Prioritization of Housing Typology Criteria in Sabzevar City[1]

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ABSTRACT

This study tried to find typological criteria at the building scale and for housing specifically. In this study type and typology have been analyzed into the etymological origin and architectural origin. Firstly four developing stages based on methodological and historical interpretation have been analyzed; Rationalist philosophy of the enlightenment, Modernist ideology, Neo-rationalism after the 1960s, and the last relates to Neo-traditionalism. After that, the problem of modern discontinuity and morphology as a cure for temporal chaos of types has been analyzed. Secondly, practical schools of morphology, type, and typology have been reviewed into three categories of British, Italian, and French schools. Thirdly it has been a comparison between British and Italian schools as well as the Conzenian and Caniggian approaches to typology. After that typology at the architectural and building scale has been analyzed and discussed, then typological criteria at the building scale have been concluded and discussed. Finally, typological criteria for Sabzevar houses have been compiled into five categories: outline, arrangement, building layout, building façade, and building material. The research method is based on the documentary research method. 45 sub-criteria have been selected from the literature review in general, and with the Delphi method, 15 sub-criteria have been extracted from them. Questionnaires were distributed among 10 experts through the snowball method. Typological criteria for Sabzervar's housing have been studied for the first time in this study and it is never been dealt with anywhere before. Therefore in this study housing typology criteria have been compiled and prioritize at building scale for the first time in Sabzevar city.

Keywords: *Criteria, Type, Typology, House, Sabzevar*

1. Introduction

Today so many countries have faced a globalization crisis, as a consequence cities and settlements are missing their character and physical identity. Physical identity is the city character that must be saved. Mirmoghtadaee (2016) has mentioned three main factors for physical identity; continuity/change, similarity/distinction, and unity/polarity. Today there is a problem with modern discontinuity. The main question of this research is what the criteria of typology for houses at building scale in Sabzevar city are. Urban morphology is a branch of urban studies that deals with the form and structure of a settlement.

It studies complex and intricate types of forms and how different factors set their mark on the whole city. In this way, urban morphology examines the configuration of urban form as well as the relationship between the individual forms and the city as a whole, from the formative years of the city through its subsequent transformations. The word morphology was first used in bioscience to describe form and structure, but now is increasingly being used in geography, architecture, geology, philosophy, and other disciplines. The term urban morphology refers to the study of the physical urban form. The term typology is used to study building types and their typological process.

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[1] This article is taken from MozafarMoghaddam's PhD dissertation entitled "Explaining the continuity of physical identity in the process of evolution of the housing types, case study: Sabzevar city" guided by Dr. Vahid Ahmadi and Dr. Hero Farkisch and advised by Dr. Maryam Ostadi.

Over the past years, articles about morphology and typology have been published in different countries such as nine European countries Spain, Germany, Great Britain, Ireland, Sweden, Poland, and Portugal, two North American countries as the United States and Canada, one Asian country South Korea and one Oceanian country Australia. There was also an article by Kubat on Turkey. There are also so many studies in this field in Iran in the following years. Most of the research done on morphology has been mostly done on an urban scale. Khalagh Doost and Maroofi (1399) in their study analyzed "Hashti" and its different types in different cities in a hot and dry climate such as: Yazd, Isfahan, and Kashan. They categorized "Hashti" into the physical, behavioral, and social fields in their study. Farahbakhsh et al. (1396) in their study categorized the houses of Mashhad (First of Qajar to late Pahlavi) into three types in terms of shape and size of the components, relations, layout, texture, and decoration. Hosseini et. al. (1395) in their study categorized the houses of Arak into three types desert, mountainous, and extrovert in terms of occupancy percentage, number of floors, aspect ratio in building, the ratio of closed space to semi-open space, and number of rooms. There is no research done about typology criteria for houses in Sabzevar city that could be comprehensive about Sabzevar's houses.

This research tried to study typological criteria at the "building" scale and specifically at the "housing" scale for Sabzevar houses. There is not enough knowledge about Sabzevar Houses. If we consider the city as a living being, the skin cells of that city become the dwellings of that city. So the dwellings or houses of each city construct the identity and character of that city. Therefore, studying the types and typology criteria at building scale helps to prevent identity crisis especially at the city like Sabzavar, which there is not any specific data about houses and there is increasing identity crisis especially at housing sector. Today, there is no continuity in housing in Sabzevar so after that, there will be an identity crisis in housing and society in Sabzevar. So to prevent this identity crisis in future it is necessary to make cognition to Sabzevar houses and compile typological criteria for Sabzevar houses. Sabzevar is one of the major cities of Khorasan Razavi province, located in the west of Khorasan, northeast of Iran, on the road from Tehran to Mashhad. In this article, the first literature review has been analyzed, second, the material and methods have been reviewed, and then houses from Sabzevar have been introduced, the thirdly results and discussion and finally conclusion has been analyzed.

2. Literature Review
2.1. Etymological origin of type and typology
The root of the word "Type" can be traced back to the Greek verb typto, meaning "to beat, to hit, to mark" [34]. When we look at the writings of philosophy and the psychology of perception, we see that typos acquire a meaning close to that of "Model". Describing a set of characteristics necessarily present in a group of concrete individuals answering, that is to the type. The Oxford dictionary's definition of type reflects this understanding: "by which something is symbolized or figured, anything having a symbolical signification, a symbol, or emblem" [35].

The term "typology" emerges around the mid-nineteenth century. The term was used to refer to the study of types; the comparative analysis and the classification of scripture types. In paleo-ethnology, typology referred to the study of sets that are recognizable through the coherence determined by the repetition of a single cultural type. In psychology and medicine, psychological and constitutional types are examined, while in sociology the ideal types are being studied and become the ordering principle of inquiries on multiform, concrete socio-cultural organizations. Towards the mid-twentieth century, typological study becomes a basic way of thinking, which enables reciprocal communication between logical-mathematical sciences and social and cultural sciences.

2.2. Architectural origin of type and typology
The concept of type was theoretically articulated following the rational philosophy of the Enlightenment. The historical transformation of type and typology concepts since the Enlightenment has been examined in four developing stages based on methodological and historical interpretation: the first conceptualization developed out of the rationalist philosophy of the Enlightenment, the second relates to the modernist ideology, the third relates to Neo-Rationalism after the 1960s and the last relates to Neo-Traditionalism.

According to architectural historian Anthony Vidler, "like newton in science, like Locke in philosophy, like Rousseau in anthropology", the architect of the Enlightenment looked at the beginning of the shelter as the first type of habitation. Quatremere de Quincy's idea of type was explicitly and systematically theorized for the first time in the history of architecture. Quatremere de Quincy conceptualizes the definition of type based on three concepts: origin, transformation, and invention.

He defines the concept of Type by comparing 'model' and 'type'. He defines 'model' as a mechanical reproduction of an object and 'type' as a metaphorical entity. The model is a form to be copied or imitated: "all is precise and given in the model". Type, on the contrary, is something that can act as a basis for the conception of works, which bear no resemblance to one another: "all is more or less vague in the type" [33]. The architectural 'type' was at once a 'pre-existent germ', origin, and primitive cause [34]. J.N.L. Durand employed the methods of comparative taxonomy for the study of building forms where he enumerated a limited number of inventories of building elements: Pilasters, walls, and foundations, the result was his major work, Receil et parallele des edifices de tout genre, a kind of "typological atlas of architecture" [22].

Modernist ideology is based on the changing social structure and the need for mass production after the post-war era. In this era, the form-making process became equivalent to the mass-production process. The type became standardized: "the pyramid of production from the smallest tool to the most complex machine was now seen as analogous to the link between the column, the house, and the city" [34]. Type in the process of mass production required repetition, type had become a prototype. The main characteristics of the prototype can be summarized as rationality, functionalization, and design control mechanism. Italian architectural historian Gregotti emphasizes the notion of type turning to stereotype by explaining that "a production-oriented model becomes anti-specific and universally applicable and scientifically based" [12].

The Neo-Rationalist theory of type emerged in the late sixties after the decline of modern architecture, intending to emphasize the continuity of form and history against the fragmentation produced by the mechanistic understanding of typology.

According to Moneo, this is the time when typological studies find their most systematic and complex theoretical development [27]. Moneo believes that type is a concept that describes a group of objects characterized by the same formal structure [27]. The very first study based on the Neo-Rationalist theory of type is Muratory's examination of the urban texture of Venice in his work Studies for an Operating Urban History of Venice (1959), in his study, types were explained as the generators of the city and they included in them all the elements that defined all other scales [27].

This theory, the Neo-Rationalist approach, received much more influence with Aldo Rossi and Carlo Argan's interpretations of Quatermere de Quincy's type theory contained in the Encyclopedie Methodique. It has been suggested that Rossi's typological concepts favor the local and autobiographic elements that were neglected by Modernism. The latest development that shares the significance of the Neo-rationalist emphasis on the relationship between the elements and the whole is the Space Syntax approach, which borrows the concepts of 'genotype' and 'phenotype' from the discipline of biology and applies it to social sciences in general and architecture in particular [13].

The neo-traditionalism is connected with both the pieces and the whole. The Neo-Traditionalism seeks a fresh paradigm to guarantee and to order the public realm through individual buildings [30]. Streets, blocks, and buildings are interdependent, and each decision affects the other, just as each block with a specific character determines the appropriate block and street, and each building has a specific quality of the block that surrounds it and the street that surrounds it [31]. The matrix for addressing the totality of street, block and building principles of the Neo-Traditionalism is design-not policy planning-and amounts to an aesthetic position. But this position is not about the definition of style, particularly revivalist style [31].

It can be said that the type theory has evolved into Neo-Rationalism and Neo-Traditionalism. At the center of this theory is the traditional city, emphasizing the natural process of urban growth and emphasizing an unbreakable chain from the continuation of the form of houses to the streets and regions and the city.

Table 1: comparison of four theory of type and typology (Authors)

Type in Enlightenment Theory	Type in Modern Ideology	Type in Neo-Rationalism Theory	Type in Neo-Traditionalism theory
The architects of the enlightenment theory have discussed the origin of first settlements.	Modernism theory about type has been formed based on social revolutions from world war for mass production of building.	Neo-Rationalists persisted on continuity in terms of form and history in response to typology understanding.	Type is the source of historical continuity of cities.

With the emphasis on the relationship between components and the whole, the approach of rationalism for understanding the architecture, suggests morphology and morphological analysis and accordingly forms a continued development of typological studies. Historical and conceptual trends of typological theories have been shown through the following diagram (figure 1).

In figure 1, historical and conceptual trends of each typological theory has been categorized and classified into the following diagram based on the time line. The notion of the type, theorists, and their key theories about type have been classified.

Figure 1: Historical and conceptual trends of typological theories (Authors)
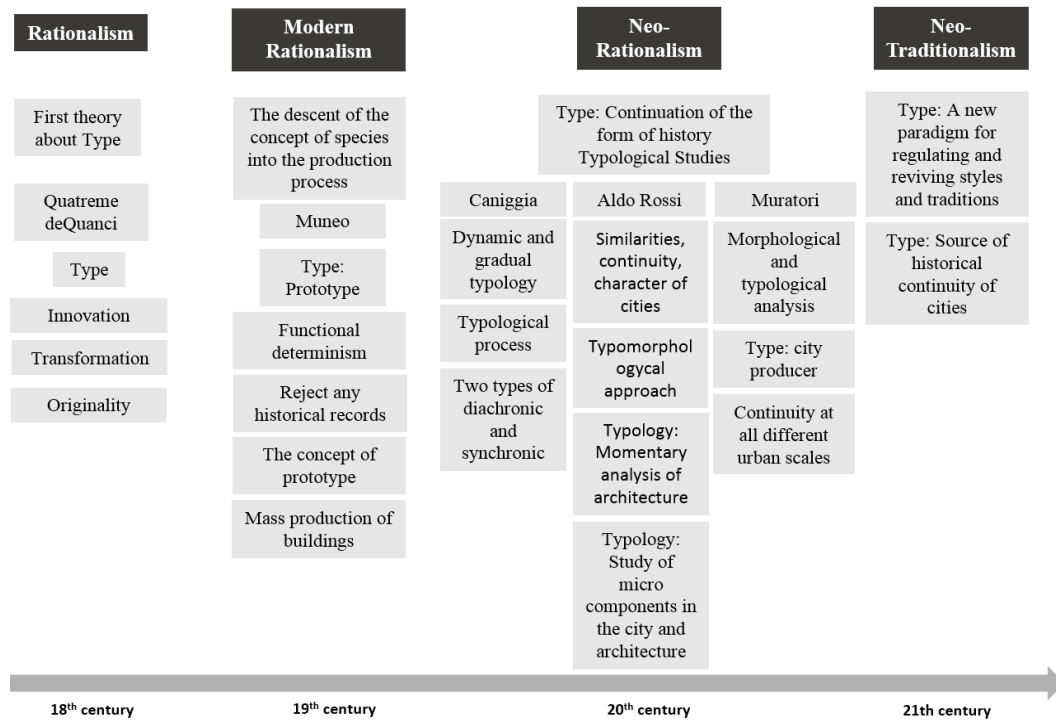
2.3. The problem of modern discontinuity/ Morphology as a cure of temporal chaos of types

Applying historical urban forms in urban planning and design, and architecture can be seen as an approach in contrast with the rapid urban changed that happened during the modern period. The ending of the 19th century led to the development of reforming acts for ideal concepts of cities. Morphologically the physical results of these reforms are tall buildings, hypermarkets, highways and subways, and new formal expressions of monumental buildings.
We can use the word "Mutation" as a metaphor for this process of change.

Naturally, a city might transform from one formal condition to another, but through the modern process, the word "mutation" can be used to explain the conversion. Many elegant works, theoretically and practically, were formed by pioneers of urban morphology, such as Conzen (1960) and members of the Muratorian school [4]. Many projects have been done mainly in Italy based on morphological concepts.

2.4. Practical schools of morphology, type and typology

They have been many studies on typology and urban morphology, Anne Vernez Moudon has categorized them into three main schools: British school, Italian school, and French school [29]. Each of these has its theory, origins, theoreticians, and factors. In the following notes, these schools have been explained.

2.4.1. British School

Moudon identifies this school of thought as British since the major research of this school is done by M.R.G. Conzon. Although he is originally German, he migrated to Britain, and his research is based on his examination of English cities [29]. Conzon focused his studies on England's cities, especially "Alenwick". He called these studies "Townscapes" which are a combination of analyzing a city's map, building form, and function. The city's map includes streets and their relation with the network system, components and their association with blocks, and the outline of blocks [1]. He also established two concepts: "Fringe-Belt" and "Burgage cycle" [26]. With the historic study of urban development, Conzen also introduced "Plan Unit", units that were shaped in different morphologic eras. As each era has its specific circumstance, this segregation is both practical and logical [1]. Conzen's idea was developed by "Whithand" research. The boundaries of urban morphology from geography to urban economy, the study of the relation between a city and its occupants, and dynamic methods of constructing buildings were expanded by him. The British approach represents an idea that claims current urban developments are not completely new incidents; they are the continuation of the previous alternation process [1].

2.4.2. Italian School

Italians were the first who study the precise typology of the urban tissue. Italian schools studied urban morphology before the other two schools. In the 1950s, an Italian architect Muratori started to analyze the typology of houses and their location in the city. He then studied the active history of the city based on what he had created, with the notion that a city is a contextual expression of cultural development [26]. Muratori attempts to create a concept for design based on the traditional procedure of urban construction [28].

Italian school was not only leaded by Muratory's analyses of Venice and Rome, but the role of studies of others such as Cervelatti and Scannavini on Caniggia and also writings and design projects of a generation of Italian architects such as Rossi and Anymonio were significant [1]. This school can be considered as a response to homogenization and standardization of modernism and most of the research in this framework was on types of buildings that are considered as a basis of the creation of urban tissue and the whole city. Caniggia developed the potential in Muratori's definition of building type as an a priori synthesis, and with the typological method, paving the way for a scientific approach to building as a science of the built environment. Caniggia believes that the typology process is a connection between types of buildings and urban fabric that start with an "elementary cell" [23]. Caniggia's study of Como and his initial restoration of Como courtyard houses in the 1960s were as crucial to him as Venice had been to Muratori during the previous decade where he could test directly in the field, on the town's historical tissue, the innovative result of Muratori's conception. This was Caniggia's starting point, utilizing the potential of Muratori's definition of building type, applying it to the city's tissue, and developing Muratori's concepts of an elementary cell. "The group Florentine" is known as the second most academic source of thoughts after Caniggia [4].

2. 4.3. French School

This school appeared in France in late 1960's. Contrary to Italians who achieved their approach towards urban morphology within architecture, French school believed that the accumulations of different fields were effected on urban morphology [1]. French school does not believe in any distinction between "before" and "after", due to examinations of various models and theories. They tends to focus on either urban patterns or urban tissues [1]. French consideration of urban form creation theory is the most significant characteristic of this school. It can be said that the goal of morphological studies in France is the evolution of amount of realism in different theories. It can be said that all of these schools support the bellow three main principles (table 3):

Table 2: The accomplishments of Muratori and Caniggia (Authors)

The accomplishments of Muratori and Caniggia				
	Aims	Strategies	Contents of thought processes	Type of writing
Muratori	To have an overview of the world in an attempt to grasp its historic essence	Adopted schematic methods	Organism Architectural Organism	Difficult to read and sometimes obscure
Caniggia	To understand the nexuses of the process of building transformation on various scale	Avoiding any strict schematic methods	Structure and building type	Always clear and discursive

Table 3: Main Elements of Morphological Studies (authors)

Main elements of morphological studies	
Form	Urban forms are defined with the assist of created spaces, open spaces and activities that occur on them.
Time	Urban forms can only be examined via analyzing of evolutions and transitions which can be taken place through history.
Resolution	Urban form study includes various "resolutions" such as building, section, block, street, city and region.

2.5. British and Italian School

The Conzenian (Historio-Geographical) and Muratorian (Process Typological) approaches to urban morphology are the mainstreams of this field of knowledge. Both of these approaches have a nature of historicity embedded in them. The Conzenian approach shows a chronological approach according to its temporal dimension. Similarly, for the Muratorian approach, Cataldi shows how Muratory reinterprets the old concepts of Italian architectural design to give the continuity of form to his designs. Conzen explains his method based on a great notice of what he calls time-section investigation [6].

He describes the role of time in the process of change in the urban tissue. A town plan of a settlement can be considered as a record of distinctive material residues and understanding the form of a settlement needs a temporal sequential investigation that reveals the way each period embedded its formal components in that town plan. In the process of changing land uses, building fabric and town-plan changes in the order of velocity. During this process one district area, in a certain period, might be representative of all past periods and of the time ongoing change [6].

Table 4: The comparison of similarities and differences between schools ([29]; [1]; [23]; [8], [26])

School	British school	Italian school	French school
Origin	German Morphology	Typology Study	Italian school Ideas of Boudon and Lefebvre
Unit of analysis	Map unit	Basic Cell	Island
Aspect	Current situation with emphasis of alternation procedures	Current situation with consideration of the past	Development of a type of critical design in order to reach the effects of urban design theories
Aim of study	Explanative-descriptive	Prescriptive	Analyzing the design theories of construction of cities in the past
	These studies are more about how and why cities are created.	These studies are more about improving urban designing on the method of construction of cities in the future.	Critical designing
Scholars	Larkham, Conzon, Whitehand	Muratory, Caniggia	Paneri, Castex

The concept of "operative history" suggested by Muratori is an implication of the powerful role of historical dimension in the typological process, which is the fundamental framework of the Muratorian School. The historical process based on a definite cultural context operates on building constructions in cities, delivering constructional tradition from time to time. The concept which contains this deliverance is the main concept of typological process, type. Type, by its essence, can be considered as a priori to a given time and space, rolling on the architectural design process by saving all historical values as a concrete link to the continued existence of a city. As Cataldi presents the concept of operating history comes from the critique that Muratori expressed against the modern movement and its crisis of continuity.

2.5.1. Conzenian, and Caniggian approach
Caniggia and Conzon both have had similarities such as; Both were connected with cities as historical phenomena; both conceptualize these phenomena in a manner and to a degree that contrasts with the dominant descriptive approach; both recognized cycles in development and focused on periodicities on the creation and adoption of physical form; both privileged the predominant forms in the landscape, the huge number of ordinary buildings, rather than the small minority of buildings of architectural distinction [32]. The comparison between Conzenian and Caniggian approaches has been presented in table 7.

Table 6: Theory, components and methods of Conzenian approach and Caniggian approach (Authors)

	Theory	Components	Methods, tools and so on
Conzenian approach	Historic understanding as the key to recover the sense of continuity in architectural practice	Type Morphological period	Morphogenetic methods Typology Cartographic redrawing
Caniggian approach	The analysis of design processes of townscapes in the 19th and 20th centuries	Fringe belt Morphological period Buragage cycle	Town plan analysis Cartographic redrawing

Caniggia and Maffei's work is rooted in the concepts developed by Saviero Muratori at about the same time Conzen was working on the principles of town-plan analysis. Muratori, Caniggia and Maffei start from the principle of *aggregation* as the basis for the hierarchy of elements stated as an abstract schema. The schema is a compositional hierarchy made up of *elements, structures, systems and organisms* (picture 3). Structures are aggregates of elements, systems are aggregates of structures and organisms are aggregates of systems (picture 3).

The basic relationship between the levels is therefore part-to-whole [21]. Set in terms specific to the built environment, materials such as bricks, tiles and timbers are elements that go together to form structures such as floors, walls and roof; structures go together to form rooms, stairs, corridors and the like, which in term go together to form the whole buildings (Picture 4) [21].

Table 7: comparison of elements identified by Conzen and Caniggia and Maffei [21]

| Conzen	Caniggia and Maffei
streets	streets
Plot series/Blocks	Pertinent Strips
Plots	Lots
Buildings	Buildings
	Rooms
	Structures
	Materials
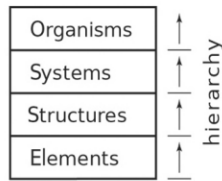
Picture 3. Caniggia and Maffei's schematic [21]
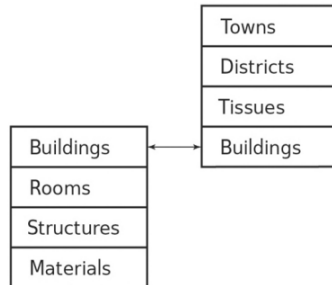
Picture 4. Caniggia and Maffei's double, four-level hierarchy of elements [21]

Caniggian's examination of spatial correlation of built objects is based of subdivisions that forms a hierarchy (picture 5). The components are elements, a structure of elements, a system of structure, and an organism of systems. Picture 5 shows a hierarchy of spatial arrangement. Elements are units of the system studied. Grouped together, the elements from structures that are the building blocks of the system itself.

These building blocks can be different, but they are all formed by grouping together in some way a number of elements of the smallest type. A number of particular structures grouped together in a similar manner from a unit of a higher order, I, e, the system. The same idea can be taken further, whereby a grouping of systems forms a unit of an even higher order. In Caniggia's terminology, this is known as an organism of systems. To provide further classification, it is useful to consider examples of how Caniggia used concepts in his work [19].
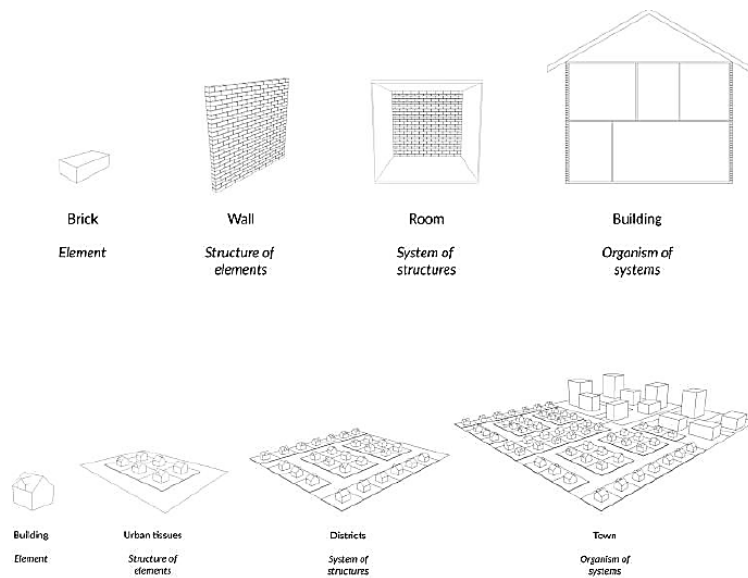
Picture 5. A schematic diagram demonstrating the spatial correlation of a building and a town according to Caniggia [19]

Caniggia applied this schema to individual buildings. An element could be a brick, timber, tile, etc., a structure of elements is formed through the combination of building materials, for example, walls, interior floors, roofs, etc., arrangements of the latter into rooms, stairs, corridors, etc., is the system of structure, with the organism being the building [3].

As in Conzen's plan unit and Caniggia'a tessuto urbanio, these different elements are interrelated in a hierarchy. Smaller-scale elements combine to form larger-scale elements which in turn are parts of still larger elements.

Using the hierarchy as a framework, it is possible to define tissues systematically at different levels of specificity by describing the constituent elements step-wise through the levels of resolution. At the most general level, a tissue can be described as an arrangement of streets and blocks. Grater specificity is achieved by describing the component plots of the plot series and on through component buildings, rooms, structures, and materials, depending on the level of specificity appropriate to the task (Picture 6).
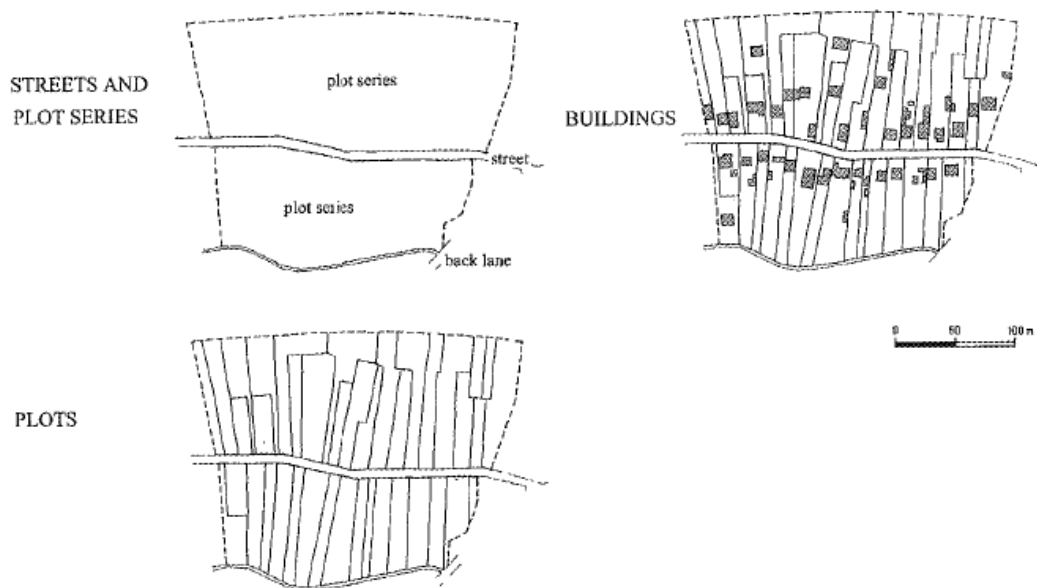
Picture 6. An urban tissue shown at increasing level of resolution [20]

The specific characteristic used to describe each element is its position, outline, and internal arrangement (picture 7). The position is described in terms of the element's place relative to other elements in an arrangement making up a larger-scale entity. Thus a plot can be described in terms of its position in a block, relative to other plots and streets (i.e., the edge of the block). One can identify corner plots or plots on the long or short edge of a block. With rectangular plots, one can also distinguish between wide or narrow frontage plots, that is, between those with a long or short side on the edge of the block [20].

The outline of an element is specified by describing its external boundaries in terms of shape, size, and proportions. In some instances, either for convenience or because of lack of information, this is limited to the plan outline, that is, the two dimensional outline on the ground plane arrangement is described in terms of the type of component parts, the number of parts, and their relative position. In turn, the types of component parts are distinguished by their outline. Different types of tissue can be systematically identified in analysis and described in terms of the characteristics of the constituent elements at each level of resolution.

POSITION

In the case of the plot, this characteristic is set in terms of the orientation of the plot to the street and its position relative to the sides of the block, e.g. long side, short side or corner.

OUTLINE

Shape, Size, Proportions

In this case, showing the two-dimensional *plan outline* Other two-dimensional outlines include elevation and section outlines.

ARRANGEMENT

Type of component parts, Number of parts, Relative positions

The example shows one building, a boundary wall in three sections and a single open space

Picture 7. Characteristic used in identifying types [20]

3. Materials and methods

The methodology used in this research is based on "documentary research method". Many researches stated that document researches include institutional memoranda and reports, census publications, government pronouncements and proceedings, and so on. Documentary research is one of the three major types of social researches. Table 8 shows three common characteristics of documentary methods.

Based on figure 2, data is collected then data display and data reduction has happened and conclusion is shaped. Table 9 shows the research framework.

3.1. Case study

Sabzevar is one of the major cities of Khorasan Razavi province, located in the west of Khorasan, northeast of Iran, on the road from Tehran to Mashhad.

This research tried to study the remaining historical houses in Sabzevar tissues some of them are not registered in the cultural heritage list (See table 10). Eight houses of each era have been selected to be analyzed. Qajar, Pahlavi 1nd, Pahlavi 2nd, and Enghelab era have been selected, there have been 32 houses in total.

45 sub-criteria have been selected from the literature review in general, and with the Delphi method, 15 sub-criteria have been extracted from them. Questionnaires were distributed among 10 experts through the snowball method. Then within the T-test geometric mean was obtained and the Freedman test has been applied to hierarchy of criteria. Then the second round had been done and Kohen's kappa factor has been calculated over 0.6 so the questions had high validity and one Delphi round was enough.

Table 8: Three common characteristics of documentary methods [17]

Three common characteristics of documentary methods		
They rely entirely on the analyses of data collected for purposes other than those of particular studies in social relations.	Documentary studies often call for ingenuity in translating existing records into quantifiable indices of some general concepts.	Documentary studies are particularly susceptible to alternative interpretations for the natural events and their effects.

Data Collection → Data Display

↓ / ↕

Data Reduction ↔ Drawing and verifying conclusion
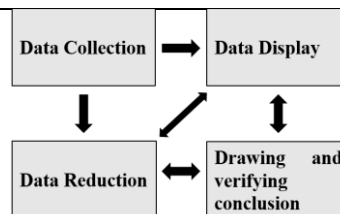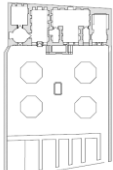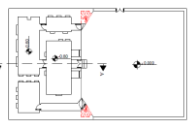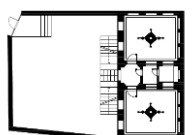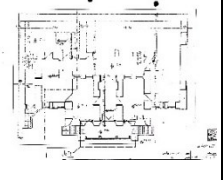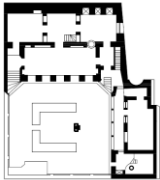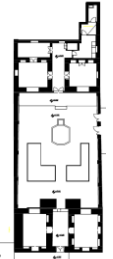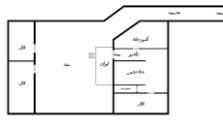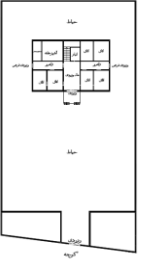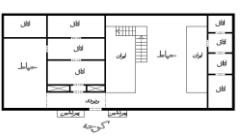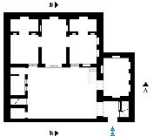
Figure 2. The components of data analysis [25]

Table 9: Research framework (Authors)

Concept of type			
Rational philosophy of enlightenment			
Enlightenment theory	**Modern ideology**	**Neo-rationalism theory**	**Neo-traditionalism theory**
Quatrme deQuanci: Type; innovation, transformation, originality.	Moneo: Type; prototype	Muraturi: Studies for an operating urban history of Venice (1959) ⬛ **Muratori School** Gianfranco Caniggia Giancarlo Cataldi Luigi Maffi Paulo Vaccaro Mria Grazia Corsini ⬛ **Gianfranco Caniggia** Dynamic and gradual typology Typological process	Elizabeth Plater Zyberk and Andres Duany: Type; a new paradigm for regulation and reviving styles and traditions and source of historical continuity of cities.
		Aldo Rossi: Similarities, Continuity, character of cities.	

Table 10: Houses from Sabzevar

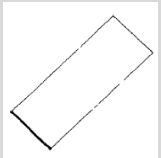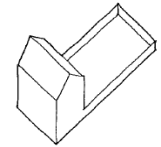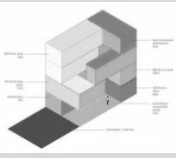| Qajar				
	1.Aldaghi House	2.Amiri House	3.Owlia House	4.Jafarzadeh House
	5.Hejazi House	6.Shariatmadar House	7.Kian House	8.Vasei House
Pahlavi 1nd era	1.Estaji House	2.Tofighi House	3.Haghiran House	4.HeshmatNia House
	5.Badiee House	6.Safakar House	7.Fazel House	8.BlashAbadi House

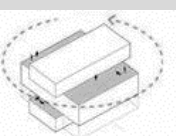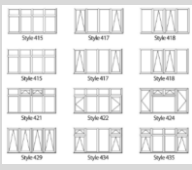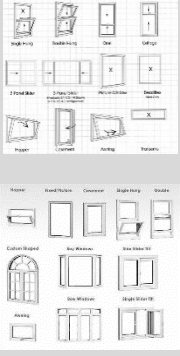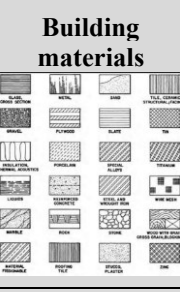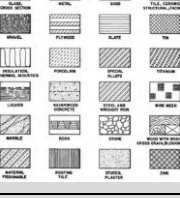|				
Pahlavi 2ⁿᵈ era	1.Shiayan House	2.Sade House	3.Parsi House	4. Faramarzi House
	5.Malvandi House	6.Adeli House	7.Motevali House	8.Jajarmi House
Enghelab era	1.Mosalmani House	2.Parvandi House	3.HaresAbadi House	4.Afchangi House
	5.Divandari House	6.Hadadi House	7.Zhian House	8.KianShokuh House

4. Results and Discussion

Caniggian approach from Muratorian school of thought in addition to Conzonian approach identifies the theoretical and conceptual framework of this research about the typology at the building scale (houses typology framework).

Building layout, building façade, number of floors, roof types, building materials, and structural system are commonly used physical characteristics in the definition of types and typology at the building scale (see [9], [8], [30], [16], [2], [15]). (See table 11). Table 11 shows the results of the studies of Kropf, Corsini, Dufaux, Darin, Oliviera, and other researchers' works about type and typology at the building scale. As Kropf stated outline is about shape, size, and proportion and arrangement includes the type of component parts, number of parts, and relative positions [20]. Building layout includes so many factors as many researchers stated such as courtyard [7], number of dwellings,

rooms, and floors [10], number of floors, and so on. The façade is an architectural element that can voice the function and meaning of a building. Façade components that need to be discussed are gates and entrances, ground floors zones, doors, walls, guardrails, and roofs while building façade compositions which include division, rhythm, ornaments, shapes, materials, colors, and textures [16]. Building material and the structural system are about the material and system of structure that a building has, a building has both a material and a structural material (Sakhtmaye) and a construction system that plays a role in transmitting the load to the foundation.

In the studies in table 11, the criteria at building scale were not been prioritized and there was not any studies which analyze and compile the typology criteria at housing scale (Building scale) for Sabzevar city. Therefor in this study these criteria have been compiled and prioritized for the first time at building scale for Sabzevar's housing types (See table 12). Also, theory and physical factors affecting types in housing have been localized for Sabzevar area.

Table 11. Commonly used physical characteristics in the definition of type and typology at building scale (Authors)

Commonly used physical characteristics in the definition of type and typology at building scale	
Criteria	**Sub-Criteria**
Outline	- Shape - Size - Proportion [20]
Arrangement	- Type of component parts - Number of parts - Relative positions [20]
	-Space arrangement [24]
Building layout	- Courtyard (sequential or divided) [7]
	- Number of rooms - Number of floors [9]
	- Number of floors [8]
	- Stair position - Backward courtyard - Underground floor - Door position in room (one door, two door, 5 door) - Number of floors [30]
	- Organizing space for both indoor and outdoor spaces (Position and Shape) [10]
	- Orientation - Aspect ratio - Spacing percentage (Open space percentage) [16]
	- Mass and Space relation - Introverted or Extroverted - Entrance (Interface space?) - Backward courtyard [2]
Building façade	- Roof type [9] [23]
	- Height of building [8]
	- Roof type [16]
	- Window (Type, Material) - Door (Type, Material) - Wall (Type, Material) - Floor (Type, Material) - Roof (Type, Material) - Proportion (for façade components) - Balance (symmetrical for façade components) - Iteration/ Rhythm (repetition of the shape of the opening element and supporting column with parallel position) - Hierarchy (Door element to the same type of window using different sizes) [15]

	- Details and components such as arches and other openings - Decorative Frames - Metalworking decoration - Backward facades [2]	
	- Geometry of building façade division - Sky line - Ground line - Decorative components on façade [24]	
Building materials 	- Wall material - Roof material [9]	
	- Wall material - Roof material [16]	
	- Exterior wall Material such as masonry brick, wood, wooden framework, … - Interior wall Material such as masonry brick, wood, wooden framework, … [2]	
Building structure 	- Building Structure [24]	

After that, through statistical analysis, those criteria and sub-criteria have been analyzed to localize for Sabzevar housing typology. This process has been done by distributing 10 Delphi questionnaires among architectural experts using the snowball sampling method. Results show that 15 sub-criteria from 45 sub-criteria have reached the geometric mean number 4. (Figure 3). In figure 3, these sub-criteria such as type of component parts (7.0000), relative positions (6.7000), orientation (6.7000), introvert and extrovert (6.4000), mass and space relation (5.4000), the geometry of building façade division (5.0000), shape (4.9000), spacing percentage (open space percentage) (4.9000), skyline (4.9000), aspect ratio (4.7000), decorative components on façade (4.4000), the height of the building (4.3000), number of floors (4.2000), number of rooms (4.1000), and organizing space for both indoor and outdoor spaces (position and shape) (4.1000) are reached to the geometric mean upper than four. So they have been the main selected criteria for Sabzevar housing typology.

Figure 3: Frequency distribution of respondents according to questionnaire questions
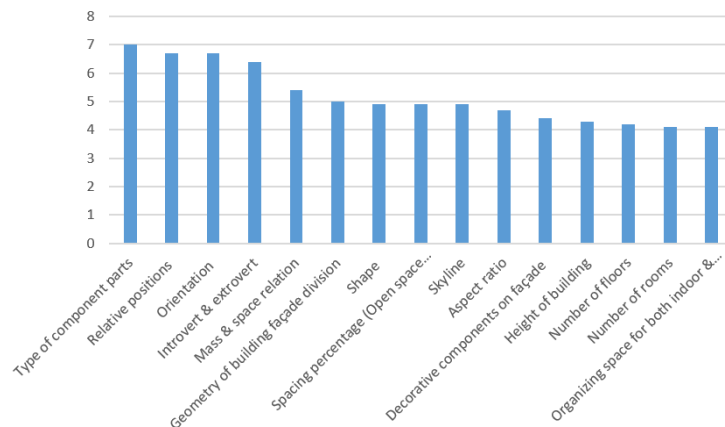
Table12: Typological criteria for Sabzervar's housing

Priority	Sub-criteria	Criteria
1	Type of component parts	Space arrangement
2	Relative positions	
3	Orientation	Building layout
4	Introvert & extrovert	
5	Mass & space relation	
6	Geometry of building façade division	Building façade
7	Shape	Outline
8	Spacing percentage (Open space percentage)	Building layout
9	Skyline	Building façade
10	Aspect ratio	Building layout
11	Decorative components on façade	Building façade
12	Height of building	
13	Number of floors	Building layout
14	Number of rooms	
15	organizing space for both indoor & outdoor spaces (position & shape)	

5. Conclusion

This study tried to find the typological criteria at the building scale, specifically for housing. This study aimed to institutionalize these criteria for housing in Sabzevar. Based on the literature review, typological criteria at the housing scale have been found and set for Sabzevar's housing typology criteria. Based on Table 10, in Sabzevar city since the lack of documents of the total available plans registered in the cultural heritage of historical houses and even not registered, there has been a lack of information and research restrictions.

The results of this research in comparison to Khalagh Doost and Maroofi (1399) show that they analyzed "Hashti" and its different types in different cities in a hot and dry climate such as Yazd, Isfahan, and Kashan in their study, and they categorized "Hashti" into the physical, the behavioral and social field in their study. But in this research, the criteria for housing typology have been compiled. Farahbakhsh et al. (1396) in their study categorized the houses of Mashhad (First of Qajar to late Pahlavi) into three types in terms of shape and size of the components, relations, layout, texture, and decoration.

Hosseini et. al. (1395) in their study categorized the houses of Arak into three types desert, mountainous, and extrovert in terms of occupancy percentage, number of floors, aspect ratio in building, the ratio of closed space to semi-open space, and number of rooms. But the result of this research is comprehensively done with the criteria of typology of Sabzevar houses. And results of this research show that there are 15 sub-criteria of housing typology in Sabzevar. Based on table 12 and statistical results and analysis of the obtained (figure 3), "space arrangement" is the most crucial criterion but the most repetitive answer is the "building layout" criteria. Although "space arrangement" is an important criterion, it has only two sub-criteria. But "building layout" with the highest sub-criterion has the highest frequency.

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