Research Article

Typomorphology: A Methodological Approach to Context Analysis in Architectural Design Education

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Abstract

The study aims to demonstrate the importance of typomorphological knowledge as a method of contextual analysis in architectural design education. The Architectural Design Studio is a place for students to experience design tools, methods, and practice, and focuses on developing the ability to design and teach. Design, with its phases of analysis, synthesis, and evaluation phases, is a dynamic process that consists of adapting and transforming the information obtained from past experiences and making it suitable for the creation of new designs. The analysis phase is one of the most crucial stages in the architectural design process, as it involves the study of the context. The context typically includes tangible data such as topography, the built environment, functional relationships, the history of the area, and its current significance. The typomorphological approach is a method for studying context and is crucial to introduce into design education. The study intends to reveal the contribution of supporting imaginative education with theoretical knowledge to the design process and how typomorphological knowledge can be taught, in architectural design education. The paper analyzes the significance and role of context in architectural design education and process, provides knowledge on typomorphological approaches, and explores through examples the contributions of researchers using these approaches to design education in this field and how they produce solutions. The conclusion discusses the concepts, issues, and analytical techniques addressed by four different researchers in their architectural/urban design courses integrating typomorphology and the contributions of this knowledge to the architectural design process and the education of students.

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INTRODUCTION: DEFINING THE RESEARCH PROBLEM AND OBJECTIVES

Cities are organisms that undergo physical transformations over time as a result of socioeconomic factors. New design ideas often embody these modifications, responding to the needs of the time they occur. How can new design concepts be integrated into the urban fabric with a significant historical background while preserving the city's character and satisfying present needs?

A new urban design should be integrated into the existing built environment while taking into account contemporary demands and preserving the city's identity, all within the existing urban fabric. In order to convey new meanings, it is imperative to comprehend and interpret characteristic elements. A design that demonstrates consideration for historical development, existing forms, and current demands enables the incorporation of contemporary spatial characteristics that can effectively contribute to the ongoing evolution of urban environments (Gygax, 2007). The concept of 'urban fabric' encompasses the physical structure and historical development of urban areas, as well as the relationship between urban spaces and individual buildings. Furthermore, it serves as an instrument for analysis and explanation (Kropf, 1998). The typomorphological approach can be an essential starting point for analyzing the urban fabric to inform the development of a modern structure that aligns with the unique characteristics of the surrounding district within an established built environment. While this approach is crucial within their respective domains of application, it can also function as a valuable instrument in the realm of architectural design education.

The works of Kropf, Oliveira, Hayward & Samuels, and Maretto are analyzed because they are key figures in the field of typomorphology and have made significant efforts to incorporate this subject into architectural and urban planning education. Therefore, this study aims to demonstrate the importance of typomorphological knowledge as a method of contextual analysis and its integration into architectural design education. It does this by comparing the approaches of four contributors to architectural and urban design education that incorporate typomorphological knowledge and by formulating predictions about the fundamental concepts, issues, techniques, and their contribution to students.

CONTEXT IN ARCHITECTURAL DESIGN EDUCATION AND PROCESS

Architecture is a discipline that exists in a potential environment between logic, emotion, and intuition (Salama, 2008; Schön, 1984). While it provides physical structures for social functions, it is also concerned with the aesthetic dimension of the human experience. As a representative of research and design, architecture faces a multitude of problems and strives to find solutions (Schön, 1984).

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The Architectural Design Studio, which allows students to combine their talents, values, and architectural terms and focuses on developing the ability to design and teach design, is the "center" of architectural education, prioritized in the program (Dutton, 1987; Schön, 1984; Uluoğlu, 1990). The architectural design studio provides an environment for students to engage with their ideas and social interactions. It is a place for students to experience design tools, methods, and practice, i.e., *learning by doing*, and creates a productive environment that enables students to switch between different modes of thinking through actions such as drawing, talking, and making models (Dutton, 1987; Schön, 1984). In the studio, students acquire both theoretical and practical knowledge, which they apply to their design process in response to critique and guidance from their instructor in a virtual environment. According to Schön (1984, 1987, 1988), designing education based on the *"reflection-in-action"* approach, relying on the strategies of "telling and listening" and "showing and imitating" between the instructor and the student, creates a cycle in which the student and the teacher work together, generate ideas, and evaluate the results.

Cross (2021) states that different approaches view design as a cyclical process involving the analysis phase of defining the problem and listing the requirements of the design, the synthesis phase of finding the solution, and the evaluation of the performance of alternative designs against a set of criteria before determining the final design.

Architectural design is associated with both a program and a site. During the initial stages of the design process, the architect evaluates and interprets information about the site through the analysis of data pertaining to the natural, built, and social environment, commonly referred to as the context. This analysis serves to unveil the underlying ideas and principles that will serve as guiding principles for the design. In the concept phase, designers utilize diagrams, visuals, and written materials to specify the ideas forming the basis of the design and organize decisions. During the composition phase, which is a creative process related to form, the designer generates products in various shapes that conform to the program's specifications, evaluates these products, and determines whether to proceed with the predetermined concept. Through feedback, the designer determines whether any changes are necessary. Upon achieving the desired form, the designer formulates the ultimate outcome as a structure and material. During the use phase, people experience it through light, sound, and spatial terms after construction (Figure 1) (Farrelly, 2007; Leupen et al., 1997).

One of the most crucial stages in the design process is the study of the context. The context typically comprises tangible data such as topography, the built environment, functional relationships, the history of the area, and its current significance. Developing the design subsequent to comprehending and analyzing this data ensures that the proposal is understandable and open to discussion (Leupen et al., 1997).
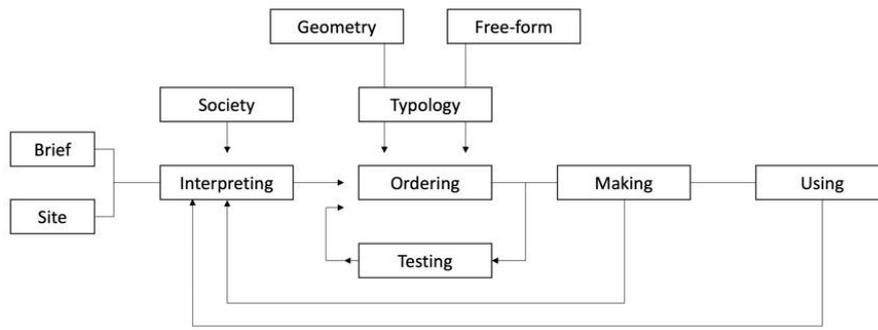
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Studies on the design process have a role in learning the design in architectural design education (Uluoğlu, 1990). Studies conducted in the 1990s concerning design theories emphasize that design is a form of knowledge and regard basic types such as concepts, prototypes, and examples as an internal part of design. This approach views design as a dynamic process that involves adapting and transforming information from past experiences to meet current requirements (Oxman, 1990). This perspective reveals the importance of including typomorphological approaches as knowledge in design education.

TYPOMORPHOLOGY
Type and Analytical Typology

Typology is a theoretical approach that enables the classification and interpretation of buildings according to their specific characteristics. The Age of Enlightenment and positivist thought orientations influenced the emergence of this approach. The most influential theorists in the creation of typological analysis as a method of classification were Quatrémere de Quincy, Guadet, and Milizia, as well as J.N.L. Durand, who conducted research on building type (Yücel, 1979). These approaches, which remained as a "classification of forms," were far from the content of today's analytical typology.

In response to modern architecture, Saverio Muratori led the reintroduction of typological studies in Italy in the 1960s; M.R.G. Conzen developed geography-based analyses in England; and the Versailles School in France developed typological and morphological studies to examine the structure of urban space (Gürer, 2016).

Typomorphological approaches perceive urban structure as a constantly changing organism and use the concepts of type and typology to understand the urban structure. In the seventeenth century, the classification of objects according to their particular and common characteristics played a crucial role in adapting the concept of type to architecture. Type in architecture emphasizes the shared features within the urban fabric and the group of buildings (Panerai & Castex, 1970). Typologically, the building is not regarded as a separate entity, distinct from the other buildings that form the urban fabric. The objective of typology is to examine and define the structural relationship between the part and the whole: to categorize buildings, streets, walls, gardens, or, in other words, all the structural elements within this urban

fabric in relation to the urban form of a particular era (Panerai, 1979). Panerai discusses the analytical typological procedure in three distinct steps: an inventory, a comparison of elements, and a classification of types (Panerai & Castex, 1970). Inventorying is the process of separating the components of an element, which is the analysis phase. The comparison of elements involves the analysis of similarities and differences as well as the identification of factors contributing to change and development. Clustering of types enables the analysis of specific types by focusing on a limited number of patterns that emerge from them (Yücel, 1979).

Typology in architecture pertains to the examination of the classification of certain types of forms, and architectural typologies reveal the structural characteristics of buildings. Conversely, urban morphology studies analyze the city as the habitat for human life, examining its elements, their development and transformation processes, and the social and economic impacts of these changes. The integration of the concepts of typology and morphology in the late 20th century has resulted in the development of a new and comprehensive framework for describing urban space, known as typomorphology (Moudon, 1994).

Typomorphology

According to Moudon (1994), typomorphological studies comprise typological and morphological methods to define the urban form based on the typological classification revealed by buildings and open spaces. The studies deal with all scales of the built environment, from a small room or garden to a large urban area. It describes the urban form as a dynamic structure, constantly changing between those who produce it and those who use it. In this respect, typomorphology provides a basis for examining the nature of building design and its relationship with the city and the society in which it exists.

Traditions: Determining the Typomorphological Approach

Typomorphological schools have developed different approaches to understanding the built landscape. These schools propose a methodology to explore the production and construction of cities, anticipating changes, transformations, and developments in design and planning. An examination of the studies carried out reveals three distinct schools: Italian, English, and French.

- ### Italian School: Muratori and Caniggia

Typomorphological studies were introduced in Italy in the 1940s by Gianfranco Ganiggia and his followers under the guidance of Saverio Muratori. Italian morphological studies seek harmony between the old and the new. Researchers carry out typological studies to examine the relationship between the modern approaches that emerged in the urban form before and after the industrial period (Marzot, 2002).

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Saverio Muratori argues that the foundations of architecture lie not in the fantastic products of modernism but in the continuous tradition of city-building from antiquity to the 1930s. (Moudon, 1994). In his work, Muratori treats the formation and development of the city as the result of cultural behavior, criticizing the laws that define them as natural and the modern urban sciences that handle urban design as a technical subject (Marzot, 2002). He regards building typology as the basis for urban analysis and asserts that cities' structures can only be perceptible by analyzing their historical development. According to Muratori, type is an a priori synthesizing concept and an active organism associated with a specific time or historical period and place. Type is an internal structure that unites disparate elements and an energetic, dynamic link that reveals one element's relationship to another. A type is the creative basis of a process, remaining constant while the "shaping form" changes; it is collective formation and expression (Menghini, 2002).

Caniggia does not document the historical progression of the city's development, yet his work imparts the fundamental principles that form the city. Caniggia states that the human environment consists of interrelated *built objects* and is classified into four scales: the building, the group of buildings, the city, and the region. Each object, the living entity itself, is depicted as a complex, interconnected entity composed of elements, structures, systems, and organisms. These objects form the built environment, which is also an organism (Moudon, 1994).

Caniggia clarifies that cities are not a completed entity, but an evolving process formed by the gradual juxtaposition of many small elements. Analyzing the alteration of the type in time and space leads to an understanding of the formation and transformation of cities. According to Caniggia, the establishment of "procedural typologies" constitutes a basis for understanding the construction, design, and architecture of cities. Type is defined as the conceptual presence of an element in the form of cultural experience, apart from its physical or phenomenological existence. Its volumetric characteristics, position in relation to the street, and solar orientation determine a base type. This base type is later re-evaluated for transformations and adaptations over time. Therefore, type is described in terms of its formal concepts, correspondence with the scales above and below it, and its historical evolution (Moudon, 1994).

- **England: Urban Morphology and Conzenian Tradition**

M.R.G. Conzen, a prominent figure in the development of urban morphology in England, primarily focused his research on town plan reading. He defined this method in three stages (Moudon, 1994; Whitehand, 2001):

a. *"Town or ground plan:"* a two-dimensional cartographic depiction of the physical layout, including streets, parcels, and building plots.

b. *''Building fabric:''* consisting of buildings and their related open spaces.

c. *''Pattern of land and building utilization:''* comprehensive analysis of land utilization.

The methodology of *''town plan analysis''* entails the identification of three primary elements of the town plan. These are the streets, the parcels, and the buildings. The parcel, which serves as the organizational structure for the urban form, is considered the primary unit of study in town plan analysis. Conzen clarifies the composite situation that arises from the amalgamation of different units, referred to as *"plan units,"* across various areas in the city. These are often observed in different variations of street, parcel, and building size and form, indicating disparities in the socio-economic origins of the settlements as well as buildings from different periods. These units have a role in the stratification of the townscape (Moudon, 1994).
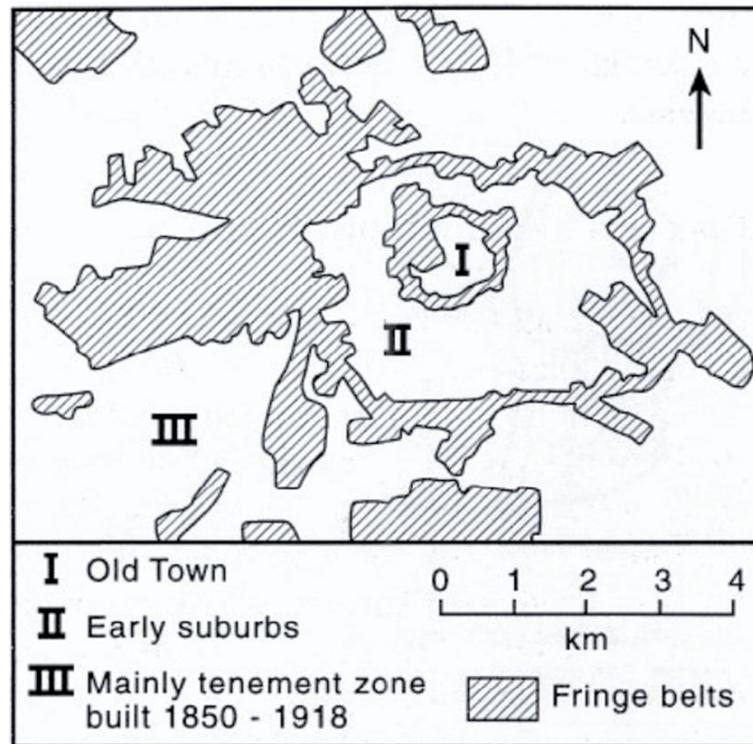

Figure 2. Inner Berlin fringe belt (H. Louis study) (Whitehand, 2001).

Conzen (1960) made significant contributions to the field of urban morphology by introducing two key concepts: the *"urban fringe belt"* and the *"burgage cycle."* *Urban fringe belts* (Figure 2) tend to emerge during periods when there are no built-up areas on the urban periphery or when they grow very slowly. Herbert Louis, a German geographer and one of Conzen's pioneers, observed the uneven growth of urban areas toward the periphery. In two of his earliest studies of the urban fringe belts in Berlin, he noted that the city walls, referred to as the *"fixation line"* by Conzen, were the primary impediment to the city's expansion. Urban fringe belts mostly consist of green open areas, encompassing parks, sports fields, and public buildings. Typically, these

plans have relatively expansive plots, fewer hard surfaces, and minimal road crossings (Whitehand, 2007).

The burgage cycle involves the progressive occupation and subsequent removal of plots and backyards through the construction of buildings, referred to as the 'urban fallow' phase, followed by their re-entry into the development cycle (Figure 3; Figure 4). Increased construction activities within the city and evolving functional demands led to the expansion of buildings on the parcel. However, various factors, such as economic crises, new zoning regulations, natural disasters, and wars, cause the number of buildings to decrease (Whitehand, 2007).
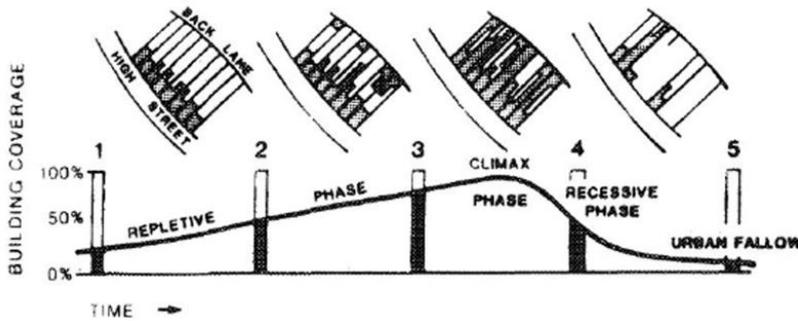
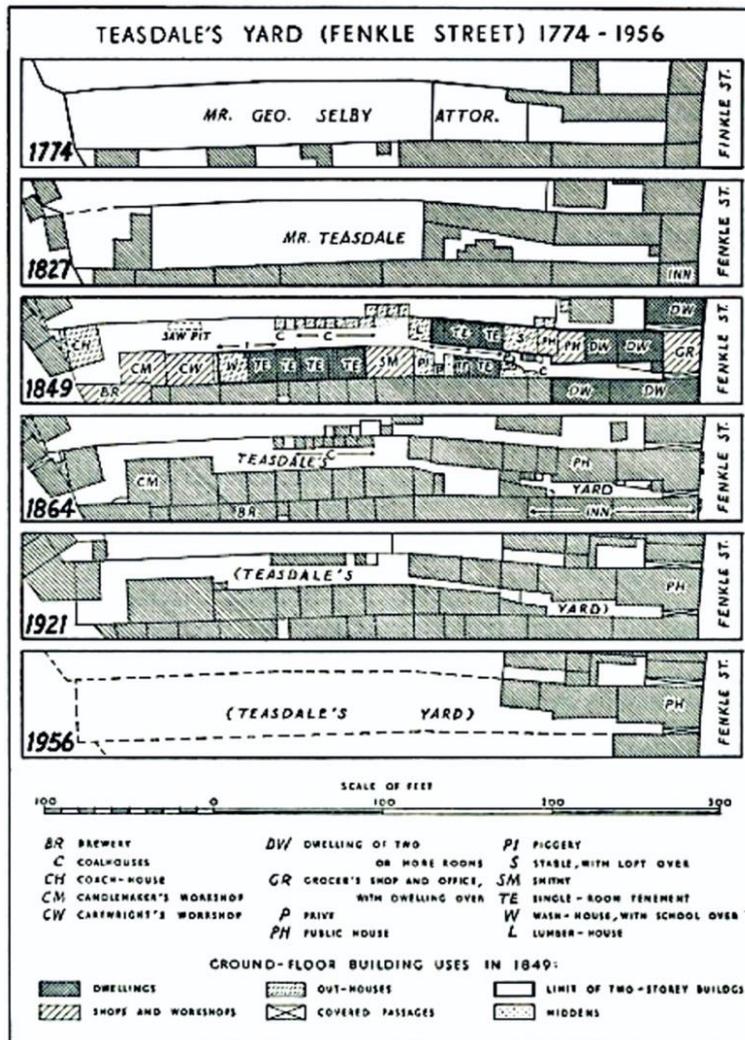**Figure 3.** Burgage cycle phases (Larkham & Jones, 1991).

Figure 4. Conzen's Alnwick Town Fenkle Street Teasdale Garden burgage cycle study (Conzen, 1960).

- **France: Versailles School of Architecture**

The Versailles School of Architecture was established following the institutional reform resulting from the student and worker rebellions in 1968. Aligned with Muratori's philosophical perspective, the school asserts that the modernist movement has caused a break with the past and argues that the roots of architecture should be sought in traditions. In Italy and the UK, the debate is between architects and geographers, but in France, a collaborative effort is being undertaken by sociologists, historians, geographers, and planners in conjunction with architects to cultivate a more sophisticated understanding of the city (Moudon, 1994).

Panerai, an outstanding member of the Versailles School, authored analytical works in which he expounded upon his perspectives on the examination of the city and its surroundings. His approach was like those of the English and Italian schools, and he advocated for expressing detailed observations beyond the main topics (Gürer, 2016). In his urban analyses, Panerai identifies four main categories, including *the typology of elements*, *urban growth*, *the articulation of urban space*, and *triangulation and legibility*. *The typology of elements* mentions the terms "type" and "typology" and examines the four-stage typological method for determining the typology. These are the categories of *typology of buildings* and *typology of unstructured spaces and other arrangements*. Cities, as living organisms, are constantly changing and progressing, resulting in *urban growth*. Panerai examined this category by segmenting it into three subheadings: *types of growth*, *limits of growth,* and *crossing the limit*. It is significant to understand the urban form within the context of its constituent elements and their interrelationship in unity. Panerai developed two sub-categories for the *articulation of urban space*. The *hierarchy*, consisting of private, daily, and urban levels, determines the organization of the elements that make up the city, while the *overlay* determines the relationship between these levels through various elements in cases where the organization's interpretation is unclear. Under the heading of *triangulation and legibility*, the author initially referred to Kevin Lynch's book *The Image of the City* (2012), stressing the significance of examining the urban landscape as a whole and along a route identifying visually perceived urban images. Panerai defined monuments as discrete elements, drawing attention from Aldo Rossi in *The Architecture of the City* (2006), and stated that they should be interpreted in terms of their relationship with the entire city and urban fabric (Panerai & Castex, 1970).

INTEGRATION OF TYPOMORPHOLOGY INTO ARCHITECTURAL AND URBAN DESIGN EDUCATION

In architectural design education, it is significant to combine typomorphological knowledge with the experience of design practice. Scientific research investigates the methods of integrating this knowledge into architectural and urban design education, identifying

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the sequence of subjects to be taught to students and the most effective teaching approaches (Oliveira, 2018b). In this context, the studies of Kropf (2018), Oliveira (2018a), Hayward and Samuels (2018), and Maretto (2018) were examined.

Karl Kropf: ''The Design for Conservation''

In his lecture *"Design for Conservation,"* Kropf (2018) discussed the integration of urban morphology knowledge into education and the role of these principles in the design process.

This course examines the process of adapting new developments in historic environments to the site and protecting particular areas within the settlement, rather than individual buildings or artifacts. Within this framework, the course attempts to clarify to students the distinction between "looking" and "making," i.e., between describing the historical process and physical form of the built environment and creating new developments. The primary objective is to impart knowledge on urban morphology using design and objectify its abstract principles rather than solely teaching design. The course consists of four modules, namely *introduction*, *analysis*, *design guidance and critique* and *design proposal* (Figure 5)*. At the beginning of the semester, the course content is introduced to the students to facilitate their comprehension of the subject matter. Students concurrently carry out their individual work alongside the presentations and training sessions. In the midterm, students are required to provide a brief presentation, followed by the submission of their work in their final report at the end (Kropf, 2018).

In the first and second weeks, the *introduction* section encompasses a design activity, the presentation of case studies, information about the basic concepts (*natural environment*, *built form*, *use*, *control*, *intention*, *construction*, *perception*, *development and evolution*, and *flows of materials and resources*), and an organization of field visits to local settlements (Kropf, 2018).

From weeks three to six, in the *analysis*, the instructor explains fundamental morphological concepts and provides information about the analysis methods through presentations, including graphic visuals. Throughout this process, students analyze the environment and give interim presentations. In the lectures, *''historical development and map sequencing, route structure analysis, urban tissue analysis, land use analysis, and townscape analysis''* are explained verbally and with visual examples as the basic techniques of desktop analysis. According to him, the field trip is the initial and most substantial part of the analysis. With predetermined walking routes and systematic recordings, the place can be better perceived through the senses, its characteristics and elements can be identified, and the desktop analysis made in the same process can be checked and improved. Following the completion of their desktop analysis, students present their conclusions and findings to the class at the midterm (Kropf, 2018).

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Subsections	Contents and delivery of the lessons
	The module runs for 12 weeks and focuses on the design of new development in the historic environment and the principles of area-based historic conservation
1. Introduction (weeks 1–2)	Delivery: Short initial design exercise; illustrated lectures focusing on general principles and ways of thinking about design and conservation; coursework project brief introduced, example coursework made available (learning by example); walking tour of local settlement
2. Analysis (weeks 3–6)	Delivery: Illustrated lectures on basic morphological concepts and analytical methods: including demonstrations of graphic methods Student coursework: information gathering, mapping, desktop analysis and field surveys; interim presentation of results
3. Design guidance and critique (weeks 7–10)	Delivery: Illustrated guest lecture given by working Conservation Officer focusing on issues raised in practice on current projects; illustrated lectures on writing and presenting design guidance. Open discussion of examples of new development in historic environments. One-to-one tutorial sessions and parallel open studio for peer-to-peer learning Student coursework: formulate guidance, focusing on exercising judgement to select the elements and features that are most important to the character and identity of the place while allowing for growth and change in response to changing needs; illustrate guidance with maps, images, text, dimensions and diagrams; undertake design critique with reference to analysis and guidance
4. Design proposal (weeks 11–12)	Delivery: Illustrated guest lecture given by working property developer focusing on issues raised in getting consent for building in a conservation area; illustrated lectures focusing on the historical context for current principles of urban design and compositional principles of architecture and the central principle of abstraction; Open discussion of designs selected and introduced by students Student coursework: generate and present a design project (ideally of the site subject to the critique); compile coursework into a project document using a range of methods including text, images, maps, tables, diagrams

Figure 5. The program for the *Design for Conservation* course (Kropf, 2018).

During weeks seven and ten, *Design Guidance and Critique* includes a presentation by a conservation specialist about contemporary concerns, information on writing and presenting design guidance, and discussions on recent developments in the historic environment. The lectures, field trips, and presentations aim to enable students to develop an idea of what they feel and think about the built environment and to gain the ability to communicate their design with their "why." The purpose of the design guide is to provide a holistic expression of the existing positive characteristics of the area, particularly its historical character and the qualities that sustain activity and vitality. Students critique the consequences of change and transformation that result from the removal of some elements and the introduction of new designs within the existing identity (Kropf, 2018).

In the *Design Proposal* (weeks 11 and 12), the developer presents the issues that arise in the process of seeking permission for a building in a conservation area. Visuals support the lectures, which focus on the historical context of current urban design principles, the compositional principles of architecture, and the main principles of abstraction. Additionally, students hold discussions on the designs they have prepared. Students develop and present a new design project that aims to make modifications and transformations based on the design guide and critique they have formulated and concurrently produce a project

document incorporating various visual elements such as text, visuals, maps, tables, and diagrams (Kropf, 2018).

Vitor Oliveira: ''Urban Morphology''

Oliveira (2018a) conducts *''Urban Morphology''*-titled trainings as a lecture or workshop at multiple universities in Portugal, Brazil, China, and Spain. The course consists of seven chapters titled *Introduction and the Elements of Urban Form, The Agents and Processes of Urban Transformation, Cities in History, Contemporary Cities, The Study of Urban Form: Different Approaches, From Theory to Practice,* and *Relationships with Other Fields of Knowledge* (Figure 6).

	Contents
Introduction and The elements of urban form	**Lesson 1** 1.1. Introduction 1.2. The Elements of urban form: the urban tissue, the natural context, the street system, the plot system, the building's system
	Lesson 2 1.2. The elements of urban form
The agents and processes of urban transformation	**Lesson 3** 3.1. Agents of change: developers, architects, builders, local authority planning officers, local politicians
	Lesson 4 Processes of urban transformation: plans in the nineteenth century, plans in the first half of the twentieth century, plans in the second half of the twentieth century; plan implementation and development control
Cities in history	**Lesson 5** The early cities: Sumerian, Chinese The Greek cities The Roman cities
	Lesson 6 The Islamic cities The Medieval cities The Renaissance cities The nineteenth century cities
Contemporary cities	**Lesson 7** Contemporary cities in Africa, america, Asia, Europe and Ocenia
	Lesson 8 One contemporary city
The study of urban form: different approaches	**Lesson 9** Classics in urban morphology and in urban studies
	Ders 10 Historico-geographical approach Process-typological approach
	Lesson 11 Space syntax Spatial analysis
From Theory to practice	**Lesson 12** Urban morphology and planning
	Lesson 13 Urban morphology, building typology and architecture
Relationships with other fields of knowledge	**Lesson 14** Urban morphology and society (Public health, social justice) Urban morphology and economy (heritage tourism) Urban morphology and environment (climate change, energy)
Conclusion	**Lesson 15** Conclusion and students feedback

Figure 6. Syllabus of *urban morphology* (Oliveira, 2018a).

The lectures are delivered through the utilization of visual slides, enriched with interactive questions and discussions, and supported by supplementary resources such as books, articles, applications, films, and websites. The initial part of the course focuses on the *city's object*, extending until the ninth lesson, then on the *researcher's identification and explanation*, and also on the ability to articulate the physical form of cities. Oliveira outlined the objectives of the Urban Morphology course in four points:
• Understanding urban morphology as a method for examining the city's physical form requires the recognition of the agents and their processes operative in shaping that form.

- Recognizing and evaluating the diversity of urban form in fabrics from different time periods and regions.
- Introducing students to the concepts and techniques used in the analysis of urban form.
- Understanding the physical dimension of the cities (Oliveira, 2018a).

The first lecture, *"Introduction and the Elements of Urban Form,"* provided a definition of the fundamental components of urban form, namely the natural environment, public space, plot, and buildings, encompassing streets and squares, using examples from diverse urban fabrics found in various cities. The second lecture involves carrying out an exercise[1] created by Oliveira and Perdicoulis, which is designed as a computer-based application. In the exercise, a study area is given to the students. At first, the students only receive topography as data, while in the second stage, topography and the road system are provided. The initial student offers a new urban element to the field using these data. Following this, every student adds an urban element, taking into account the addition of the preceding student. This exercise seeks to balance and alter the emphasis on the building element in architectural education, underscore the importance of the street element in the city-building process, and demonstrate that the city is the result of collective work (Oliveira, 2018a).

The third lecture in the *''Actors and Processes of Urban Transformation''* explains how each agent, including architects, civil engineers, planners, and elected politicians, who effectively transform the urban fabric, particularly the built environment, participates in the process, how they fulfill their own goals, why they set these goals, and how they interact with each other. In the context of understanding urban transformation processes, the fourth lecture provides information on how residents should act collectively to create a balance between the planned and spontaneously built appearance of the city. The presentation of planning approaches analyzes three different periods: the 19th century, the first half of the 20th century, and the second half of the 20th century (Oliveira, 2018a).

The fifth and sixth lectures, entitled *''Cities in History,''* describe the development of cities across seven different historical periods. The objective of these two lectures is to get an understanding of the main characteristics of the urban form elements in the new period, the manner in which these elements come together to form various urban structures in different urban fabrics, and the elements that have undergone transformation and preservation over an extended period (Oliveira, 2018a).

''Contemporary Cities,'' the seventh and eighth lectures, focus on forthcoming trends, explore diversity, and caution against the homogenization and globalization of urban environments. The seventh lecture examines the physical structure of cities, with a particular emphasis on emerging urban forms. It explores the agents and processes that shape these forms, how the newly developed types of

[1] Oliveira describes it as a "game". In the article, it is translated as "exercise".

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urban form harmonize with the existing urban fabrics, which urban fabrics are being displaced by new formations, and the main differences in urban form in the diverse fabrics. In the eighth course, students present information about street typology, building blocks, plot structure, building typology, plot/building relationships, and street/building relationships of a place where they have resided, studied, worked, or experienced, that is, the main morphological characteristics (Oliveira, 2018a).

''The Study of Urban Form: Different Approaches,'' lectures nine, ten, and eleven, cover various approaches to studying urban fabric. The ninth lecture provides an introduction to classical works in the field of urban morphology and studies, while the tenth lecture discusses historico-geographical and process-typological approaches. The former provides Conzen's analysis of the urban landscape, town plan, building typology, land, and building utilization. The works of Whitehand are also examined. The process-typological approach discusses Muratori's type, urban tissue, organism and operative history, and the research and applications of Caniggia. Additionally, the 11th lecture introduces the syntax of space and the analysis of space (Oliveira, 2018a).

''From Theory to Practice,'' the 12th lecture, aims to provide an understanding of the potential contribution of urban morphology to planning practice. The lecture examines numerous examples within this theoretical framework. Lecture 13 explains the relationship between urban morphology, building typology, and architecture through the examples of the ENPAS building in Bologna, which focuses on form, structure, and tectonic perception in the context of a typological approach, and the Tate Britain building in London, which focuses on space in the context of spatial syntax (Oliveira, 2018a).

Lecture 14, titled *"Relationships with Other Fields of Knowledge,"* comprises three distinct subparts that offer insights into the social, economic, and environmental aspects of urban morphology. The social dimension explains strategies for enhancing the relationship between urban morphology, public health, and social justice. The economic dimension focuses on heritage tourism. The environmental dimension emphasizes issues related to climate change and energy (Oliveira, 2018a).

At the end of the course, Oliveira summarizes the main points covered in the lectures and presents them as a conclusion. Finally, he obtains feedback from the students via an anonymous questionnaire and uses this data to improve the course content in subsequent processes (Oliveira, 2018a).

Richard Hayward and Ivor Samuels: JCUD

Hayward and Samuels (2018) outlined how urban morphology concepts are used as a design tool in urban tissue in lectures examining the analysis and design proposals for large-scale housing projects as part of master's courses at various universities. According to them,

having students from diverse educational backgrounds contributed positively to the course content but created difficulties in the residential layout design.

They emphasized that architecture students should concentrate on building groups related to public and private spaces rather than individual buildings. It is crucial to consider physical environmental data, topography, infrastructure layout, and socio-economic context when designing residential areas to achieve more appropriate outcomes (Hayward & Samuels, 2018).

The course consists of 10 lectures, each lasting three hours (Figure 7). These ten lectures can be completed within a week, with two lectures every day over a period of five weeks or one lecture per week over a span of ten weeks. The *urban tissue* concept, as defined by Conzen as the *"plan unit"* including street, plot, and building elements and by Caniggia and Maffei as the *"tessuto urbano"* encompassing streets, pertinent strips, lots, buildings, rooms, structures, and materials (Kropf, 2014), is used as a design tool throughout the course. They defined tissue as the essence of past schemes and their application to new contexts (Hayward & Samuels, 2018).

Module 1	An introduction to tissues and types and the qualities of diverse examples, and the manner in which they may be used to establish the development capacity of a site utilising the inherent qualities of the tissue
Module 2	A field visit to a suitable urban area focussing on varied tissues used in relative proximity, concluding with a discussion and recording of observations from the student cohort and the tutor
Module 3	A first tissue workshop in groups of 3 or 5, progressing to the preparation and presentation of the first two stages of the process, recording the observations of the cohort and tutor
Module 4	In this module, the students are required to complete the final stage of applying the tissue and to measure and record all aspects of the 'design' achieved, including density, mix, and key design and site characteristics
Module 5	In this module, the students are disbursed to urban study areas in groups to review further examples of tissue, identified from a teaching list, or from personal knowledge and recorded photographically and infield drawings
Module 6	Groups agree their findings from the self-guided field work in Module 5 and apply one tissue to one site provided by the tutor to the final stage, recording outcomes as they previously have done so in Module 4
Module 7	Students are introduced to the process of using simple software to judge the financial viability of tissue-based development proposals; each group runs the software for one of the tissue studies that they have completed
Module 8	The students are offered a range of related topics from which to choose to make a 5-minute presentation for Module 9 (depending on the number of groups, these presentations may be done in sub-groups, with a plenary at the end)
Module 9	Following on from the group topic presentations set at the end of Module 8, and a plenary discussion the tutor will draw together themes from the work of the 9 Modules
Module 10	The tutor will make a presentation on developments in the use of tissues and the value of the process as a means of applying morphological study to design. The module and course will conclude with a review discussion of the learning outcomes and manner in which the programme may be further developed to maximise learning from exemplary types and tissues

Figure 7. The content of the course (Hayward & Samuels, 2018).

The workshop emphasizes the importance of analyzing the relationship between the tissue and the site rather than quickly introducing a new design process. During the first stage, it is expected from the student groups to map the connections, actual or potential routes existing at the site and to document the observed outcomes and corresponding discussions in written form on the plans. During the second stage, students propose and debate minor modifications to

create a more practical plan that remains compatible with the existing tissue. During the final step, students summarize their previous work on-site requirements and development and discuss the feasibility of the proposed plan, suggesting modifications to the tissue to achieve a transformation and design that aligns most effectively with the group's objectives for the study area. Five points summarize the criteria critical at each stage of the process (Hayward & Samuels, 2018):

- Determining the characteristics of the tissue and site as a group and adding the acquired data to the drawings,
- Changing the fabric as little as possible and documenting the rationale behind each modification while consistently remembering that the fabrics serve as identifiers for the strengths, weaknesses, opportunities, and threats posed by the different tissues in the sites.
- Allocating an adequate amount of time for the tissue study and then utilizing the majority of the tissue in the design phase,
- When proposing modifications to the tissue, document the specific changes made and the underlying reasons for them, and
- Rather than focusing on the known and unknown aspects of the selected tissues, the characteristics they reveal are understood and conveyed by the students' groups.

According to Hayward and Samuels (2018), the evolution of design possibilities realized by the tissues contributes to the following points:

- To highlight the importance of comprehending the built form within tissues across various contexts,
- Encouraging students to become ''reflective practitioners'',
- The information acquired through individual field trips yields more accurate outcomes compared to accessible hand drawings or computer-generated data related to the study area.

Marco Maretto: Urban Morphology Education in the Framework of Sustainability

Maretto (2018) discusses the urban morphology approach from a sustainability perspective. He stated that technology and energy performance are the subject of sustainability in architecture, but not the architectural culture, and in this regard, he mentioned the concept of ''*authenticity*'' as an essential aspect of sustainability. He pointed out that a structure needs to be built according to environmental data (climate, materials, etc.) and should be ''*authentic*[2]'' by meeting the social and cultural needs of the community in which it is built.

Maretto (2018) stated that urban morphology can be used as a method in the design process with a sustainable perspective, citing the following reasons:

- The morphological analysis of the urban fabric provides an authentic understanding of the physical structure of the environment, the reasons for the transformations taking place, and the interventions to be undertaken in these transformations.

[2] The *"authenticity"* of a structure depends on the fact that it is recognized by the society that builds it, that the culture of that society forms an identity with it, and that the technology of that culture can reproduce and develop it (Maretto, 2018).

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- As a tool, urban morphology can combine sustainability approaches with cultural, social, urban, and formal aspects of urban design and architecture.
- Between the macro and micro levels of urbanization, urban morphology can offer the *"social-building neighborhood"*, including physical (from building to neighborhood scale) and social (from family to community) elements, as a basic approach for sustainable urban planning. The social-building neighborhood is considered to have a substantial role in sustainable urban planning due to its ability to bring together the plurality of elements specific to the urban fabric and the desire for unity specific to living spaces in contemporary cities with many co-features of residential activities such as kindergartens, work areas, sports facilities, etc.

Workshops in Architecture and Urban Morphology (W.A.M.), held in many different cities since 2013, teach concepts and tools while student groups create designs at a realistic case site. The workshop consists of three phases (Figure 8):

1. In the methodological part, students learn the basic concepts of urban morphology (polarity, route, fabric, hierarchy, nodality, and social-building neighborhood)[3] and integrate them into the structural reading of the study area.

2. They confirm their structural reading through field studies and form the main framework of the design project.

3. The final stage concentrates on the environment's design and the urban design project's development (Maretto, 2018).

[3] Guiseppa Strappa's (1998) article, "The concept of enclosure in the creation of distinctive building types" provides additional insight into these principles.

Stages	Weeks, lessons, contents, products
1. Methodological	It is held in 12 weeks It is devoted to the learning of the basic morphological tools and the main software for the environmental analysis/design It is organized in theoretical lessons and practise laboratories At the end of the stage, MSc students will provide a basic morphological map, a first nodality survey and the environmental analysis of the design context First evaluation step
2. In-the-field workshop	It is held in one week MSc students verify the analyses previously developed and prepare a basic morphological master plan Together with the hosting institution, it is structured in a number of lessons and a continuative (24 h) laboratory activity At the end, students will present their work to a jury that will examine and evaluate their tasks Second evaluation step
3. Environmental design and urban project	It is held in 16 weeks It is entirely dedicated to the urban and environmental design MSc students provide a detailed master plan (accompanied by a complete morphological map, a nodality survey and the environmental analysis) They will have to deliver a number of accurate panels and an overall model Final evaluation step

Figure 8. The content of W.A.M. (Maretto, 2018).

In the workshop, students prepare a context morphological map, which serves as a base for entering the beneficial functional data of the physical context, and then conduct a nodality analysis. Using the context morphological map as a base, the next step involves creating a context functional map. These two maps make it possible to prepare a

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morphological master plan, which contains the initial morphological and functional elements and forms the basis of the urban design project. The context morphological map supports the morphological master plan throughout the process to evaluate the morphological consistency of the new interventions. By carrying out environmental analysis on the prepared morphological master plan, the data is transformed into an urban master plan. As a result, a morphological, functional, architectural, and environmentally aware urban master plan is revealed as a design product capable of supporting the complexities of the contemporary city and preserving the "place-making" feature (Maretto, 2018).

CONCLUSIONS AND RECOMMENDATIONS

It is crucial to integrate typomorphology approaches into education in the fields of urban design, planning, architecture, and conservation, which have interrelated practical applications (Barke, 2018). In Italy (Maretto, 2015), Spain (Ruiz-Apilánez et al., 2015), the United States, and probably elsewhere in the world (McClure, 2014), few schools of architecture consider typomorphological research as a scientific instrument for architectural and urban design and integrate it into the educational system.

Two different conclusions were drawn from the four studies analyzed in the section ''Integration of Typomorphology into Architectural and Urban Design Education''. The former are the concepts and issues related to the different dimensions of urban form taught to students in typomorphology education and analyzed in the design process. The latter is the contribution of the course to the students and their architectural design process.

Currently, there are uncertainties regarding the content of basic theories, concepts, and techniques and how to teach them to students in design education based on a typomorphological approach (Oliveira, 2018a). After analyzing the four studies, *Table 1* was created to present the initial findings. It lists a comparison of different concepts, issues, and analysis techniques addressed in the variously shaped education models, with the researcher responsible for each marked. Researchers commonly include the following items in their courses: identity/character, type, typology, hierarchy, natural environment data, urban fabric, street, building block, parcel, building, use and movement, perception of the environment, and historical development and transformation of the city. The provided table can be used as an example for transferring content to students and for analysis when introducing the typomorphological approach in a course construct.

Table 1. The concepts, issues, and analysis techniques related to different dimensions of urban form in urban morphology and typomorphology courses.

Concepts/Subjects		Karl Kropf	Vitor Oliveira	Richard Hayward & Ivor Samuels	MarcoMaretto
Identity/Character		x	x	x	x
Type		x	x	x	x
Typology		x	x	x	x
Hierarchy		x	x	x	x
Sustainability					x
Authentic-authenticity					x
Pole-polarity					x
Node-nodality					x
Social-building neighborhood					x
Natural environment*		x	x	x	x
	Topography		x		
	Climate				x
Built Environment	Urban fabric	x	x	x	x
	Streets/Routes	x	x	x	x
	Plot series/Blocks	x		x	x
	Plots	x	x	x	x
	Buildings	x	x	x	x
	Rooms	x	x		
	Structures	x	x		
	Materials	x		x	x
Human-form relations	Use/movement	x	x	x	x
	Control	x			
	Intention	x			
	Construction	x			
	Perception	x	x	x	
Urban historical development and evoluation		x	x	x	x
Flows of materials and resources		x			
The agents of urban transformation			x		
Cities in history & contemporary cities			x		
Classics in urban morphology/urban studies			x		
Different approaches	Historico-geographical approach		x		
	Process-typological approach		x		
	Space syntax		x		
	Spatial analysis		x		
Urban morphology and society (public health, social justice)			x		
Urban morphology and economy (heritage tourism)			x		
Urban morphology and environment (climate change, energy)			x		
Context morphological map					x
Context functional map					x
Urban master plan					x

* In the articles explaining the information transferred to the students within the scope of typomorphology education, they mentioned only the natural environment. The concepts specifically mentioned under the term natural environment have been added under the title of natural environment.
1) Kropf (2018) stated in his article that natural environmental data are mentioned in education. Kropf (2017) mentioned geology, minerals and soils, topography, water resources (including groundwater), plant and animal communities, and climate within the scope of natural environmental data in his book "The Handbook of Urban Morphology".
2) Oliveira (2018a) mentioned in his article that he explained natural environment data within the scope of education. Oliveira (2016) stated that in his book "The Elements of Urban Form", land reliefs, soil and subsoil quality and suitability, climate, wind and solar effects, and topography are analyzed as natural environmental data.
3) Maretto (2018) evaluated as part of the environmental analysis: Distribution analysis of luminous contributions and albedo values using solar axonometry and three-dimensional block diagrams, climate, and microclimate analysis (average temperature and wind profiles), irradiance profile analysis, and solar axonometry.
Within the microclimate analysis: thermal comfort, radiation components, wind components, and visual comfort.
Analysis of wind components: Outdoor space dimensions, wind speed at two meters height, height of adjacent buildings, wind.

As a second outcome, this text lists the contributions that the integration of typomorphological knowledge into architectural design education is believed to make to students and their architectural design education. The envisaged contributions to students are as follows:
- Comprehend typomorphology as an alternative approach within contextual analysis methods.
- Understand that analyzing the context is just as important as creating a new design.
- Understand and interpret the basic concepts of urban fabric conveniently because of the information learned in the design process.
- Strengthen their theoretical and literary bases.

- Gain awareness by reading and understanding the urban fabric (characteristic features, historical character, potentials, problems, etc.).
- Recognize the significance of groups of buildings and their connection to public spaces in the design process, rather than focusing on individual buildings.
- Be more conscious and systematic in the analysis process.
- Observe more consciously during field trips, see what they look at, evaluate what they see, and develop their ability to transfer these evaluations into design proposals.
- Develop the ability to justify the solutions they present in their design proposals and explain them to the other participants.
- Understand the place's identity, local culture, and values, which support Maretto's (2018) "authenticity" approach in the context of cultural sustainability, to provide more applicable proposals for interventions in the built environment.
- Produce designs quickly, consistent with the urban fabric, with less guidance in deciding new design proposals.

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Resume

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