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Research paper

METHODOLOGY DESIGN OF RESIDENTIAL BUILDING BY THE ARCHITECTURAL STUDIO BJARKE INGELS GROUP, CASE STUDY: THE MOUNTAIN AND VM HOUSES

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Abstract

Multi-family housing represents one of the key aspects of contemporary architecture, and the studio BIG (Bjarke Ingels Group) is recognized for creating unconventional and attractive, as well as functional and practical solutions for buildings of this purpose. Using two examples of multi-family housing projects, The Mountain and VM Houses, located in Copenhagen, the methodology of their design is explained through the application of various types of analyses, including contextual, conceptual, and analysis of project formation. The aim of this paper is to provide a systematic overview of the development process of selected projects, from the initial idea to their realization. The research findings show that different approaches to designing buildings with the same purpose and on the same location can lead to distinct but equally high-quality solutions. It has been determined that the use of a single typological unit can result in a very complex form, while the use of different types of housing units can result in a simpler form. This paper highlights the importance and complexity of the designing process of multi-family housing, contributes to the understanding of the design methodology of the studio BIG, and opens possibilities for further application of similar analyses in the study of contemporary architectural projects.

Key words: *Studio BIG, Methodology of Architectural Design, Multi-family Housing, Function of Space, Architectural Form*

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1. INTRODUCTION

Architectural design is a complex process that many architectural theorists have attempted to explain and define. The design process was methodologically divided into several phases by different authors. Markus and Maver divided the process into analysis, synthesis, appraisal, and decision [1]; the British architectural association RIBA divided it into assimilation, general study, development, and communication [2, 3], while Lojanica identified preparation, idea incubation, concept formulation, concept verification and solution development as phases of process of architectural design [4]. Most recent framework has simplified the process into three stages: contextual analysis, conceptualization, and project formation [5]. Contemporary architectural practice encompasses a diverse array of methodological approaches, rendering the design process significantly more complex than a linear sequence of steps. Nevertheless, a comprehensive understanding of this process requires its decomposition into distinct phases and its examination through multiple aspects [6].

The design of multi-family housing faces many challenges in contemporary architecture, and the studio BIG finds original and innovative solutions [7]. As examples of multi-family architecture, The Mountain and VM Houses [8, 9] (Figure 1) were selected as case studies, to demonstrate that, despite being located in the same area and sharing programmatic similarities, they embody two distinctly different formal and conceptual approaches, yet both represent equally successful architectural designs.

Figure 1. VM Houses and The Mountain, source: [9]

The architecture of studio BIG follows new principles and introduces new ways of thinking into architecture. Moving beyond the traditional concept of “form follows function” coined by Louis Sullivan [10], studio BIG emphasizes “form follows fiction” [11] as a central design strategy that integrates multiple aspects simultaneously and fosters a comprehensive design perspective. Contrasting the modernist ideal of “less is more” [10], studio BIG promotes the principle “Yes is more” [12], which welcomes complexity, diversity, and contradictions to generate creative and innovative architectural outcomes [13].

2. METHODOLOGY

According to the most recent contemporary approach [5], the design methodology of selected projects by the architectural studio BIG has been analyzed through several key aspects, including contextual analysis, conceptual analysis and analysis of project formation, simultaneously for each project. In the following text, the results of the conducted

comparative analyses for VM Houses and The Mountain will be presented, through which the methodology design of the studio BIG is demonstrated.

2.1. Contextual Analysis

With regard to the broader context (Figure 2), the case study buildings are located in Ørestad, a newly developed urban district situated on the southern edge of Copenhagen, Denmark. This urban district represents a mixed-use area that integrates residential, commercial, cultural, and educational facilities within walking distance [9].

VM Houses and The Mountain are located in easternmost edge of Ørestad which places them in direct proximity to the border of another district to the east characterized predominantly by low-rise single-family houses, typically one or two stories high. This neighboring residential area is separated from the site by a canal, a strip of greenery, and a street. To the west of the site, there is a zone of multi-family residential buildings ranging from five to eleven stories in height. These are also separated from the subject buildings by a street and a canal, above which is a railway. The distance from the subject buildings to the nearest neighboring structures on both the eastern and western sides is approximately 40 to 50 meters. A dead-end extension of Ørestad Boulevard functions as a spatial boundary that separates the two projects, situating The Mountain on its northern side and VM Houses on its southern side. To the south of VM Houses, the mixed-used buildings are situated, spatially separated from the building site by a small urban park, while to the north of The Mountain lies Ørestad Streethal (Figure 2). The described immediate context had a considerable impact on the buildings' height, storey count and architectural form.

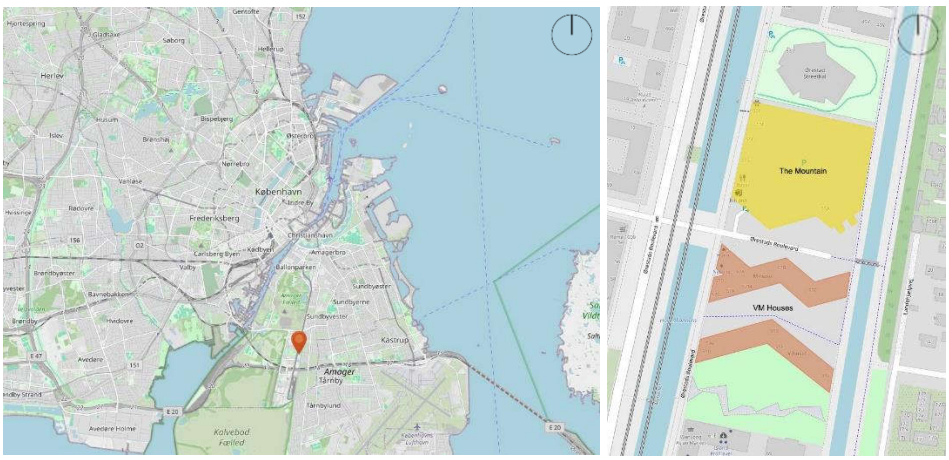

Figure 2. The broader and the immediate context, source: OpenStreetMap, author

The climatic conditions at the location of both buildings are the same as in the rest of Copenhagen. The city has a temperate maritime climate, characterized by mild winters and moderately warm summers [14]. Precipitation is frequent throughout the year, and the number of sunny days is relatively low [14], which creates a demand for increased access to natural daylight in residential buildings.

The cultural and social context encompasses an easygoing lifestyle, high living standards, social cohesion, and a strong sense of community, all characteristic of the Danish environment. In architecture, these values are reflected through the prioritization of comfort, sustainability, and quality of life [15].

2.2. Conceptual Analysis

The concept behind almost every studio BIG's project is based on a narrative approach embracing the principle of "form follows fiction" [11]. Their architectural process is driven by storytelling, frequently initiated through a "what if" question: what would happen if this idea were realized [12]. The initial idea in their projects is developed through multiple iterations and is integrated into the context. As a result, their projects often present spatially compelling structures that stand out due to their consistency with the original concept.

In the case of VM Houses, the concept is formed around the question: What if residential buildings were shaped like the Latin letters: "V" and "M". Instead of simply placing two parallel residential structures, the design adopted the distinctive shapes of these letters (Figure 3) in the floor plan, as this configuration allowed for improved daylight access, better ventilation, enhanced views, increased floor area, and a more dynamic layout. For The Mountain, also known as Mountain Dwellings, the concept was conceived through a question: What if the characteristically flat city of Copenhagen were to gain a mountain of its own. According to that idea the building was designed to resemble a sloped mountain form (Figure 3), with the structure gradually rising in height, featuring a parking facility occupying the lower, inclined base of the building and residential units terraced above it.

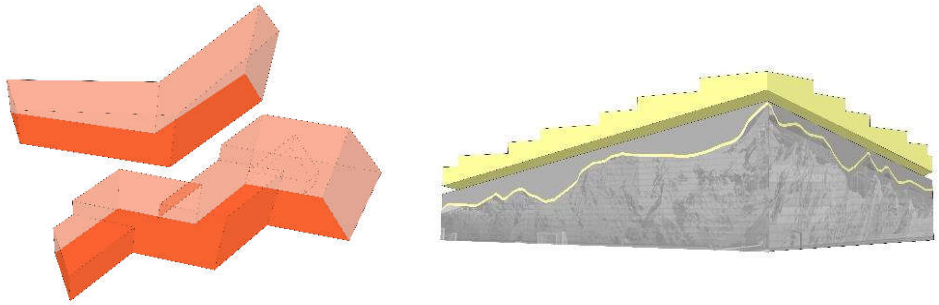

Figure 3. Concept for VM Houses (left) and The Mountain (right), source: author

"The idea is that rather than choosing between opposites, you can try to incorporate opposite extremes," explained Bjarke Ingels, describing the central concept behind studio BIG's "yes is more" philosophy [12, 16]. This conceptual approach applied in case study projects concerns the arrangement of residential units in relation to the complexity of the facade. In the case of VM Houses, a greater number of diverse residential unit types were placed to span two or three floors, resulting in a simpler overall form and uniform facade (Figure 4). Conversely, The Mountain employed a typology where each residential unit is similarly organized as a single-floor unit, but resulting in a dynamic and expressive facade (Figure 4).

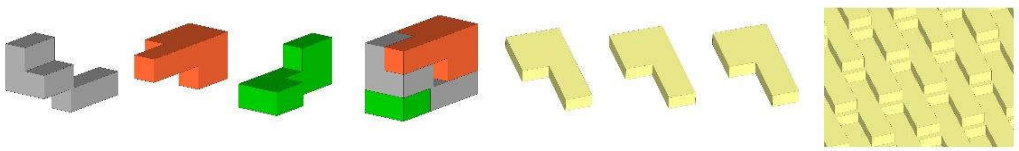

Figure 4. Concept: arrangement of residential units - VM Houses (left) and The Mountain (right), source: author

2.3. Analysis of Project Formation

Project formation is a complex process that involves a series of decisions related to form creation, spatial and functional organization, contextual response and refining architectural details. Bjarke Ingels claims about his works that “even though it’s carefully crafted, premeditated, discussed and designed and tested, when you see it, it has to feel effortless” [17]. This statement highlights the complexity behind Studio BIG’s design methodology, while also emphasizing their aspiration to create architecture that appears natural, fluid, and easy. This effortlessness is firstly noticed in the building’s form and then in other aspects such as materiality, function, and user experience, creating a harmonious and intuitive architectural design.

The following section presents an analysis of methodological and architectural design considerations, beginning with an explanation of the form and its development (Figure 5) as the most distinctive aspect of the architecture of these two buildings.

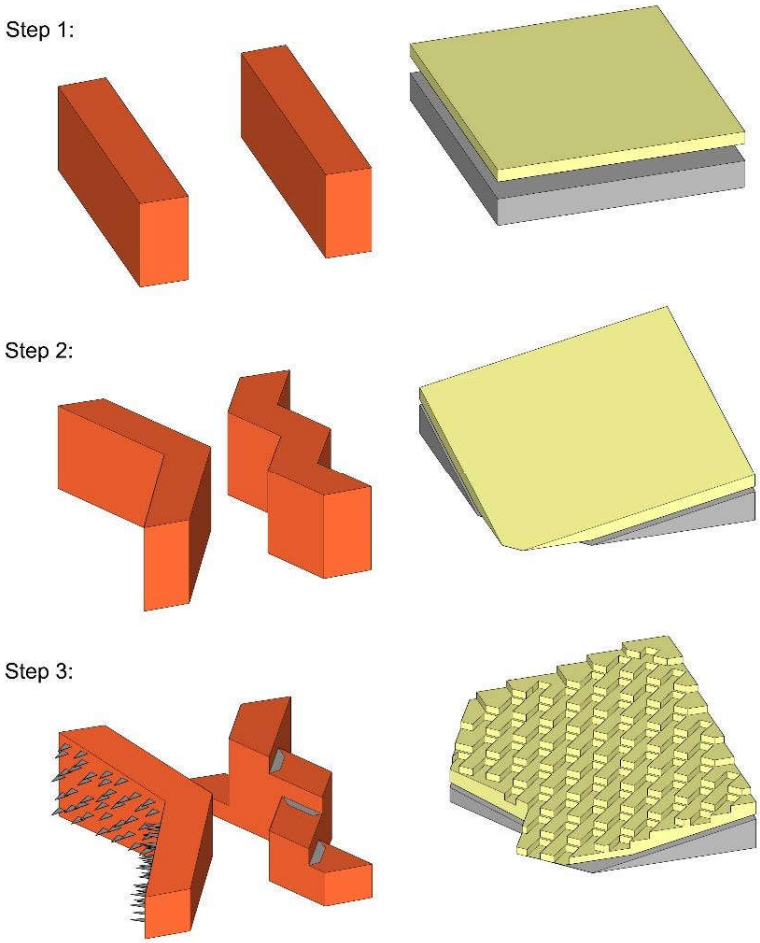

Figure 5. Form creation of VM Houses (left) and The Mountain (right), source: author

The first step in defining the form of both buildings involves establishing their overall volumes and determining their respective functions. For the VM Houses, this consists of two parallel, rectangular prisms that extend east to west, representing the residential buildings (Figure 5). In the case of the Mountain, the initial concept proposed allocating

approximately two-thirds of the overall volume to parking space below, with the remaining one-third designated for housing units above (Figure 5).

The second step in the form development involved the conceptualization of the buildings' defining characteristic shapes. In this step of creating the form of the VM Houses one of the prisms was pulled inward at the center, creating a V-shaped volume, while the other prism was bent at multiple points, creating a M-shaped volume (Figure 5). The Mountain had one of its corners lowered to ground level, creating the characteristic appearance of a mountain slope (Figure 5).

The third and the last step is about finalization of form which is related to context matching, involving further modifications to height and shape, and adding the details. The height of the VM Houses was reduced on the side adjacent to low-rise, single-family houses, while the full height was maintained on the side facing taller, multi-family residential buildings. Additionally, a two-story volume was added to the M-House to improve accessibility. Terraces were added: spiked, triangular terraces on the V-House and rooftop terraces on the M-House, effectively utilizing available open space (Figure 5). In the case of the Mountain, its height was already aligned with the surrounding context, so only the form was further refined to reflect the jagged silhouette of the M-House. The residential portion of the building was also articulated by projecting an orthogonal grid onto its top surface, guiding the following placement of individual housing units, resulting in a form resembling stepped pixels [18] (Figure 5).

One aspect of form is color, which plays an important role in subject buildings. In addition to materials such as glass, concrete, metal, and wood, which are characterized by their neutral textures and tones, vivid colors are selectively used in specific areas. Colors are applied in circulation and semi-public spaces, such as corridors, staircases, ramps, and parking garages. In VM Houses, the residential section contains three main corridors, each serving three floors. These corridors are distinctly colored: the lowest is painted green, the middle one yellow, and the highest orange-red (Figure 6). In The Mountain, there is a single continuous interior space for circulation that connects all levels. The colors change distinctly between floors, starting with green on the lowest level, progressing through yellow, orange, red, pink, and purple, concluding with blue on the highest floor (Figure 6). The use of color in both projects enhances users' spatial orientation and contributes to the visual identity of the buildings.

Figure 6. Color distribution - VM Houses (left) and The Mountain (right), source: [9, 19]

An essential architectural feature observed in both VM Houses and The Mountain lies in the conceptualization and integration of residential units are designed and combined into three-dimensional form, directly influencing appearance of the facade. In the case of VM Houses, there are approximately 105 different unit types, yet they are designed to combine seamlessly, forming a very simple overall shape and a uniform facade that does not reveal the complex internal organization (Figure 7). In contrast, The Mountain contains only a single standard residential unit type repeated throughout the structure with minor modifications along the perimeter. Despite this typological uniformity, the arrangement of these units creates a highly dynamic three-dimensional structure and a visually expressive facade (Figure 7). As Bjarke Ingels explained “once you force these sort of seemingly mutually exclusive concepts together, you actually get a new hybrid that somehow ends up looking different because it performs differently” [17]. This approach reflects studio BIG’s methodology of combining contrasts into cohesive architectural solutions [16].

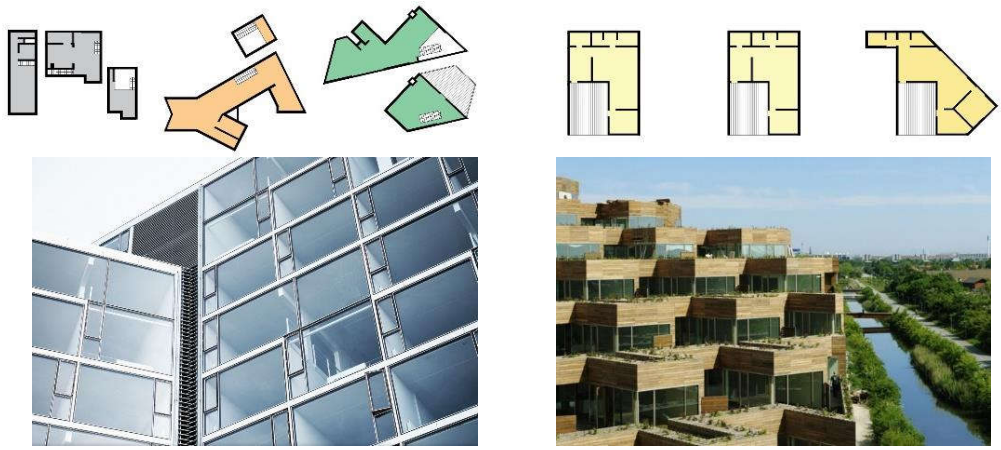

Figure 7. Residential units compared to the facade - VM Houses (left) and The Mountain (right), source: author, [9, 20]

Both projects prominently feature extensive glass surfaces on their facades, reflecting a thoughtful response to the local climate, a moderate maritime environment characterized by relatively few sunny days. Despite this shared contextual adaptation, the two projects present distinctly contrasting architectural approaches. VM Houses express openness through large, uniform glass surfaces on the facade, while The Mountain, with a significant portion of its facade dedicated to parking and the residential units positioned atop the structure, conveys a sense of privacy and enclosure from its surroundings.

Though fundamentally different, both buildings exemplify Bjarke Ingels’ belief that "In the big picture, architecture is the art and science of making sure that our cities and buildings fit with the way we want to live our lives” [9]. This diversity in architectural expression parallels the diversity of the inhabitants they serve. VM Houses represent a classic example of multi-family housing offering a variety of unit types distributed across multiple floors and maintaining openness to the exterior environment. Conversely, The Mountain presents a more private residential typology. Although it is multi-family housing, each unit mimics the form of a single-family home, complete with expansive terraces and green spaces reminiscent of private yards, accommodating a lifestyle centered around family living.

3. RESULTS AND DISCUSSION

The comparative analysis of VM Houses and The Mountain has revealed studio BIG's methodological approach to designing multi-family housing. Despite their shared location, function, and programmatic framework, the two projects demonstrate distinct conceptual and formal outcomes, resulting from different narrative design approaches.

Both buildings were shaped in direct response to their surroundings, demonstrating how contextual parameters can serve not as constraints, but as valuable design potentials. From a conceptual standpoint, storytelling emerges as a central design principle in studio BIG's work, where each project begins with a "what if" scenario that evolves through narrative-driven iterations. These distinctive conceptual strategies not only define the unique architectural identity of each project but also demonstrate studio BIG's commitment to integrating form, function, and context in innovative ways.

Contrast plays a key role in studio BIG's architectural approach, as seen in the VM Houses and The Mountain projects. Studio BIG achieves visual simplicity through a mix of diverse unit types in one project, while generating visual complexity using a single repeated unit in the other. Table 1 provides a comparative overview of architectural characteristics observed in the VM Houses and The Mountain projects. VM Houses consist of 225 units, encompassing approximately 105 distinct housing types, each spread across 2 to 3 floors, offering a wide variety of residential options. The facade is uniform and simple, enabling openness towards exterior. Open spaces are in form of balconies and few rooftop terraces. In contrast, The Mountain comprises 80 residential units, of which approximately 50 are identical. It is characterized by one main unit type with slight modifications. Facade is expressive and dynamic, but enables privacy. Open spaces consist of roof terraces for every single unit. All of these architectural characteristics reinforce a harmonious contrast between openness and enclosure, as well as diversity and repetition, highlighting studio BIG's capacity to create varied living experiences through distinct yet equally intentional residential design solutions.

Table 1. Comparation of architectural characteristic of VM Houses and The Mountain

architectural characteristics	**VM Houses**	**The Mountain**
building form	V-shaped and M-shaped	mountain-like slope
number of housing units	225	80
number of unit types	~105 different units	~50 identical units
unit layout across levels	units across 2-3 floors	single-floor units
facade	uniform and simple	expressive and dynamic
open spaces	balconies, rooftop terraces	roof terraces on all units
parking	in the surrounding area	inside the building
unit typology → visual expression	multiple unit types → simple exterior	one unit type → dynamic exterior
user lifestyle	openness and diversity	privacy and conformity

4. CONCLUSION

The design of residential buildings is a highly complex process influenced by the ideas, conceptual framework, context, and the architect's individual approach. The comparative analysis of VM Houses and The Mountain demonstrates that different design strategies, whether based on typological diversity or uniformity, can result in, yet equally successful architectural solutions. Within the framework of contemporary architecture, especially in studio BIG's projects, the relationship between form and function is inseparable.

By analyzing the design methodology of VM Houses and The Mountain, it is shown that the processes and methods of contemporary architectural design are changing. This paper reflects a broader transformation in contemporary architecture, where the emphasis is not only on the built outcome but also on the reasoning behind design choices. By focusing on methodology as an important part of architectural research, this study encourages further exploration of how architects can engage with complexity, contradiction, and innovation in the design of residential architecture.

Beyond the comparative examination of two case studies, this paper outlines key characteristics of current residential design practices, with an emphasis on the strategies employed by studio BIG. Future studies might expand this investigation by exploring other building typologies within studio BIG's portfolio or by analyzing comparable housing projects from different contemporary architectural studios.

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