal).

The research developed from previous participation in international conferences and seminars, publication of articles and applications for FCT grants (*Fundação para a Ciência e a Tecnologia*), Portugal. The outcomes of the 2020/21 fourth-year Project Laboratory units, addressing the first pilot case study, Sesimbra, perfected the scope of the research, which was carried out in parallel through post-grad research with the second cycle master’s programme design studio labs and final master projects, with the publication of scientific articles and the writing of doctoral theses.

The article presents the results achieved in the first semester of the fourth year of the design studio (2020–2021) held at the Lisbon School of Architecture of the Universidade de Lisboa. The chosen pedagogical approach explores the “emotional reconstruction” [9] of the urban seafront of Sesimbra—a small fishing and touristic town on the Portuguese Atlantic coast—vulnerable to the effects of rising sea levels and extreme weather events. Students were challenged to design an urban strategy for the adaptation and transformation of the port and seafront, combining several interpretative layers, including the mean sea level rise scenario in an extreme weather event context, topography, urban layout, plot structure, built fabric, singular buildings and singular urban spaces.

In the definition of interpretative layers for reading and designing the coastal landscape adjacent to the water body, we consider that it was necessary to introduce a new lens of analysis: “[entra]mar”.

The “[entra]mar” is aimed as a neologism of a formal and compositional concept. The neologism is composed of *entra* (a Portuguese form of the verb that in English means ‘get in’ or ‘enter’, the idea of movement towards the inside), *trama* (a Portuguese word that in English means ‘grid’) and *mar* (a Portuguese word that in English means ‘sea’). In conclusion, the neologism is defined through the verb ‘to weave’ and the object complements ‘grid’ and ‘sea’, thus aiming to convey the image of movement, of the interweaving of relations between the city, and its characteristics of urban form and the sea: the urban form intertwined with the sea.

The “[entra]mar” is therefore a research project that has research by design as its method of approach to address scientific research hypotheses and objectives through the use of interpretative drawing methodology present in urban morphology discipline. Ref. [10] concludes his article by writing that the time has come for urban morphology to be incorporated into design studio pedagogy, encouraging students to apply morphological methods in real-world contexts.

In conclusion, the article aims to demonstrate the pedagogical role of urban morphology in the transformation and adaptation of coastal cities, through the pilot case of

Sesimbra (a Portuguese coast town), in the context of the rise in mean sea level caused by climate change.

Therefore, we consider that the solutions, defined through the academic exercise, in the context of the Embryo Research Project “[*entra*]mar”, can influence, through the dissemination of results, the methodology for the drafting of urban plans and architectural designs by different actors, and are effective in meeting the objectives defined by the United Nations 2030 Agenda [11] and the development of Integrated Coastal Zone Management (ICZM) [12]. For example, the further definition of national adaptation plans and actions are effective in protecting people and tangible and intangible assets (EC 11.5) from the effects of extreme climate events (EC 11.1; EC 13.1) [11].

2. Urban Morphology as a Method and Adaptation to Sea-Level Rise as an Objective, in the Context of Architectural Pedagogy

Faced with the negative externalities that climate change brings to the urban form, it has become necessary in the contemporary world to combine a dual and synchronous approach in architectural pedagogy practice, where urban morphology is the method [13] and adaptation to climate change is the objective.

2.1. On the Role of Urban Morphology (UM) in Architectural Pedagogy

In Ref. [8] at the opening of his text *The teaching of urban morphogenesis* (1986), he wrote: “I have made an attempt here to outline some of the reasons why I felt it important to develop a course entitled The evolution of Urban Form—and to discuss some of the themes around which a course in urban morphogenesis can be developed”. Furthermore, he quoted part of a text by James Vance from 1977—*This Scene of Man: The Role and Structure of the City in Western Civilization* (New York: Harper’s College Press) extracted from the text—“The condition of an unstructured beginning, a tabula rasa, is unusual indeed in human history, and pretending otherwise presents more than a little hazard”, concluding and affirming that many of our students complete their university training without gaining a proper appreciation of this. Ref. [14] wrote that pedagogical teaching practices often use conventional notions of urban space. Although the principles of modernism legitimized and universalized this approach in urban design pedagogy thirty years ago, in the last fifteen years or so, replicating solutions to contemporary urban problems under similar conditions has become increasingly problematic [14]. Moreover, Refs. [15,16] wrote that the study of urban morphology does not occupy a central role in the design disciplines in schools of architecture nowadays, contrary to what occurred during the second half of the 20th century. For [10], there are many causes: the economic reality that does not allow the development of a reflexive urban practice; practitioners who have not been exposed to the theory or methods of urban morphology during their training experience; and, finally, design faculties that rarely teach morphological methods as part of a pre-planning, pre-design urban transformation process. Furthermore, Ref. [17] highlighted that there was a lack of international scientific publications in the field of urban morphology that would allow the sharing of the discipline’s pedagogical theoretical knowledge and its application in academic courses.

Ref. [18] inquires about the correlation between urban morphology as research of the urban landscape formal characteristics and urban design discipline. An investigation that, rather than aiming to find an unambiguous and definitive solution, seeks to lay the foundations for broadening the debate on the operability of urban morphology. Refs. [19,20] wrote—as also reported by [21]—that the understanding of socio-political and socio-cultural contexts on a macroscale is necessary, but by no means sufficient, for drawing up urban plans and projects, as the lack or poor spatial understanding, through urban morphology, can lead to wrong design interventions. Ref. [22] wrote in 1997 that for architects, morphological analysis is still a difficult mental exercise because few are willing to dedicate time to collecting data on the urban landscape.

Refs. [20,23] also suggest that the overcoming of pedagogical limitations found in urban design education requires the breaking down of boundaries between design disciplines. Moreover, Ref. [14] states that the teaching method based on learning-by-doing allows students to independently draw analysis and project space through a problem-solving approach. If urban morphology is to exist in design practice, it must first become a major component of academic curricula in architectural and urban design [10]. In conclusion, the aim is to consolidate and strengthen urban morphology as a scientific field of investigation, far from imposing a strict separation of sub-disciplines [24].

Urban Morphology as an Operational Pedagogical Tool for City Transformation

Urban design research and practice, indeed, is related to urban history, the environment, natural ecology, place studies, spatial morphology and public policy [25,26]. Despite diverse practical and academic interests and purposes, a great deal of urban design is related to the processes of the creation and management of urban form [26]. Ref. [26] also wrote that researching the characteristics that compose the urban fabric and the evolutionary dynamics is a very important endeavor for urban designers.

Ref. [14] in their text *Reflections on the pedagogy of place in the planning and urban design* quote Entrikin (1990): “The narratives that give meaning to place contain both descriptions of experience and evaluations of this experience”. For [4], urban morphology provides the tools to visualize and intervene in the urban physical environment through the study of urban landscape components and their dynamics. Moreover, through application, it is possible to consolidate from a pedagogical and theoretical point of view the act of planning [4]. Ref. [25] wrote in the 1995 text that the objectives of introducing urban morphology into design subjects were for students to acquire (1) a substantive knowledge of city-building processes; and (2) analytical skills to measure and interpret urban form as it affects access to services, lifestyle and, ultimately, quality of life. Although the science of urban morphology nowadays is not systematically applied through an operational and transformative lens, it is important to mention that, as [26,27] wrote, urban morphology is the discipline that has placed change at the center of theoretical debate and teaching since the foundation of the modern discipline in the early 1960s.

Urban morphological information is essential for urban adaptation—urban planning and design—to the effects of climate [28–31]. Moreover, for example, Ref. [31] developed in his text *Cities and Forms* a method of urban composition based on perceptive qualities combined with the study of urban morphology. The definition of a compositional process is based on the qualitative data provided by urban morphology with the quantitative data of climate to transform cities by making them fit for contemporary and future challenges.

2.2. Integration of Sea Level Rise Adaptation in Architectural Pedagogy

The urban adaptation of cities is currently the focus of several scientific research, including the approach of the “*Where the City Meets the Sea*” project that uses a combination of synchronous and asynchronous learning and collaboration activities to engage students on topics of both local and global relevance. This meta-geographical approach, in which the close interactions of local and global scale processes are emphasized, provides an in-depth understanding of the structure and multi-scale dynamics of environmental issues, as well as the recognition that solutions and ‘best practices’ developed at the local scale can be widely applied in many other contexts around the world [32].

As [33] states, the reinvention of the coast requires a dynamic vision based on detailed observation of the natural phenomena occurring on it. Moreover, the reinvention of the coast through drawing enables the understanding of the complex adaptive system, implies the reconfiguration of the conceptual framework of coastal planning and design and, on the other hand, the creation of a typological and technological range of design tools for resilient coastal landscapes [34].

As [35] (2018) wrote, the place-based design approach in the pedagogical design process leads to the development of broader and more focused knowledge, skills and

competencies on climate adaptation issues. Moreover, place-building models, such as the “Salty Urbanism” project, will engage socio-environmental development and collectively yield a new ecology of the city necessary to address the greatest ongoing challenge to planning and design: ecological design within human-dominated ecosystems [36].

Novel architecture with a new vision of adaptive urbanism lends itself to embrace historic and emerging technologies [36]. Moreover, the aim is to provide students with an understanding of how the formal relationship between the (geometric) parts of space becomes an integral part of the emerging systems within the changing environment [36].

This awareness enables drafting an abacus of theoretical references to urban planning and adaptation to climate change, both in a National [37–39] and International context [40–43] that may act as referential for the design studio.

Suggesting that the design studio can serve as a laboratory for design research, design investigation and design exploration—for tapping into investigations that explore instabilities rather than static conditions—that recognize and embed multiple and diverse social and cultural histories, stories and needs, and that inform richer, more emergent possibilities that embrace the fluid environments in which our work participates [44].

3. Research by Design of a Complex Urban Landscape through UM Tools

In the first semester of the fourth year of the design studio (2020–2021)—held at the Lisbon School of Architecture of the Universidade de Lisboa—the complex urban landscape in contact with the water body, the proposed case study, was decoded resorting to the methodological instruments of urban morphology.

In the academic year 2020–2021, the case study chosen, described and presented in this article, is the coastal urban space of the village of Sesimbra—a coastal town (30 km South of the capital), in the Lisbon Metropolitan Area, Portugal. In the following academic year, 2021–2022, the chosen case study was Quarteira—a coastal town located on the south coast of Portugal, in the Algarve region—extensively discussed in [45,46]. The urban space of two coastal towns, Sesimbra and Quarteira, were the pilot cases of the “[*entra*]mar” Embryo Project. Furthermore, the results obtained, for the case of Sesimbra, both in class (pedagogical achievements) and through the research project, were presented in the exhibition: “[*entra*]mar Sesimbra” (3 to 18 June, Sesimbra, 2023).

The urban design and interpretation of the existing urban form of the complex urban landscape in contact with the water body was divided into two consequential phases: the reading phase (i); and the design phase (ii).

Ref. [25] wrote that the urban form course she was holding was divided into three parts: (i) an introduction to urbanization trends and the theoretical basis of the morphogenetic approach, (ii) a core of illustrative case studies of cities, and (iii) measurements and comparative analyses of elements and processes that shape cities. The various steps described by [25] can be compared in parallel with the pedagogical methodology of second-cycle optional courses that were taught at the Lisbon School of Architecture, namely *Laboratory Lisbon* and *Other Cities*. Nevertheless, in the second-cycle design studio courses, the role of urban morphology is focused on expanding from the interpretation to the design. Going beyond transmitting a theory and a method, it explores the consequential relationship between reading and designing.

3.1. Reading Phase

The changing relations between water, land use and activities present both conceptual and practical challenges to planning and urban design [4]. The complex urban space, public and private, adjacent to the water body, which is nowadays vulnerable to the effects of the rising mean sea level and extreme weather events, is a potential subject for design research as it confronts students with various and multiple material and immaterial issues.

Pedagogically, the interpretation of the urban object is divided into stages, each of which is based on simple rules that stimulate the student’s creativity and autonomy within a precise code for drawing representation and physical model elaboration. The spatial

issues addressed stem from, but are not limited to, the physical and visual relationships between the city and the port areas; the recognition of singular urban elements in the urban fabric; and the pre-existing architectural buildings vulnerable to the effects of rising mean sea level, as well as the decoding and representation of the different historical layers of formation and the evolution and transformation of the city's urban form [47]. The pedagogical approach of the exercise is based on urban form decoding as the first act of the project, acknowledging in the urban fabric the grounding for the conceptual approach for the transformation of the city. Recognition of the pre-existing characteristics of the site, through the study and characterization of the overlapping morphological substrata, permits the preservation of the memory of the urban transformations that have taken place [48].

The understanding of the place is considered the first act of design. In fact, when referring to how Fernando Távora chose the place for the Boa Nova Tea House, the architect is implying that the project was already inscribed in the place prior to its existence, but only for the ones who are able to see it. Nevertheless, "being the first to see it comes with tough intuition, only possible with vast experience" [49]. The use of morphological interpretation to decode and understand a place is a catalyst for this intuition and is especially useful for students to incorporate as a methodology that can be part of the design process.

Therefore, prior to the initial drafting of the urban strategy for the adaptation and transformation of the port and waterfront, students were asked to conduct a morphological reading of the urban landscape. Six different layers were therefore considered: territory (i); time and layout (ii); singular forms (iii); incisions (iv); overlap (v); and "[*entra*]mar" (vi). The rational abstraction of the complexity of the urban landscape that individualizes layers, as a lens that enhances the vision over a specific theme, thus revealing its form in relation to the whole [33], is not trivially simplifying, but rather a tool to allow different visions of the whole and constructing the basic graphical elements of a narrative to explain the urban landscape in time and space [50].

The layer depicting the "territory" (i) consists of the representation of the territory geomorphology translated to the land topography, as well as the sea bathymetry, drawn in contour-level lines. The topographical and hydrographical specificities of the site, Sesimbra case study, at different scales of approach were addressed and represented. The acknowledgment of coincidences between the topographical characteristics and the urban layout was a direct consequence of the exercise and rendered a representation of the shape of specific urban elements, public space linear systems, that are coincident with ridge lines or valley lines (Figure 1).

In the layer entitled "time and layout" (ii), the urban layout, indeed the public space, and its evolution over time are represented in a sequent series of plans drawn at the same scale with the same criteria. The representation of the formal evolution of the layout reveals not only the expansion over time of the coastal city, especially since the second half of the 20th century, with the advent of tourism but also a change in the formal relation of the urban form to the sea. The irregular, residual spaces between the urban structure and the beach were gradually appropriated for the construction of the public space, the seashore street and a horizontal surface mediating between the built-up area and the beach (Figure 2).

In the different urban layouts that correspond to the evolutionary moments of the urban core, one can recognize the predominance of street grids predominantly perpendicular or parallel to the coastline, adapted to the topography, especially in the oldest areas of the town. Starting in the first half of the 20th century, the restructuring of the urban fabric was supported by the opening of an avenue perpendicular to the sea and inscribed in the main line of the valley, just as the embryo of what is now the via del mare was established as a linear public space mediating between the urban fabric and the sea [43].

The seashore street is characterized by having the boundary only on one side, and the buildings, the horizontal plane, the walking surface, the interfaces are on the other side with the beach through ramps, stairs and narrow walls.

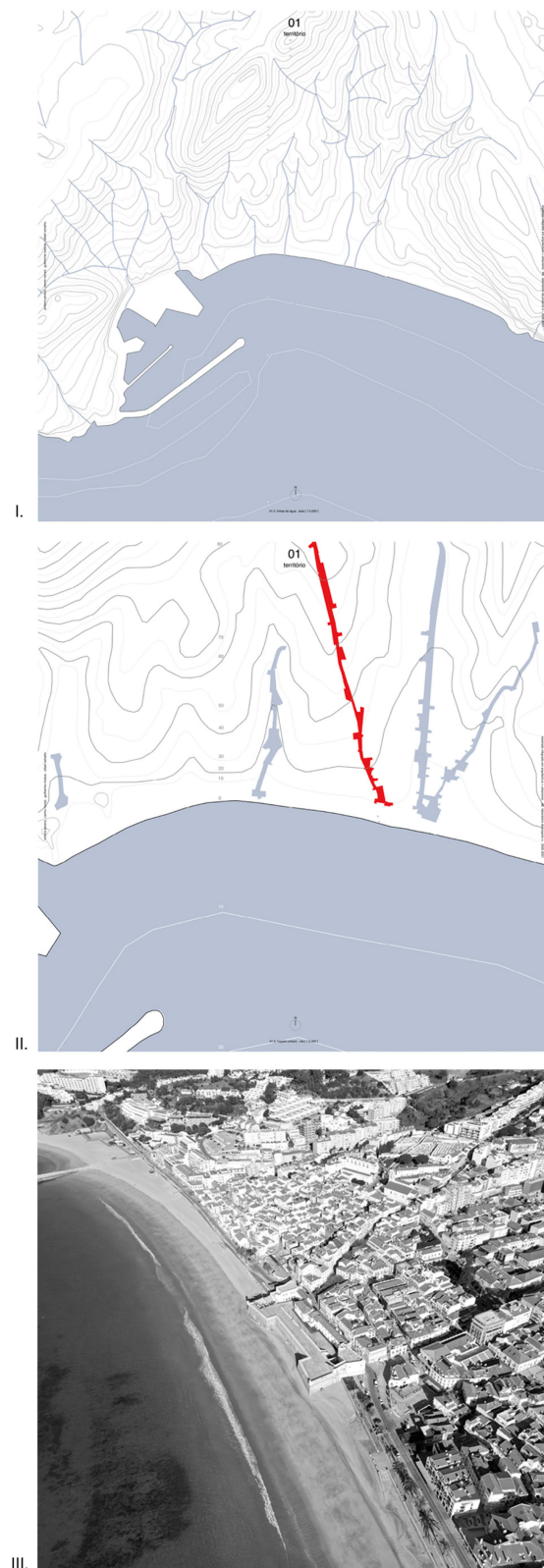


Figure 1. Territory (I) and (II) Source: António Pereira, Carmo Morais, Guilherme Mateus, Rafael Ramalho—Fourth-year students in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa. (III) Sesimbra beachfront from the sky. Source: Nawaf Al Mushait, 2021. “[entra]mar” Embryo Project Archive.

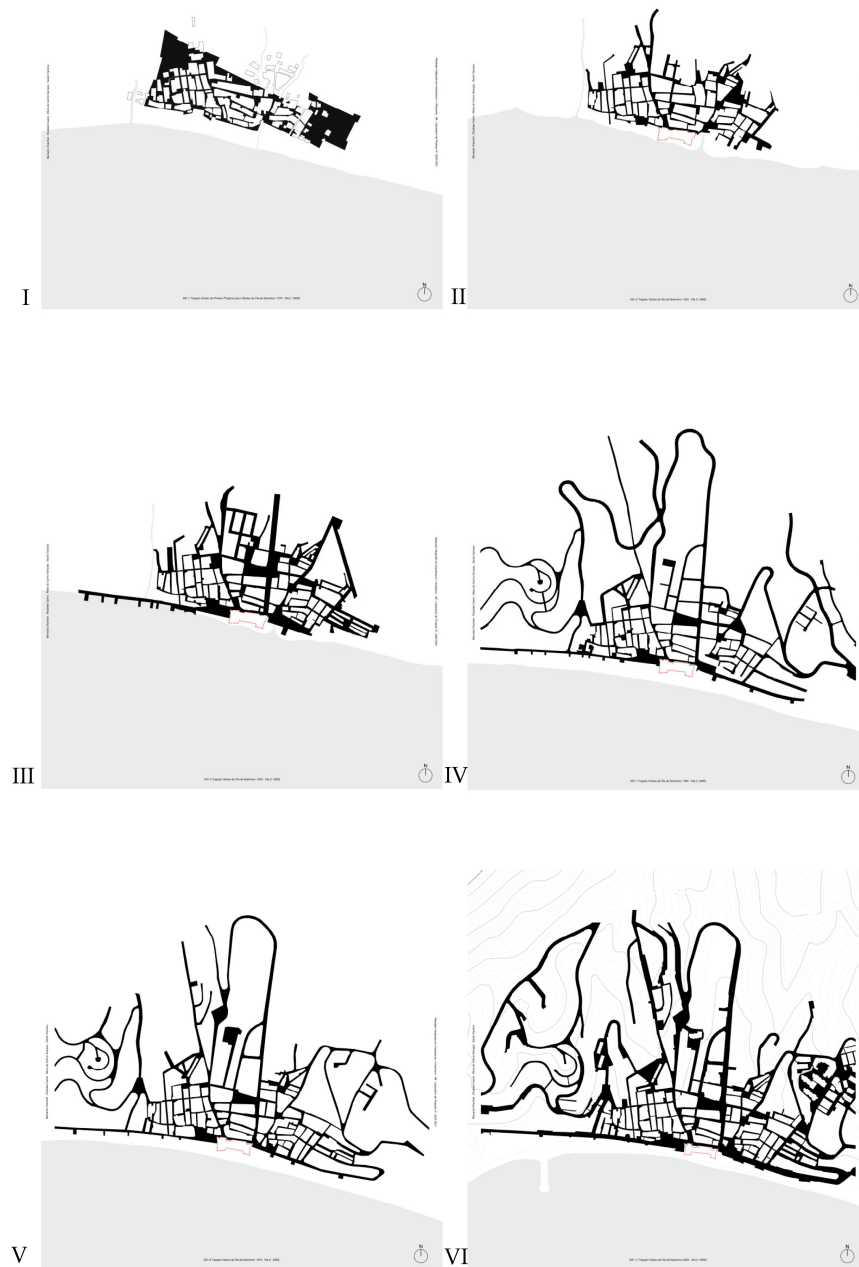


Figure 2. Time and Urban Layout of Sesimbra in (I) 1570, (II) 1905, (III) 1929, (IV) 1950, (V) 1976, (VI) 2004. Source: Bernardo Chambel, Elisabete Caeiro. Maria do Carmo Sampaio, Sarah Cipriano—Fourth-year students in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.

Revealing the different times in the urban layout and, furthermore, acknowledging the evolution and transformation of the urban space, there is evidence of the form of elements that in certain periods materialized the mediation between the village and the sea, namely the linear space parallel to the sea of the seashore street and the multiple ramps perpendicular to the sea in the continuation of the street urban layout.

In the “singular forms” (iii) students were asked to represent exceptional public spaces and buildings as distinctive elements in the urban fabric depicted in relation to the contiguous public space. The representation of singular buildings in the plan is drawn up through their ground floor plan in relation to public spaces, analogically a reference to Nolli’s *Nuova Topografia di Roma* (1748) plan. The fortress that dominates the bay but also religious buildings or recent tourist complexes that have an architectural value in their

relationship with the urban landscape were, in this case, considered singular elements in the urban landscape. Beyond the usual relationship between singular buildings and exceptional elements in the public space, the elaboration of the “singular forms” conceptual model has explored the vertical dimension of exceptional built elements that constitute visual references for orientation both in the sea and in the land (Figure 3).



Figure 3. (I) Singular Forms of Sesimbra interpretative plan and (II) model. Source: (I) “[*entra*]mar” Embryo Project Archive; (II) Alessandra Pace, Fernanda Costa, Julianna Costa, Maria Luíza de Carvalho—Fourth-year students in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.

If the first three previous topics of research can be ascribed to the broad theme of the morphological analysis of urban space, the other three, while still having an urban morphology methodological basis, required a further imaginative approach on the part of the students. The theme “incisions” (iv) required the students to identify, in a three-dimensional approach, the extensive cuts and anthropic insertions in the territory. The result is a model of intense synthesis that made evident the breakwaters, the harbor landfill and also the medieval and post-Renaissance defensive structures that dominate the bay (Figure 4). Curiously, a substantial part of the elements that were identified by the students as “incisions” are actually located in the contact between land and sea, thus revealing the protagonist of these elements in the composition of the urban seafront.

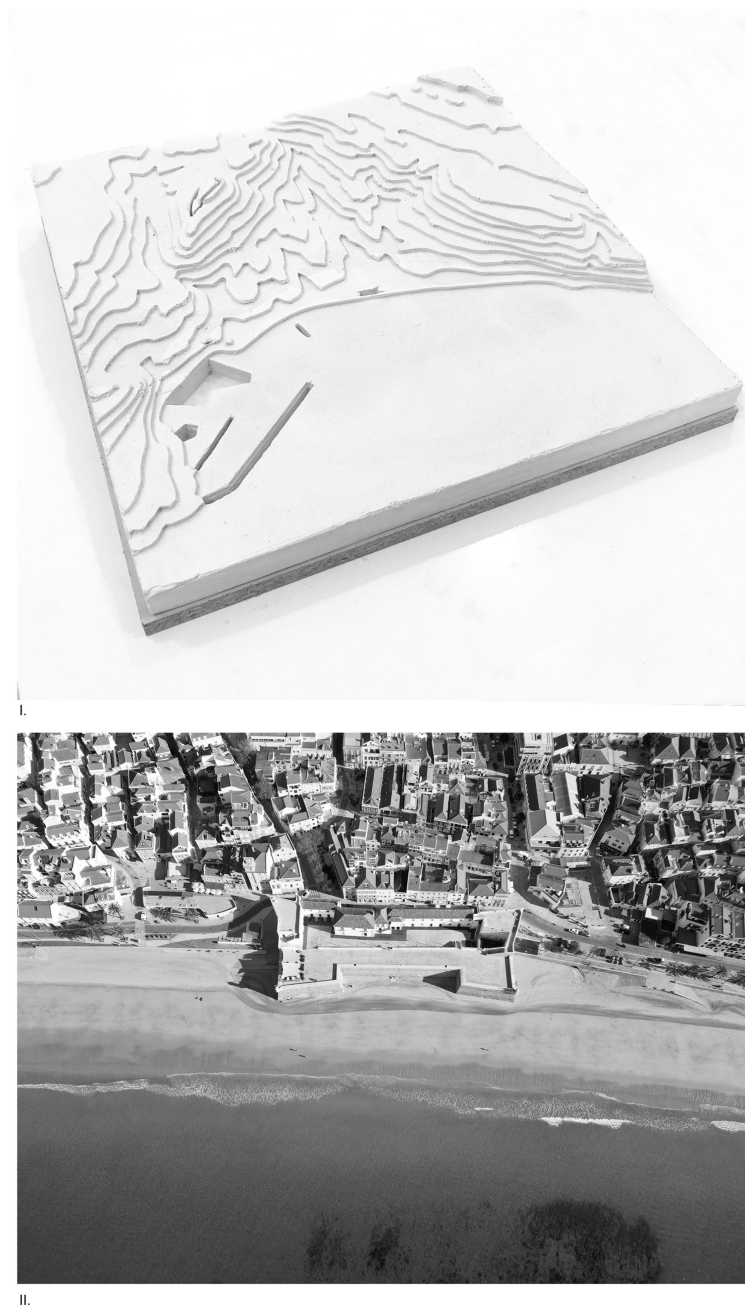


Figure 4. (I) Incisions of Sesimbra model. Source: Ângela Vieira, Carolina Martins, Cláudia Direitinho, Francisco Vicente, Inês Silva—Fourth-year students in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.; (II) Sesimbra beachfront from the sky. Source: Nawaf Al Mushait, 2021. “[entra]mar” Embryo Project Archive.

In the thematic entitled “time and layout” (ii), the temporal evolution of the urban form was separated into different drawings, decomposed to be elementarily read in sequence. Complementarily, in the thematic “overlap” (v), students were asked to observe and reproduce the different temporal, spatial and functional overlaps that occur in public space. Examples include the overlapping of public uses in private spaces and private uses in public spaces, but also, the overlapping of different functions on the beach over time (from fishing port activities to the current tourist and recreational site). Moreover, overlapping is spoken of and must be thought of when one is faced with the effects of the rise in the average sea level in relation to public space (Figure 5). “Overlap” has unmistakably

acknowledged a temporal dimension not always easily perceived by students and one of the most important qualities of public space.

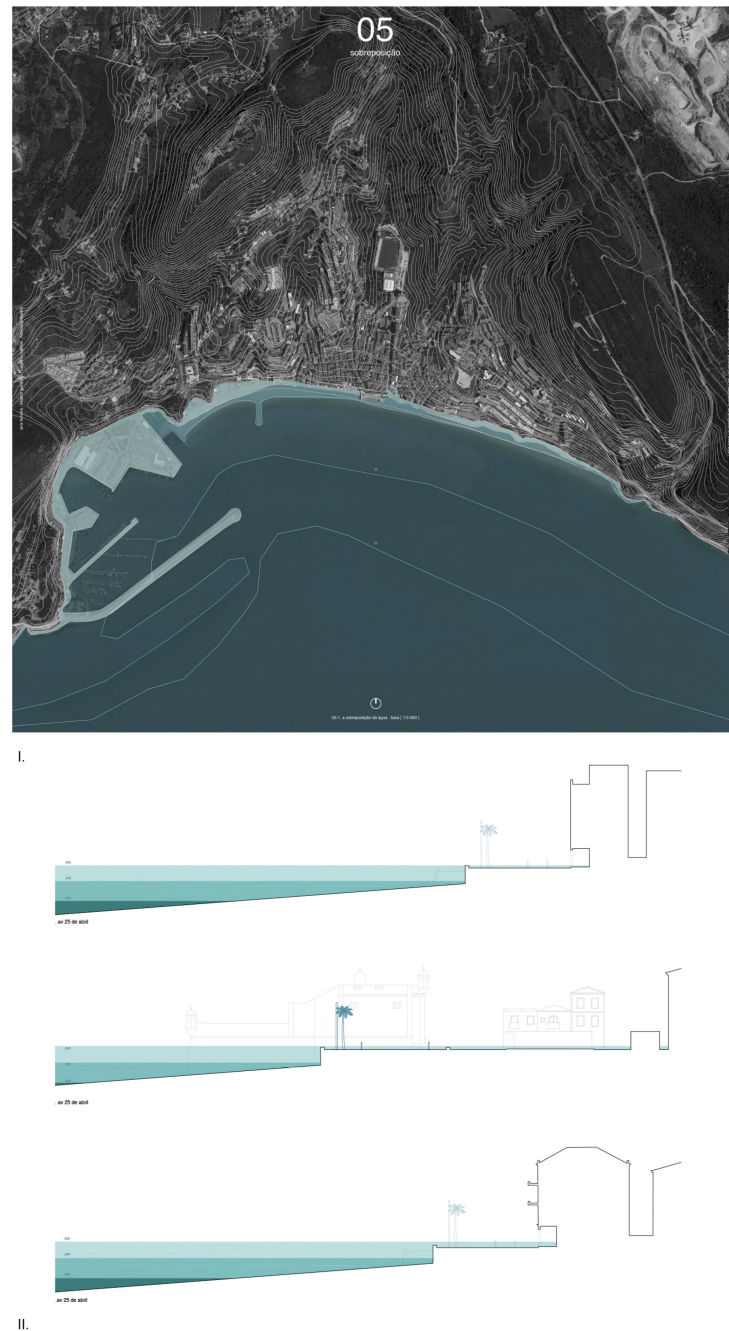


Figure 5. Sesimbra Overlapping plan (I) and sections (II). Source: Ana Ferreira, Beatriz Gordinho, Catarina Martins, Francisca Coelho—Fourth-year students in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.

As referred to before, “[*entra*]mar” consists of a neologism that stands for the sea intertwined city or the urban form that is intrinsically related to the sea. Proposing the theme “[*entra*]mar” (vi) to students consisted of an intellectual stimulus to rediscover the formal compositional elements of the city, which are morphologically related to the sea.

Contributing to the interpretation and design of urban areas vulnerable to the effects of mean sea level rise were the scenarios outlined by the IPCC report [51]. Indeed, we believe that providing students with qualitative data on the changing climate, and its effects

on the urban, has defined the importance of rethinking and redesigning the vulnerable urban areas.

Retracing the form of the urban elements—streets, urban blocks and plot structure—which are morphologically related to the sea, allows us to create new cartographies, based on the form of the city, from which an interpretation of abstract grids with specific rhythms can be inferred. Composition matrixes that double as interpretative drawings of the urban form and support for the design of future built elements.

We consider that the decomposition of the urban space, both its systems—topography, urban layout, etc.—and elements—streets, squares, plots and buildings—allows us to extract the composition matrix of the urban fabric and its intrinsic relations with the territory. In the specific case of the coastal urban fabrics, with a focus on the relation with the sea, this method can be adjusted to decode the urban form interrelated to the sea. This interpretative reading was made in a two-way relational process from land to water, and from water to land, conferring a formal matrix for the development of the sequent design phase (Figure 6).

The codified representation of reality in elementary interpretative diagrams and single-material models makes it possible to reduce the complex nature of the city, to extract the layers essential to its understanding and to help students learn to interpret and even select the themes of design composition grounded in the morphological character of the urban landscape.

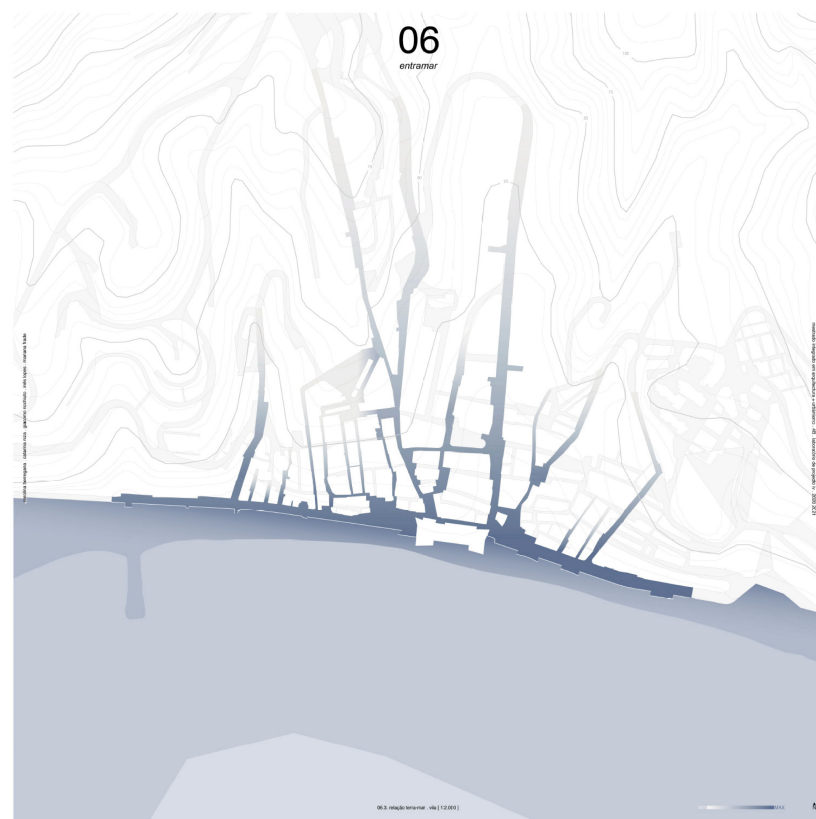
In conclusion, the first phase is the interpretation of the coastal territory, the decoding of urban fragments and the drafting of a lexicon, a typological framework composed of the analysis of urban elements and, therefore, of their transformation over time in the space between land and sea. Also, as part of the interpretative reading phase, students were asked to systematize an atlas of architectural elements of the seashore, composing a curated visual glossary of water; sand; stone; wall; ramp; pier; breakwater; grid; tower/lighthouse; shelter; street; and square. This “wall atlas” [52] was taken as a recurrent set of references for the recomposition of the urban seashore from the very elements that compose it, contributing to providing speculative urban solutions of mediation between the city and the sea.

The reading was therefore understood as the first act of the project, guiding the theoretical and formal development of the waterfront’s “material urbanity” as defined by [53] as a “quality of significant places of collective and political content in their very material form. “Material urbanity”, the ability of urban material to express civic, aesthetic, functional and social meanings, is a basic concept when it comes to defining public space”.

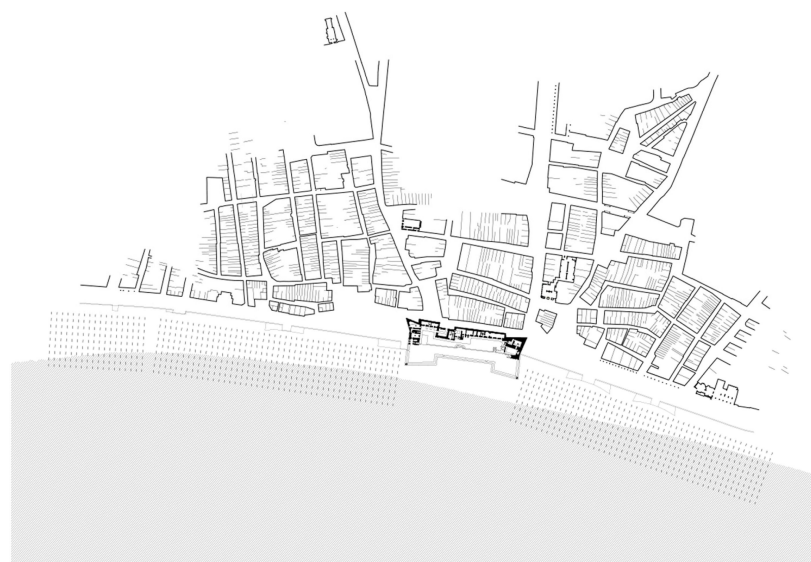
3.2. Design Phase

In the design phase, students were asked to imagine an evolution and transformation strategy for the complex urban landscape in contact with the sea. This should be based on a design concept generated from the interpretation phase, a combination of systems and elements that were decoded from the previous morphological interpretation, considering an idea for the future of the Sesimbra village, based on revealing the place from itself.

The first step was drafting the general plan. It consisted of the definition of a program distributed across the territory it covers and an urban strategy designed for the town, structured from the Atlantic margin, starting from the sea. The definition of the program should be based on consistent objectives with a critical view of present and future needs and the territorial interpretation drawn up in the previous phase. The strategy should articulate the different urban themes previously addressed across different scales of approach, resorting to the establishment of speculative solutions for the potential spaces of the urban fabric, particularly the space generated by the overlap between land and sea, understood as a structuring element of the town, establishing a formal response for the “emotional reconstruction” of the margin. The aim of the plan drafting was to combine a general and strategic vision for the margin and the pre-existing urban fabric with speculative solutions, deeply rooted in the interpretation of the site in order to define composition principles, both for urban and architectural forms.



I.



II.

Figure 6. (I) *[entra]mar*. Source: Carolina Borregana, Catarina Niza, Giacomo Ricchiuto, Inês Lopes, Mariana Frade—Fourth-year students in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa. (II) Sesimbra *[entra]mar* interpretative diagram 2023. “*[entra]mar*” Embryo Project Archive, 2023.

The second step of the design phase was aimed at formalizing urban architecture at different spatial and temporal scales for the construction of the material urbanity of the seafront. The public space project presupposes the creation of a place with urbanity, achieved through an intervention that implements in the project a detailed resolution of public spaces that materialize a spatial continuity between land and sea. This design phase

corresponds to the in-depth study and implementation of a component of the strategy previously defined in the general plan. In this way, the detailed design of part of the system of public spaces on the seafront follows the previous phase, adjusted to the urban and architectural transformation strategy enunciated by each student.

4. Design Outcomes

The systemic decomposition and recomposition of the morphological layers addressed in the reading phase allowed us, for example, to highlight the relationships between topography and urban layout, but also to reveal the spaces most vulnerable to sea level rise or to acknowledge the versatility of the public spaces by the sea revealed by the overlap. At the same time, the atlas of architectural elements conferred the basis for a speculative approach to the design of the seafront with concept collages that suggest the recombination of preexistent elements in a way conferring to the architect the role of a curator of the landscape and extending the temporality of selected elements that establish a significant relation with the place (Figure 7).

Therefore, the urban seafront design was based on the interpretation of the public space in contact with the sea and its physical-spatial characteristics, through the use of morphological interpretative drawings as a tool for qualitative research. The interpretation guided by urban morphology allowed the students to recognize the qualities of the urban fabric, the spatial relationships between the built elements and the landscape, as well as to implement, in the project, the transformation of space in the continuity of its evolutionary process while tackling contemporary and future challenges.

Furthermore, the urban morphological approach to the interpretation of the Sesimbra seafront permitted recognition of the different phases of formation and transformation of the urban space adjacent to the sea, the seashore street and through the decomposition into layers to represent the complex evolutionary processes in a timeline. Identifying times provides an understanding of which attributes and elements belong to a long time—when they appeared and when they disappeared, becoming ruins or vestiges—and which belong to cyclical ones—that is, belonging to seasonal temporal dynamics.



Figure 7. Collages of the urban seashore. Source: Mariana Frade—Fourth-year student in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.

4.1. “[entra]mar”: Sea Intertwined City

The “[entra]mar” research by design is based on the combination of two areas of knowledge, urban morphology and climate change, which combine to provide *know-how* for effective urban adaptation solutions.

During the design studio course, the applied research project “[entra]mar” enabled the development of a morphological-typological reference framework of design solutions for the mediating space between the city and the sea. Categorization was not possible on an “a priori” basis of the previous interpretative reading phase outcomes but “a posteriori” on the realized project. This overcomes one of the shortcomings noted by several authors regarding the application of urban morphology in both academic and professional settings.

The formal characteristics of the public space, its evolution and transformation were recognized and implemented by the students in the design phase to define the spatial axes and directions of the public space. The exercise proposed to the students required them to redesign and think about urban spaces vulnerable to the effects of extreme climatic events, including the rise in mean sea level, so questioning the shape, thickness and urban boundary became for many of them *conditio sine qua non* for adapting the city.

Common to most proposals and as a direct result of the morphological interpretation, the students’ individual design proposals acknowledged the existence of singular public spaces in the intersection of the valley lines and the margin, and these spaces were underlined in the urban design of the proposals as privileged articulation spaces, as joints between the urban fabric and the beach. Moreover, a few proposals considered the extension of the existing street layout beyond the existing margin, doubling their role as piers or ramps and redefining the urban margin edge design analogous to the period when ramps used to play a structuring role in the relation between the village and the beach.

Among the various outcomes of this study, three design strategies based on an interpretative reading of the place stand out: the inhabitable (defensive) wall (i), the living breakwater (ii) and the intermittent seasonal cycles (iii).

4.1.1. Habitable (Defensive) Wall

One of the singular built elements that compose the Sesimbra urban landscape in contact with the sea is the fort named Santiago Fortress.

The fort was built in the middle of the bay, for tactical military reasons, on the flat plane of the beach next to the confluence of two streams leading to the sea and the topographic lines of the valley. The fort, around which the city and public space have been consolidated over the years, has become the midpoint of the infrastructural limit of the seashore street wall. Indeed, just as the city has grown over time around the defensive element, so too has the public space. The seashore street, in order to overcome the difference in height between the beach and the ground level of the buildings on the edge of the public space, is articulated by leaning on the fortress.

The wall, a limit between the urban system and the beach, becomes, in the pedagogical exercise proposed to the students, a line on which and with which to imagine new forms, through processes of addition and subtraction, such as designing an inhabited wall.

The fort itself was already identified in the morphological interpretative reading as an incision in the landscape, a territorial landmark and an inhabited thickness that enables the expansion of the public space. The thickness of the wall, in the students’ projects, became a space endowed with formal characteristics and stereotomic details.

Following the recognition of the fortified element, an interpretative diagrammatic drafting of it was undertaken. The wall became the compositional line parallel to the coastline: an outline on which to erect a solid defense to protect the city from the effects of the extreme weather events associated with the mean sea level rise. The wall is declined as a spatial and formal element and placed in relation to the existing urban form: through openings and vertical planes of elevation changes, interstitial spaces to define a system of excavated passages, terraces and patios that articulates the city and the seashore street with multiple connections in a morphological analogy to the existing fort. Furthermore,

the spaces around the Santiago Fortress retreat to formalize the articulation between the village and the beach and provide space for the water to flow from the valleys in case of torrential rainfall (Figure 8).

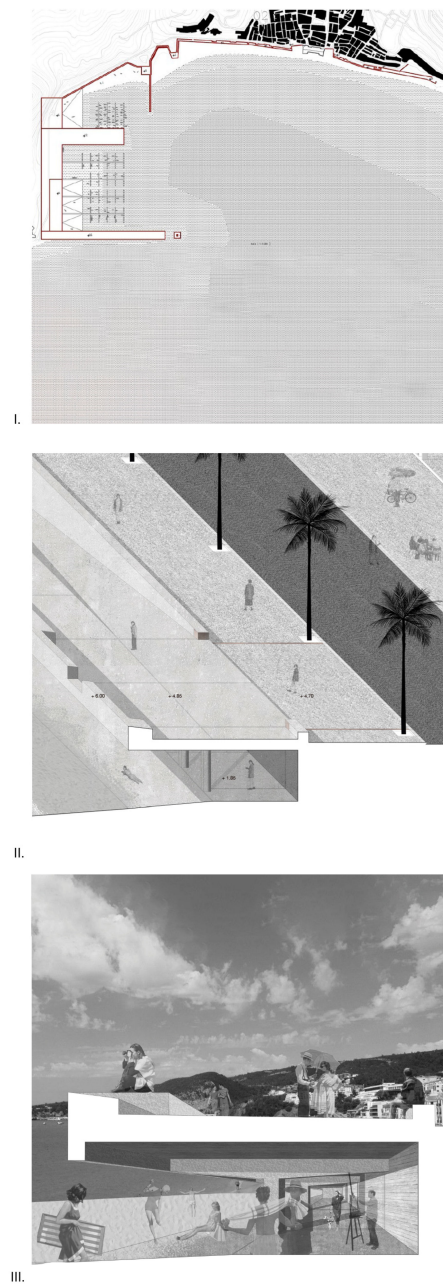


Figure 8. Habitable (defensive) wall. (I) and (II) Source: Alessandra Pace. (III) Source: Beatriz Gordinho—Fourth-year student in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.

4.1.2. “Living” Breakwaters

The interpretative reading of the Sesimbra urban landscape experimented with conceptual themes that expanded the traditional urban morphological lexicon. The interpretation of anthropogenic incisions in the landscape between land and water allowed the students to list which engravings—as in a clay model—have been made over time by humans to inhabit the landscape. These included land and sea infrastructures, such as breakwaters. Subsequent to the hard definition of what the cuts on the canvas were, some students

decided, in their project, to re-appropriate these elements, the breakwaters and imagine that life could develop on and around them.

The morphological relation that is established between the formal composition of the proposed breakwaters and the urban form of Sesimbra that was interpreted resorts to two main aspects. The form of the proposed elements stems from the form of the preexisting breakwaters and their alignments refer to the alignment of the street layouts parallel to the seashore and the protection wall of the seashore street.

Imaginative thinking that opens the door to possible appropriation by marine life or to the idea that from infrastructure it could—through practice—be transformed into a livable public space: a place to stay, and thus fill the void of the cut. Students called upon to solve the problem of rising mean sea levels imagined that these infrastructures would continue to act as wave dissipators (Figure 9).



Figure 9. Living breakwaters. Source: Giacomo Ricchiuto, Maria Luíza Carvalho, 2020—Fourth-year students in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.

4.1.3. Seasonal Cycles Intermittencies

The reading phase permitted the revelation of the spatial relation between the elements that have succeeded one another over time in the intertidal space between the land and the sea: boats, fishing nets, fish laid on the sand for buying and selling, the seashore street, the infrastructural structures for the protection of the beach; the tourist structures on the beach, and the beach umbrellas [54].

Imagining a common ground by extending the layout of the city, lines perpendicular to the margin line, become a pretext to draw the public space beyond the boundary represented by the seashore street. The seashore street, located between the land and the sea, interfaces with housing, tourist buildings and spaces with commercial functions that have become vulnerable due to the rise in the mean sea level caused by climate change [55].

Namely, by redesigning the occupation of the beach through compositional matrices composed of lines—echoed by the adjacent urban form—and dots—echoed by the elements that have succeeded one another in this space over time—we believe allowed the students to understand how the space of the beach (trivially considered a commonplace or a residual space) can become a singular place for urban planning and design.

Perpendicular lines to the margin line become spatial axes that extend public space and become streets, piers and ramps, but also breakwaters. Understanding that a line can take on different materiality allows students to define elements, spaces and volumes from compositional geometries. Designing fixed or movable elements, with which different modes of appropriation can be associated, recognizes the daily and seasonal human occupation cycles of the intertidal space, as shown in Figure 10.

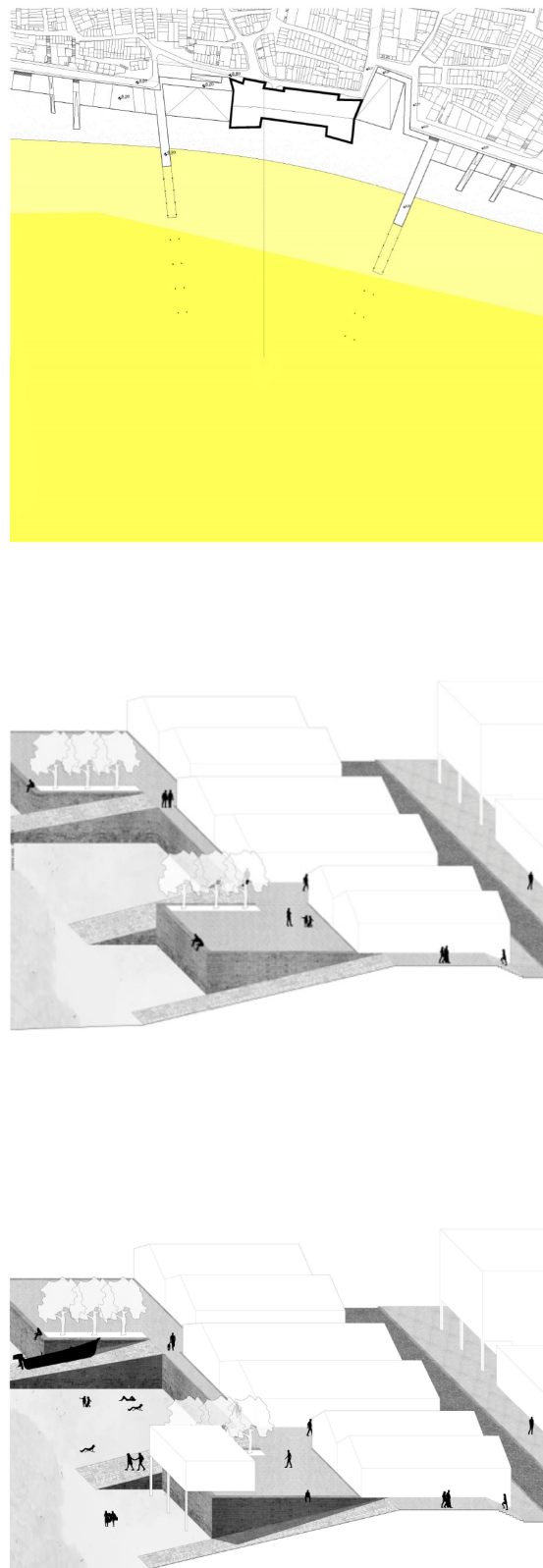


Figure 10. Intermittent seasonal cycles. Source: Julianna Costa—Fourth-year student in Architecture and Urbanism design studio (2020–2021), held at the Lisbon School of Architecture of the Universidade de Lisboa.

5. Discussion

We consider that in architecture pedagogy and urban morphology should return to a central role in the teaching of design projects, bringing clear objectives and methods according to the level of study. Urban morphology methods permit us, from the reading phase to the design phase, to decode, through drawing, contemporary issues, due to climate change, and to commensurate their effects—floods and inundations, erosion—in the urban and building fabric.

Moreover, we consider that the research by design methodology, outlined in the Embryo Project “[entra]mar”, can be applied at different academic levels, as tested in recent years at the Lisbon School of Architecture of the Universidade de Lisboa.

In the first cycle of studies (Bachelor’s degree), the emphasis is placed on the interpretation and decoding of urban form; in the second cycle of studies (Master’s degree), the usefulness of interpretation is translated into innovative design proposals based on the codes of the existing city form; students in the third cycle (Doctorate) are encouraged to use a comparative approach based on the systemic and elementary decomposition of case studies to test research hypotheses, thus enabling them to support their research on a well-founded methodology using an essential disciplinary drawing. The legibility of the morphological and morphogenetic memory of the elements that compose the city is a value of its form [56] that allows us to outline its characteristics. Despite there being an awareness of different contemporary ways of adapting coastal urban margins, we sought to find grounding in the place and at the time of the place that would support a response that departs from the geographic and cultural context in which it operates. We find that the morphological interpretation of an urban landscape contributes to the place’s revelation.

If the design studio in architecture schools is the pedagogical space in which students learn architectural practice through “project making”, we believe that this learning process should be strongly influenced by the method in which they learn. Indeed, the increasing intractability of the conditions that result in the growth or decline of the city and the sensory nature of the urban experience calls for the adoption of appropriate teaching procedures that help capture the dynamics of the urban landscape [14].

The teaching of urban morphology as a compulsory course in faculties of architecture enables students to become fluent in the language of built form and gain knowledge of the processes of city construction; they acquire basic skills in map reading and the measurement of urban form elements; they can translate the formal, functional and symbolic characteristics of urban landscape elements [25]. Indeed, urban morphology has made it possible to inform the creation of an operational interpretative method, based on the elementary and systemic decomposition of the complex nature of the urban object in contact with the sea, allowing it to be decoded and revealing relationships between the built environment and the landscape that would otherwise be hidden. Methodologically, through the decomposition of the elements and strata that compose the seashore street, it is possible to recognize the formal relationships that have been established over time in the urban system and foresee future scenarios.

Parallel to the research presented here is, for the sake of scientific coherence, presented in the text by [24] *Exploring Urban Morphology as Urban Design Pedagogy*, in which the author discusses the pedagogical path undertaken with students in the urban design course. Also, for Gu, a propaedeutic and pedagogical objective is the students’ comprehension of the tool of urban morphology applied in the decoding of waterfront space and the subsequent design transformation.

The MAR and “[entra]mar” research projects have a large pedagogical component in which students from different study cycles, through different lenses of interpretation—be it the project during the 4th academic year or the writing of the final master’s project, or doctoral research—bring new results to the debate. Although “[entra]mar” is a research-by-design Embryo Project, where the component of qualitative data obtained from the application of urban morphology is combined with the quantitative data of mean sea level rise, we theorize that similar processes can be implemented and applied to respond

to several topics concerning the relation between urban form and contemporary urban questions. Indeed, if we consider that the urban form of coastal agglomerations can contribute to aggravating the negative externalities of extreme events related to climate change, the hypothesis arises that decoding the characteristics of the urban form of coastal cities allows for intervention, transformation and adaptation to the seashore street.

We consider that the placed hypothesis can be answered through the use of urban morphology both in the urban interpretation phase—data collection, qualitative assessment of the state-of-the-art—and in the planning and project intervention phase. Although in the Portuguese coastal territory there are 38 coastal cities that interface with the sea through the public space of the seashore street, the pilot cases drawn up in the two different academic years have consolidated the hypothesis and demonstrated how even at a pedagogical level the decomposition by elementary layers of the complex city allows students to intervene with design acts coherent with the urban landscape and propose a transformation in continuity with its morphological character.

In a 2016 interview entitled *Living together is only possible if there is always the possibility to be alone* the authors state: “When teaching, you have to provide answers to students’ questions, but for us, teaching is also a way of formulating questions correctly” [57].

6. Conclusions

In conclusion, we consider that complex urban transformation of the public space—as it must respond to the future demand to adapt the public space to the effects of the rise in the average sea level, as well as the contemporary desire to experience the daily life and seasonality of the sea’s proximity—is possible only through an effective reading of the urban landscape. A reading that urban morphology, as a qualitative tool, allows. Since the adaptation of urban systems requires the structured modification of spatial and legislative dimensions, in a coordinated manner with ordinary spatial governance practices, this can be achieved through a structured knowledge of the urban landscape.

Moreover, we assess that the introduction of a new interdisciplinary perspective into the academic and architectural debate, combining urban morphology with climatic data, allows us to move beyond sterile debates on the ‘why’ of city transformation, shifting the focus of research to the ‘how’.

The current research, indeed, seeks to validate the paradigm shift from the “city by the sea” to the “[*entra*]mar”, the urban form intertwined with the sea. Moreover, it provides architecture a leading role in the agreement between nature, infrastructure and humans. In the contemporary necessity for coordinated action between the different disciplines dealing with the transformation and adaptation of cities vulnerable to the effects of rising seas, the Architect, providing the methods of urban morphology, should respond by synthesizing the know-how and contributing to project design. As [29] writes, the complexities of the agents interacting in the formation and transformation of urban form can be more accurately revealed through interdisciplinary approaches.

The pilot research project “[*entra*]mar” has made it possible, through theoretical and empirical definition, to restore the operational role, albeit in a pedagogical context, of urban morphology, as requested and desired by Muratori [58].

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