
Methods of integrating parametric vocabulary to generate urban spaces in Egyptian societies with a heritage identity

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Abstract:

The research aims at finding a compatible and innovative mechanism and methods for designing urban spaces in Egyptian societies, bearing heritage characteristics, references, and local identity by studying contemporary architectural and urban trends; also how to develop them quickly, and identifying how to implement these creative ideas through parametric methods, thus access to innovative designs. By using modern advanced computer programs, and integrating the historical character of contemporary Egyptian urbanization with parametric details and programming to explore urban spaces in areas of historical value in search of urban and architectural elements that help achieve communication, in addition to how to design New communities in Egyptian cities design and use their public places to have a distinctive urban identity and personality. Modern and contemporary architectural culture suffers from non-proliferation, and this confirms the need to identify its ideas, components, vocabulary, and mechanisms.

Keywords: (Parametric urban design - generative design - urban spaces - heritage identity).

1. Introduction:

The identity of the people's architecture in the past was clear and reflects the characteristics of these people, their environmental and social advantages. Currently, identity has been obliterated by Western concepts. This research notes that concrete buildings and blocks of tall buildings have dominated architectural thinking, not only at the local level but also at the global level. The result was that the features and manifestations of local urban values melted amid this transformation, as the bid of the West became the aim of our direction. And that we are also no longer able to analyze the incoming data and provide insight into it accurately. The aim of selecting the beneficial ones is to achieve a balance between incoming and inherited influences. Taking advantage of all the secretions of contemporary technologies and developments, including parametric techniques, and integrating them with our civilized history to create an architectural identity of our own. The contemplator of contemporary Egyptian architecture finds that there are architectural formations that spread in all cities affected by the style of Western architecture and its schools and ideas. These patterns have expressed the traditions and customs of Western societies far from our customs and principles derived from Islamic law, Which affected the heritage architecture, including what is transferred from Western architecture, which invaded the architectural scene, Westernization became a principle symbolizing progress and development, then Egyptian architecture lost its identity through the loss of its components stemming from Islamic values and expressing the natural, social and even climatic environment [1].

2. Research problem:

The urban and architectural formation of the identity of the new cities has become ineffective, because of not generating urban spaces in the Egyptian societies with a heritage identity integrated with new vocabulary represented in the parametric designs in the urban scale, to keep pace with the periods that passed through those ancient cities and left them with a unique urban formation and architectural formation for visual advancement, Therefore, the changes face a loss of character in some of the new cities. This necessitated finding a method with a heritage identity in parametric terms through evaluating the urban identity to explore architectural spaces with local buildings that express identity.

3. Research objective:

The main objective of the research is:

Finding a specific method through which the design process can be combined with interactive parametric methods to re-explore urban spaces in Egyptian societies with a heritage identity, making them flexible and can adapt to changing climatic conditions to improve thermal performance within the interior spaces.

4. Research Methodology:

The research in its various stages followed several methods

4.1 Documentation Approach:

It presents the concepts and mechanisms that refer to the challenges affecting architecture and urbanism, as well as, the concept of identity, urban and architectural formations and the personality of each of them and their impact on the urban scale, the parametric architecture with the concept of each, extracting the stages of development of the idea of applying parametric design integrated them with urban aesthetics to form and configure urban spaces in Egyptian communities with a local heritage identity.

4.2 Analytical Approach (Comparative Analytics):

The analytical approach relies on analysing models with applications for heritage projects and integrating parametric vocabulary to become urban spaces with formations that have a local identity stemming from the new design vocabulary to monitor the study of the development and design of urban space in the city, the social and technological dimensions affecting its formation and benefit from it, which greatly affected the urban formation process as in general and on the formation of urban spaces in particular.



Figure 1 a diagram illustrating the steps of the research methodology.

4.3 Deductive (Experimental) Approach:

Finally, the research presents “the formulation of a strategy with a design methodology in parametric terms to generate urban spaces with a heritage identity.”

5. First: the (theoretical) approach:

5.1 Challenges affecting architecture and urbanism:

They can be defined as variables, problems, difficulties, obstacles, or developments stemming from the local, regional or international environment. These challenges can be identified into two types. Table (1) refers to the architectural and urban challenges:

Table 1 Architectural and urban challenges.

Architectural Challenges:1
It can be cultural; this represents a serious threat to the status of the cultural system. Cultural challenges can affect the historical background, which in turn affects the heritage monuments of cities with a distinctive heritage dimension. It may be social, and this represents a serious threat to the set of values and behaviors on which the value system of the community is based [2]
2: Urban Challenges
<ol style="list-style-type: none">1.Continuous population increase.2.Depletion of fertile agricultural land as a result of the random expansion on it.3.The clear escalation of population densities in urban and rural areas and its negative impact on facilities and services.4.Deterioration of the urban environment and overlapping of land uses in cities and villages. Challenges can be defined as developments, variables, problems, difficulties, social, political, economic, or other obstacles in various aspects of life and its fields, stemming from the local, regional or international environment and posing a threat or danger. on the future of the individual, community, or state.

5.2. Identity:

Identity begins with the growth and development through the personal history of the individual with the basic knowledge available to him. Identity plays an important role in defining the features of architecture by satisfying needs. The architect has laid down “Correa” [3], there are three foundations for understanding identity:

1. Identity is a series of continuous processes, but it changes with time. It is dynamic and linked to the impact left by civilization throughout history.
2. Identity consists of a series of processes that cannot be falsified.
3. Identity is not related to self-awareness.

It is noted that there is no specific definition of identity. Many thinkers believe that identity is inherent and determines the nature of places. Others see that identity is a process of reconstruction and creation that depends on the prevailing social and cultural conditions, in this way they link this to the customs and traditions of each people, there are basic phenomena that express Identity is the continuity over time without affecting the surrounding environmental variables and the idea of uniqueness that presents limits for something and we can distinguish it from other things.

5.2.1. Urban identity: the comprehensive framework of urban identity, which is the cities with their buildings, streets, public spaces in them and everything that gives the environment its distinctive character from places that have a special mental image that is entrenched in people's memory and makes them able to easily identify them [4].

5.2.2. Architectural Identity: Community architecture is the image that reflects and represents progress. A central part of the problems facing our societies today is the separation of those responsible for creating the architectural facade of cities stemming from their cultural roots, and this led to a rift and schizophrenia of the cultural vision, between history and the cultural background. Inherited and borrowed this image, which represents progress from elsewhere and from the West in particular.

5.2.3. Community Identity: The concept of community identity is a theoretical system that refers to an individual's personal representation of the internal relationships between multiple collective identities.

5.2.4. Cultural Identity: can be defined as a complex structure for understanding the combination of congruence and difference that makes up human life.

5.2.5. Contemporary Identity: Contemporaneity requires consistency of thought, methods, and tools with what the era and contemporary produce in the context of the study, indicative of the convergence of contemporary Egyptian architectural reality with the cultural and technical data of the time scale.

5.3. Formation in the identity: Formation in the identity can be done by knowing the urban and architectural conditions of the city, so it has been divided into:

5.3.1 Shaping the urban identity: The urban identity of the city is part of the cultural identity of the community linked to the mental image of the city's natural and architectural components [5].

5.3.2 Shaping the architectural identity: It is defined as the shape and external form of the materials that make up the systems of the elements and the sensory relations between them on the horizontal, volumetric or spatial level. And the conclusion of some of the relations that link the internal architectural blocks and spaces.



5.4 Forming urban spaces in new cities:

Vacuum represents the temporal extension of things that are conceptually studied in geometry. It is also considered a symbol of a variety of sizes, shapes, locations, distances, and directions. Some scholars defined a vacuum as it is the only real necessity only for movement to become possible and active, a vacuum is a cosmic medium through which life moves. In sustainable transformations, time and place are just a relative case. The elements of forming the void in the city have general characteristics that are divided into three main elements: represented in the spatial aspects, the visual and aesthetic aspects of the spaces and the functional aspects of the void. Figure (2) also represents the open areas with urban formations [6].



Figure 2 Open areas with urban formations in the new city of Mansoura [6].

Table 2 shows the spatial aspects, visual and aesthetic aspects of the spaces, and the functional aspects of the space [7].

spatial aspects	
<p>It is a set of general characteristics where each space has a use and a distinct personality, just as each space has a shape, size, dimensions, material, color, and texture. When looking at the city within the framework of the general design, it must be realized that it is a group of spaces permeating the blocks of buildings, each space has its shape, size, and characteristics, and not just a group of buildings with different properties and elements standing on the ground in a strict or random model.</p>	
	
<p>Figure 3 shows the overlapping of uses in the villages and the lack of clarity in the return of culture to the cities [8].</p>	<p>Figure-4 is a figure that shows random population densities and their impact on distinctive buildings [8].</p>
The visual and aesthetic aspects of space	
<p>Which consists of the elements of visual perception of spaces and their visual distinction through a group of basic elements represented in (elements of visual perception, visual image of the city, and elements of site coordination).</p> <p>The effect of spaces on the visual formation of the city in terms</p>	

of (exclusivity - control - increasing symbolic and moral importance - distinguishing the urban character of the city).

The effect of spaces on the elements of the visual image of the city in terms of (distinctive signs - paths - visual neighborhoods - borders - assembly areas - gates).

- -The effect of the spaces on the aesthetic aspects and elements of site coordination and the axes of pedestrian movement and mechanisms in the city.

Functional aspects of the vacuum

Affected as a result of the change in the quality of uses and its impact on the shape and design of the space.

Change in the distribution of land uses in the city.

- The relationships of spaces and their relationship to the main activities in the city, such as the mosque, the market, and the important elements according to the nature of each city.

5.5. Character:

It is the sum of the visual qualities that distinguish a particular place from others, in addition to its association with adding people and societies. It combines the concepts of personality, privacy, uniqueness, distinction, unity, homogeneity, and repetition. It consists of the following elements:

Urban character: It is the set of distinctive features of a specific geographical area or human space, and its most important aspects can be summarized as follows:

Scope, including location, inclinations, and directions of vision.

- The visual characteristics of the built elements are heights, colours, building materials, and building lines.

The visual characteristics of urban formation: foundations for the assembly of architectural elements – a network of movement and paths.

Urban spaces: components and quality - homogeneous urban areas - distribution of visually important buildings and their relationship to the general form.

As for the architectural character: it is the set of qualities and characteristics that distinguish an architectural subject from others, depending on many principles and under various influences of many effects (subject, materials, construction, environment, climate, and the personality of the architect).

5.6. Identity:

Personality is the most prominent characteristic or group of attributes in a thing and its properties and those that do not need proof and can distinguish a thing from others and can be defined as:

5.6.1 Architectural character:

A guide to the use of resources in a specific environment, and it is a mean to create a harmonious dialogue between nature and what is man-made, and it means providing contemporary buildings stemming from the roots of the past and not derived from modernity [9].

5.6.2. The urban character is determined through the urban design of the city. The elements of the urban character of the city are:

- Paths: the main motor channels that you perceive through the city.
- Borders: They require clarity and continuity that confirm their function.
- Landmarks: are buildings or edifices that are visually clear and that can be easily distinguished.
- Nodes are the fulcrums of the city, which give it its character and identity.

- Visual districts: A region with a homogeneous character.
 - Time: It depends on the historical period of the city [10].
- We must address the analytical (comparative analysis) approach by integrating the parametric architecture vocabulary and how to interact with the variable factors in generating urban spaces with a local heritage identity.

6. Second: The Analytical Approach (Comparative Analytical)

6.1. Parametric Architecture:

It is one of the productions of modern technology given by attempts to use it in administrative buildings for the possibility of responding to external variables to raise the efficiency and improve the performance of buildings and the employment of spaces. Parametric equations are commonly adopted to express the coordinates of points that make up a geometric object such as a curve or surface, the equations are collectively called parametric or parametric representation (shown as a proxy for variables) [11]. referred to in Figure (5) Basics of Parametric Design [12].

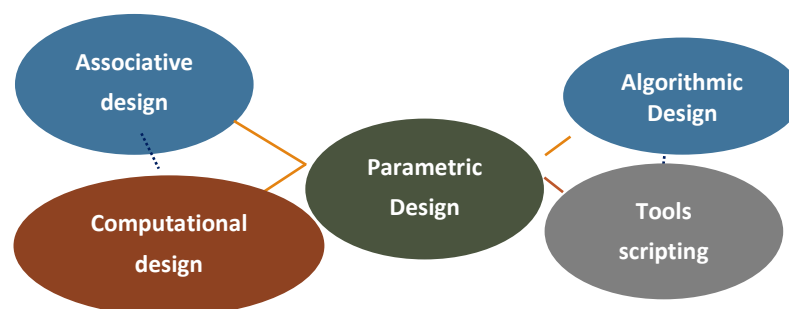


Figure 5 Fundamentals of Parametric Design [12].

6.2. Parametric Concept:

It is the expression of a set of quantities as explicit functions of several independent variables, known as "experimental factors",

Figure (6) shows also the basic equations and mechanisms to be used in the parametric design. In the last half-century, parametric design has achieved designs that adapt and interact with the changing factors of the surrounding reality, the most prominent of these variables are “algorithms”, and a special pattern of waves has also appeared, “modern optical vision” is a feature of this type [13].

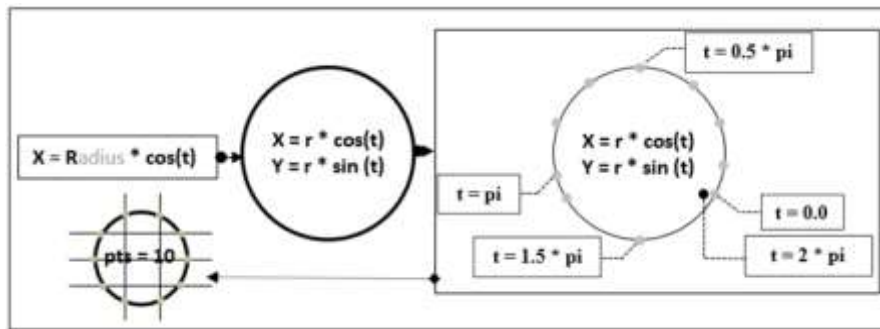


Figure 6 shows the basic equations and mechanisms used in parametric design [13].

As well as at the level of city planning and determining its densities and sizes, and the formation of its neighbourhoods and lines of road networks, there will be fluidity and smoothness in the formation of the city and the achievement of diversity in its forms without compromising its interdependence among them.

All the research and projects that are designed within architectural schools that follow parametric architecture in which the interconnection between its components appears to be similar to each other despite the diversity of their functions and sizes being designed by different architects, but they follow the same principles.

Parametric architecture depends on various principles, some of which can be called negative principles, which should be avoided, and positive principles that must be followed.

The negative principles can be summed up in: Rejection of traditional principles such as the design of classical forms with inflexible structures, such as repetition or symmetry informs, and such as collecting dissonant forms among themselves. Therefore, parametric architecture calls for inspiration from natural organic forms.

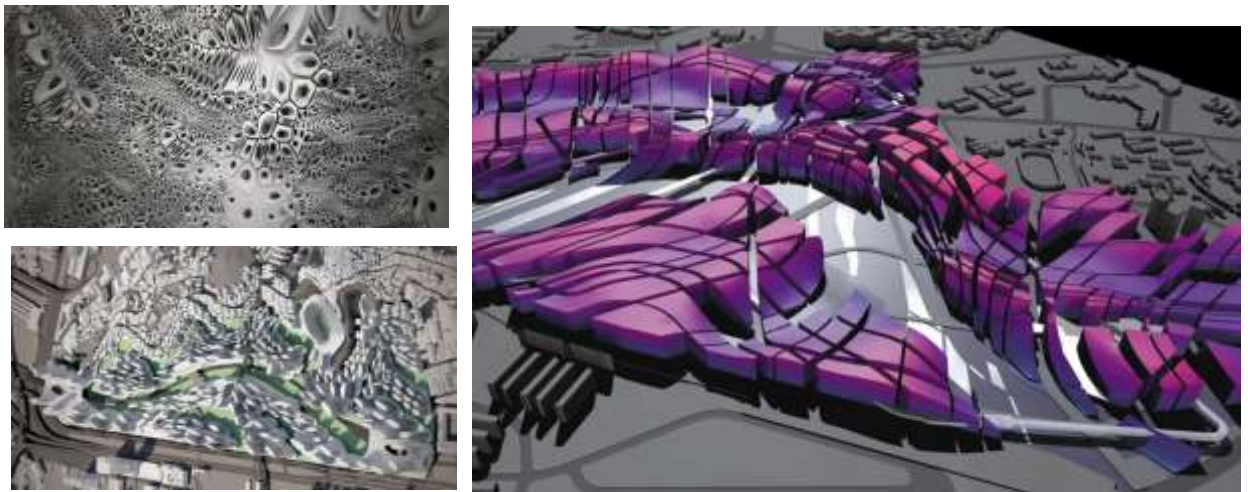


Figure 7 Applying the principles of parametric design to the planning of neighbourhoods and cities, and a future vision for the city of Mahatta by imposing and developing a strategy for parametric plans in the future.

6.3.1 Parametric Design Principles

Parametric modeling and advanced programming techniques have become an integral part of architectural practice and principles, as architects use a mix of skills to access other disciplines such as computing, engineering, art and design, and design analysis, through Rhino & Grasshopper & Diva programs.

Structural complexity, and various aspects. Figure (8) illustrates the principles of parametric design [14].

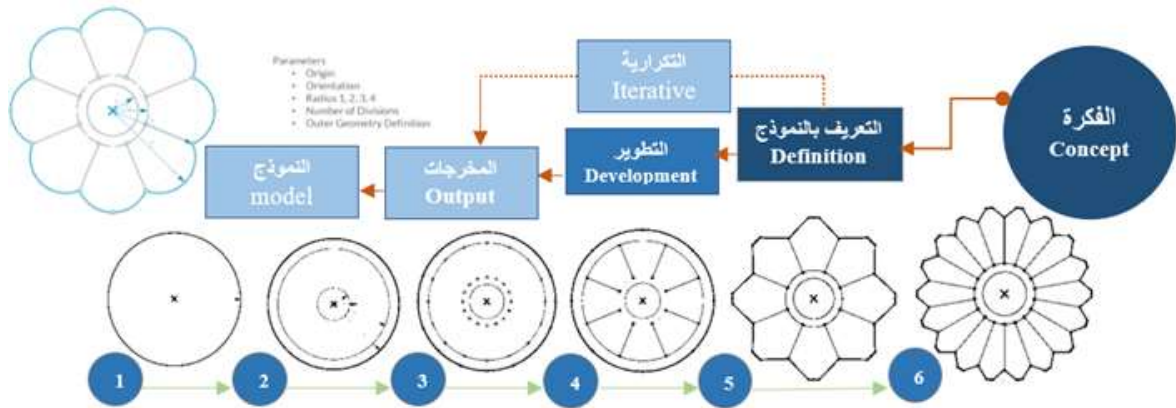


Figure 8 illustrates the principles of parametric design in practice and exploring an urban product in parametric terms [14].

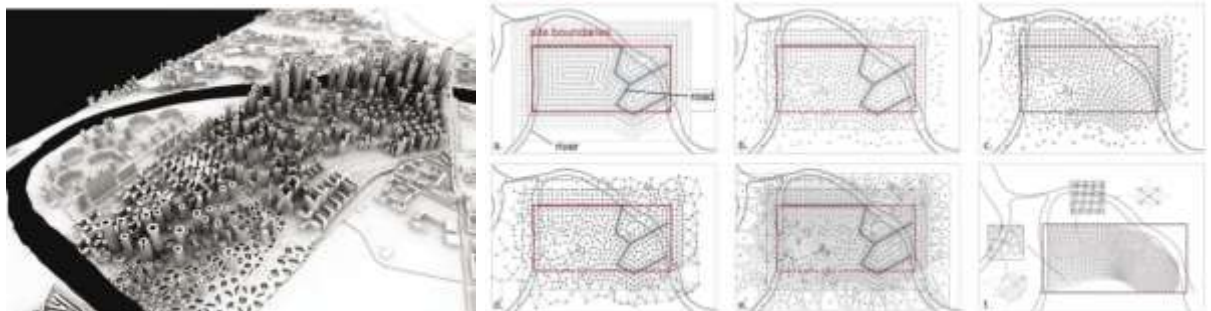


Figure 9 Right figure Preparing the initial point grid b. turning point c. orientation d. contact e. Voronoi division and. Geometry in the Voronoi Cell. The Nordic Shape Final Urban Design Proposal

6.3.2. Parametric design mechanisms and their ability to explore changing urban spaces:

Parametric design mechanisms are defined as processes through which the design problem is described and relied on the specific variables, and the change in the values of these variables by the designer produces many alternatives. Therefore, it was addressed to generate urban spaces in Egyptian societies with a heritage identity,

and then the final solution is chosen based on A set of determinants related to performance, ease of construction, user requirements, user needs, aesthetic requirements, or a combination of these requirements that put the designer as the ruler and controller of the output resulting from the parametric design.

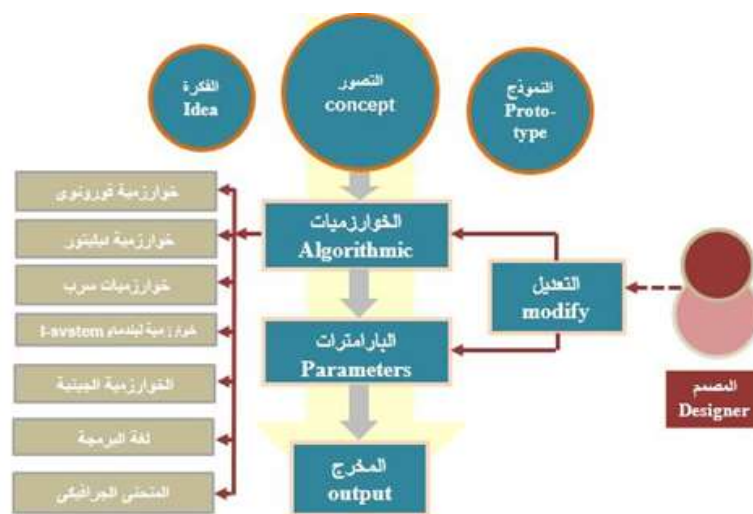


Figure 10 is a diagram showing how the parametric design works"source: Researcher"

6.3.3 Role of parametric design in generating urban spaces:

The designer’s creative parametric design is enhanced through the production of many designs, thus opening the door for the designer to implement non-traditional forms that he could not imagine alone in the urban spaces to rise to unique designs that mimic reality with heritage and local identity, also the parametric design adds to the design system the ability to choose or specify the solutions or ideas resulting from this process are done within a framework in terms of the scope of the problem and requirements. The design needs to be met, but this is not in most cases, where parametric design appears at its strongest in problems related to heritage. Thus, minimizing the variance in the design according to the criteria of utilitarianism and taking advantage of the criteria of beauty to reach the visual elevation.

Moreover, the reliance of the design on a heritage identity is defined in reality by modern parametric methods, and Table (1-1) represents the importance of parametric design during the process of the stages of the design process [15].

Table 1 represents the importance of parametric design during the process of the stages of the design process

The importance of parametric design.	Creating designs that are difficult to produce.
	The ability to modify design elements according to the changes that appear on the design.
	The ability to produce new structures and structures in their behavior, relationship, and forms.
	The ability to produce complex shapes.
	Enhance creativity of the designer.
	Time-saving.
	A suitable medium for the conceptual stage of the design process.
	Explore a wide range of design options.

Figure 11 illustrates the importance of the parametric design and the cost of its performance in urban spaces. source (researchers)

6.3.4 Applications of parametric methods and their effective role in generating urban spaces:

These studies express the eye-level perception of open space and the view from openings. The "Isovist" analysis component was used.

It is the volume of space visible from a certain point in space, with the location of that point. It is a geometric concept coined by Clifford Tandy in 1967 and refined by the architect "Michael Benedikt" [16]. This is done by Decoding Spaces and including many other output factors (such as the visible area) to explore the general pedestrian realm and plan it in parametric methods. Moreover, using building boundaries as obstacles to this analysis, it can also be analyzed in 3D "Isovist" considering building volumes fig (12) illustrate the steps of the methodology [17].



Figure 12 Steps of the methodology: urban analytics, concept development, and design development to rise to parametric concepts [17].

The isovist is one of two representations of the structure of space, along with the representation of the spatial envelope. It is an approach to describe space from a person's point of view within the environment [18]. Refers to a drawn polygon that covers an area that can be seen or reached when walking in a straight line

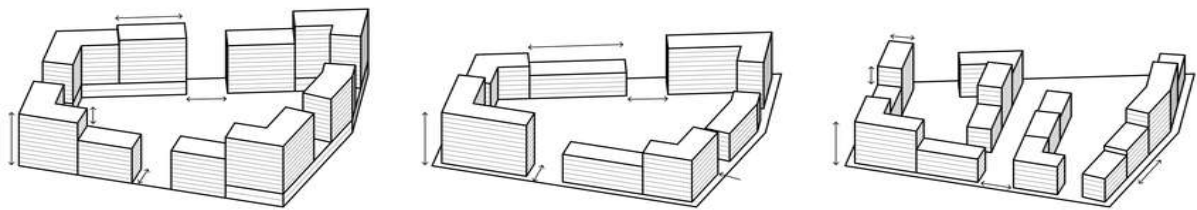


Figure 13 Parametric input parameters for residential typology generation are illustrated [17].

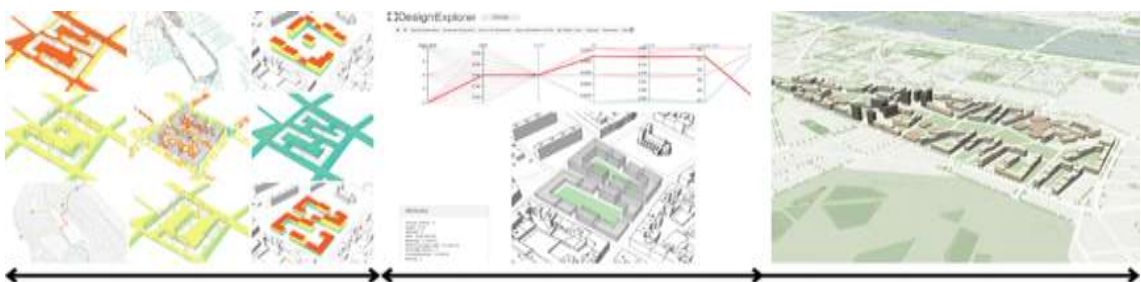


Figure 14 Methodology Steps: Analytics, Simulations, Design Evaluation, and Visual Integration. Visual integration analyses of the different patterns are performed using sites in the public domain that are represented by parametric methods and vocabulary [17].

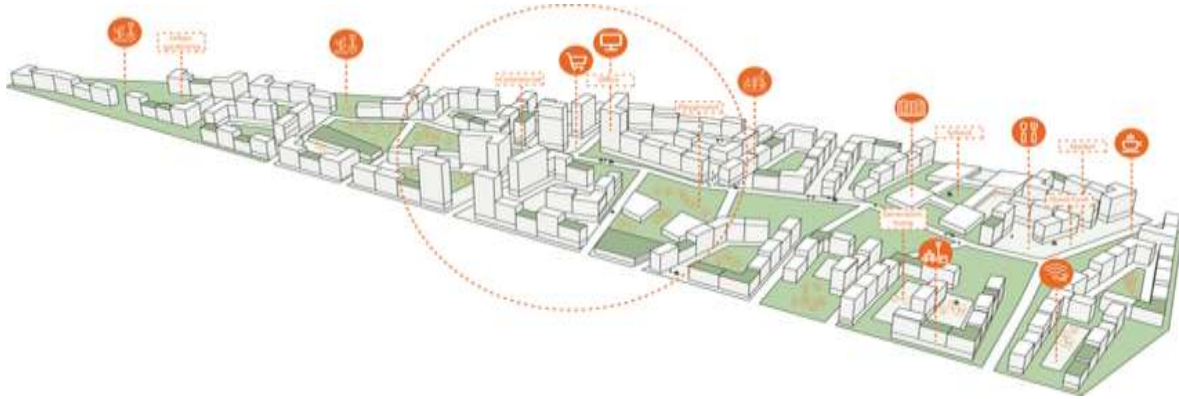


Figure 15 Graphical illustration of the master plan in Vienna and the direction to develop a plan to simulate the parametric concepts and vocabulary [17].

Results:

- 1- Modern architectural culture leads to the loss of identity.
- 2- There is no specific definition of identity.
- 3- Vacuum considered a symbol of a variety of sizes, shapes, locations, distances, and directions.
- 4- Parametric equations are commonly adopted to express the coordinates of points that make up a geometric object such as a curve or surface.
- 5- Parametric method is an expression of a set of quantities as explicit functions of several independent variables, known as "experimental factors".
- 6- Parametric architecture depends on various principles, some of which can be called negative principles, which should be avoided, and positive principles that must be followed.
- 7- The negative principles can be summed up in: Rejection of traditional principles.

8-The designer's creative parametric design is enhanced through the production of many designs, thus opening the door for the designer to implement non-traditional forms that he could not imagine alone in the urban spaces to rise to unique designs that mimic reality with heritage and local identity.

9- Applications of parametric methods and their effective role in generating urban spaces can express the eye-level perception of open space and the view from openings. The "Isovist" analysis component was used.

10- The isovist is one of two representations of the structure of space, along with the representation of the spatial envelope. It is an approach to describe space from a person's point of view within the environment.

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