

DOI: <https://doi.org/10.38027/ICCAUA2025EN0238>

## Mapping the Density, Diversity, and Digitization of the 21st Century: The Diagrammatic Architecture of MVRDV

\* <sup>1</sup> Ph.D. Candidate **Ash Yücel** and <sup>2</sup> Asst. Prof. Dr. **Hande Düzgün Bekdaş**

<sup>1</sup> Department of Architecture, Faculty Of Art, Design and Architecture, Fatih Sultan Mehmet Vakıf University, Istanbul, Türkiye

<sup>2</sup> Department of Architecture, Faculty Of Architecture, Yıldız Technical University, Istanbul, Türkiye

E-mail <sup>1</sup>: [ayucel@fsm.edu.tr](mailto:ayucel@fsm.edu.tr), E-mail <sup>2</sup>: [hduzgun@yildiz.edu.tr](mailto:hduzgun@yildiz.edu.tr)

### Abstract

**Received:** 12 January 2025  
**Revised:** 1 May 2025  
**Accepted:** 18 June 2025  
**Available online:** 5 July 2025

Copyright © 2025 by the author(s).  
All rights reserved.

This article is published under an open-access model and is made available in accordance with the terms of the Creative Commons Attribution 4.0 International Licence (CC BY).



The publisher maintains a neutral stance concerning jurisdictional claims in published maps and institutional affiliations.

This article has been selected and peer-reviewed for publication in this journal as part of the 8th International Conference of Contemporary Affairs in Architecture and Urbanism, held on 8–9 May 2025 in Alanya, Türkiye.

“Cities have distinctive identities that vary physically according to their geographical location, demographics, culture, environment, and economic factors” (Nafa & Husain, 2021), thus, In today’s rapidly changing architectural environment, the need for new approaches to generate knowledge is increasingly important. In this era of growing complexities, diagrams have become a crucial tool in architecture, establishing the relationship between the abstract and the concrete. This research aims to explore how diagrams can be utilized to address the challenges related to density, diversity and digitization of the 21st century and provide insights into the diagram’s potential future practices. The qualitative content analysis method has been adopted, with data gathered from the unbuilt/diagrammatic works of MVRDV, a firm known for its innovative and speculative projects in the field. Findings revealed that diagrams are mostly utilized to shape forward-thinking designs, unite stakeholders, integrate data and technology into architectural spaces, and discuss environmental issues. This study emphasizes the potential of diagrams in linking architectural practice to contemporary challenges, suggesting that this potential could be further explored through various design examples and discourse in the future studies.

**Keywords:** Diagram; Density; Diversity; Digitization; MVRDV.

### 1. Introduction

In contemporary architectural practice and theory, the diagram has increasingly gained importance as a dynamic mechanism that shapes both the processes of thinking and production, moving beyond its traditional role as a mere representational tool. Positioned between architectural thought and the act of drawing/making, the diagram transforms architecture from a strictly formal domain of production into an interactive and multilayered process, serving as one of the most effective mediators in addressing the complexities of reality (Allen, 1998). In reaction to new technology and changing societal dynamics, it also serves as a tool that facilitates flexibility.

With its reductive nature allowing the transmission and transformation of complex systems and concepts in contemporary design practice, and its generative capacity fostering new ideas through such reductions, the diagram emerges as a conceptual tool essential to internalizing multi-layered intellectual processes. Moreover, its role in fostering innovative solutions through reductive and relational visualization techniques is evident in the stages that necessitate interdisciplinary collaboration, such as analysis, design, implementation, and management. Throughout history, diagrams have played distinct roles—from shaping utopian urban designs of the 18th century to developing spatial solutions for the functionalism of modernist thought in the early 20th century, and later addressing the multifaceted complexities of the postmodern era (Amen 2024). By facilitating interdisciplinary interactions and "subverting dominant oppositions and hierarchies currently constitutive of the discourse" (Somol, 2007, p.177), diagrams create space for innovative and liberating ideas. It could operate as a generative, abstracting, form-giving, conceptualizing, organizing, interpretative, and boundary-defining tool (Yücel & Düzgün Bekdaş, 2024).

This study comprehensively examines the role of diagrams in the construction of architectural thought and the guidance of design processes. The contribution of diagrammatic thinking to problem definition and problem-solving processes forms the focus of the study, opening up a discussion that can be enriched by new interpretations. It introduces designers to different perspectives on how diagrams can be used in the process of thinking about contemporary issues and generating suggestions, through the discussion it opens and the examples it examines. Accordingly, it is aimed to answer the research question: “How can diagrams be utilized in addressing the challenges of density, diversity, and digitization in 21st-century architecture, and what are their potential future practices in architectural design?” In order to investigate how diagrams create a knowledge production paradigm in 21st-century architecture, a qualitative content analysis

method has been used to analyze selected projects by MVRDV, a contemporary architectural office. Data were collected through the firm’s publications, website, research center ‘The Why Factory’, related articles, and visual-audio materials. In some cases, the role of the diagram as a carrier of architectural ideas is so fundamental that it can surpass the significance of the built structure itself. Luscombe (2014) noted that in Eisenman’s House VI, diagrams maintain a symbiotic relationship with reality, whereas the house does not, emphasizing that the diagram’s role in understanding and evaluating architectural practice can extend beyond physical reality. For architecture to be impactful, it does not necessarily have to be constructed; its effectiveness can be realized through the representation and transmission of ideas. Speculative architectural production, even if impossible to construct at present, may have a broader influence than built projects, as it provokes discourse on potential future realizations. Therefore, in the analysis phase of this study, MVRDV’s unbuilt, speculative projects have been addressed as ‘diagrammatic,’ and their design approaches have been examined concerning how they deal with density, diversity, and digitalization. The findings indicated that MVRDV began exploring data-driven approaches—referred to as ‘datascape’—even before the widespread adoption of BIM software. As Rankin (2005) stated, “The world is fundamentally a continuum of data, what MVRDV calls a ‘datascape’” (p.371). Recognizing the inevitability of urban densification, MVRDV seeks ways to integrate density into the built environment, making it livable rather than attempting to eliminate it. In this attempt, diagrams serve as key instruments for conceptualizing contemporary architectural approaches, establishing relational networks, rendering real-world data visible, generating adaptable typologies, and developing extreme design propositions by making formal decisions through an ongoing process rather than a fixed outcome. More critically, the goal is not merely to generate speculative narratives about future scenarios with almost no possibility of realization but to provoke discussions on possible transformations shaped by the themes of density, diversity, and digitalization.

Winy Maas (2012), co-founder of MVRDV, defined the architect’s contemporary role as: "We are the ones who can visualize the situation of the earth, cities, and environments. We are the ones who, through that visualization, can communicate it. So, we have a crucial role in this act." In this context, drawing and diagramming have emerged as instruments for communicating architectural discourse, engaging with evolving paradigms, and reinforcing relational thinking—beyond merely serving as tools for construction (Cano-Ciborro, 2023). Given the increasing complexity and density of the contemporary world, it is crucial to investigate how diagrams facilitate architectural responses to these challenges.

This paper is organized as follows: In Chapter 2, discourses on diagrams in architecture are explored; in Chapter 3, materials and methods are explained. Chapter 4 presents the analysis and findings of the MVRDV’s diagrammatic works, followed by the discussion and conclusion chapters (Figure 1).

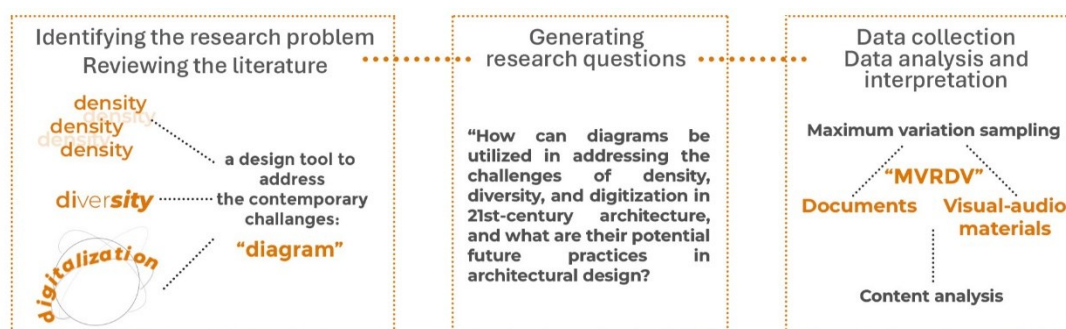


Figure 1. Structure of the Study (Developed by Authors).

## 2. Diagrams in Architecture

A diagram is a symbolic representation of the process and outcomes of an action or an entity through lines, marks, or traces. Positioned between the act of thinking and drawing/making within the architectural discipline, it reveals the interactive nature of architecture, offering the potential to explore the possibilities presented by new technologies and social forces without adhering to conventional definitions of it. This potential renders the diagram a tool of negotiation, facilitating the resolution of complexities between the real and the virtual (Allen, 1998). As it is not a sketch, a diagram does not refer to anything; as it is not a plan, it cannot be constructed. It occupies a neutral zone—a form of “neither/nor” drawing, devoid of excess (Vidler, 2005); this, in turn, underscores its capacity to simplify and reduce complexities.

Peirce (1998), known for his work in semiotics, considers the diagram as an “icon.” An icon is a sign that resembles its object; however, according to Peirce, the diagram differs from other icons. Although it resembles its object, it does so through abstraction, functioning as a mechanism that carries and generates the essence of an idea. The diagram’s ability to assume symbolic and indexical roles alongside iconicity strengthens its function, because its resemblance to its object has raised concerns that the diagram might directly transform into the building itself, leading to an architecture devoid of intellectual depth (Vidler, 2000). Perhaps due to this concern, the idea that the diagram does not necessarily have to resemble its object but rather serves as a “carrier of ideas” and structuring space and human movement, has gained prominence in discourse (Allen, 1998; Eisenman, 1999). Either by resembling its object or by organizing relationships at a more abstract level, it has established itself as one of the main tools for designers across various scales.

Corbellini (2006, p.92-95) categorized the roles of the diagram in the architectural discipline into five main categories: "reduction," "relation," "proliferation," "abstraction," and "ideology." In recent decades, as data and design problems have become complex and layered, the diagram's ability to synthesize and intensify information has made it a frequently preferred tool among designers (Deen & Garritzmann, 1998; Van Berkel & Bos, 1998). In conflicts arising from the

necessity of collaboration among various technical knowledge fields in the stages of analysis, design, implementation, and management, diagrammatic approaches facilitate cooperation through reductive visualizations, opening doors to innovation. By defining threshold conditions and establishing connections, it becomes part of social knowledge and expression, playing a critical role in large-scale impacts by redefining the relationship between different actors in complex decision-making processes (Bunschoten, 1998). Empowered by its roles in reduction and relation, it not only produces the final outcome but also generates the process itself (Corbellini, 2006). Thus, diagrammatic practice enables an architecture that generates maximum impact with minimal means (Allen, 1998). One of its most powerful aspects, abstraction, allows it to be both transferable and adaptable, facilitating the movement of knowledge within architecture and the integration of external knowledge into the discipline. Beyond being a representational tool, it functions as a dynamic instrument that guides the design process and proposes organizational strategies (Bunschoten, 1998; Deen & Garritzmann, 1998; Amore, 2023; Maryńczuk, 2023). Its ability to be instrumentalized to discuss and alter certain assumptions in architecture positions it as an ideological tool. It has been employed in critiquing a plastic, formalist, and object-oriented architecture, advocating instead for an approach that situates architecture within broader contexts, interdisciplinary interactions, processes, and infrastructural factors (Somol, 1999; Corbellini, 2006).

Diagrams can be prototypes that shape the future. Diagrams like Le Corbusier's Modulor or Dom-ino not only propose solutions to the problems of the era they were produced in but also position themselves at the center of discussions aimed at transforming architecture in later periods—such as in Eisenman's (2014) article, where he argues that by looking at Le Corbusier's Modulor through a different conceptual spectrum, the selection, size, number, and position of the diagram's elements represent the first traces of a self-referential idea. In addition to their critical value in producing solutions, the importance of diagrammatic thinking also lies in its ability to ask the right questions, as De Landa (1998, p.34) emphasized, "It is only through skillful problem-posing that we can begin to think diagrammatically." When the questions are asked correctly, providing the answers becomes easier. As this discourse points out, this study focuses on exploring how diagrams, as defined by Hays (2010) "as a new way of writing today's architecture," help produce answers by asking the right questions and focusing on specific problems.

### 3. Material and Methods

In qualitative research, reality is subjective, plural, and inductive (Groat & Wang, 2013), and the aim is not to generalize knowledge but to produce deep and specific explanations (Pinnegar & Daynes, 2007). The researcher's interpretations can be considered the primary measurement tool, often utilizing visual representations and/or words expressed through narrative tools (Miles & Huberman, 1994, p.7). In this study, the "maximum variation sampling" technique, which involves selecting individuals or cases that differ based on a specific characteristic to provide diverse perspectives, is employed as a "purposive sampling strategy"—a series of interconnected processes aimed at obtaining meaningful and qualitative data—during the data collection phase to address research problems (Creswell, 2013).

In this qualitative study, it is aimed to explore different uses of diagrams through various projects by MVRDV via purposive sampling. The reasons for selecting data from MVRDV's works for analysis are that they use diagrams as tools that integrate conceptual thinking, data analysis, and architectural narrative; interpreting urban and contemporary problems to generate spatial solutions; creating a basis for discussion through experimental and speculative projects. In this regard, data have been collected from documents and audiovisual materials (Creswell, 2013) found in articles, catalogs, the firm's website, books, works of art/fiction/film, and generic internet sources (Lucas, 2016). In line with the purposive sampling approach, the projects Pig City (2001), The Skycar City (2006), China Hills (2009), Vertical Village (2011), Rooftop Catalogue (2021), and What-If: Nederland 2100 (2024) from MVRDV have been examined. These projects have been analyzed through content analysis, an inductive qualitative research method that investigates underlying concepts within the data and their interrelationships (Neuman, 2012). This study is limited to the projects of a single office that are defined as "diagrammatic," and in future research, thematic commonalities can be identified across the works of more architects and offices to generate broader interpretations.

### 4. Results

MVRDV is a Rotterdam-based architecture and urban design firm founded in 1993 by Winy Maas, Jacob van Rijs, and Nathalie de Vries (Ruby & Ruby, 2015). In this section, the analyses of the selected projects and visuals of some diagrams used in MVRDV's projects are compiled (Table 1).

**Table 1.** The analysis of the selected projects.

---

**Pig City (2001):** Pig City, is one of the pioneering examples of the office's 'density' based work. In 2000, pork was the most consumed meat globally, but diseases such as Foot-and-Mouth and Swine Fever started to turn pork production and consumption into a crisis. Unless one turns to vegetarianism, the only solution is to change production methods and implement humane practices. However, a new issue arises at this point: the space required for biological pig farming. When calculating the production and processing of food for pigs, and the space required for pig breeding, it turns out that in an ideal production environment, 75% of the Netherlands would need to be allocated to pigs. Thus, is it possible to consolidate pig production in intensive farms, eliminating the costs and pollution of transportation and distribution? While the idea of building upwards is not new, proposing such vertical architecture specifically for farm animals is a novel and speculative suggestion (Vinella-Brusher, 2016). By optimizing all data related to pig farming, such as straw amounts, sunlight exposure, and space requirements, the result is 622-meter-tall pig towers that provide enough meat for half a million people (MVRDV, 2018). This visionary proposal, developed to address the increasing population of the Netherlands using minimal space, presents a diagrammatic design that offers solutions to today's and tomorrow's problems by stacking facilities such as waste accumulation, gas production, fish

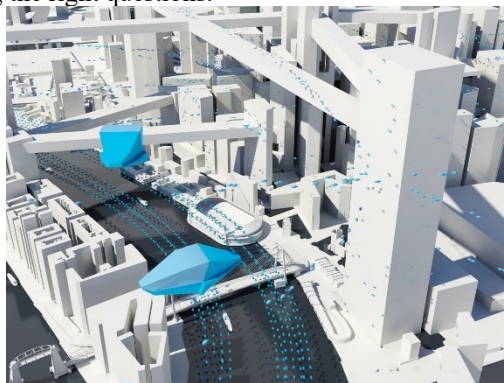
---

farming, feed storage, organic pig farms, slaughterhouses, and vehicle loading areas (MVRDV, 2005). This design is more about initiating a discussion on future food production practices by evaluating data on current practices, rather than offering a feasible and applicable idea (Fuad-Luke, 2017) (Figure 2).



**Figure 2.** Pig City (MVRDV, 2018).

**The Skycar City (2006):** It is “A city that can reformulate itself, a city that is conscious of its gained knowledge” (MVRDV, n.d., Skycar City), produced by looking at urban planning with a process-oriented approach. This process-oriented approach enables it to analyze, adapt, and generate alternatives to urban challenges. The main argument of the project is that the dominance of the space allocated to vehicles over the remaining areas of the city in existing urban areas will lead to an inability to respond to the density of the present and the future. In response, a new urbanization is created, where traffic is detached from its traditional use by bringing it to a plane that spans three dimensions. In this city, the traditional car is transformed into an environmentally friendly, affordable vehicle called a 'skycar' that moves by flying up to 800 meters high through a twelve-step diagrammatic process (Maas & La, 2007). To propose such a suggestion, the magnitude of the problem must first be highlighted; therefore, the scale of density is presented through different urban maps and graphics. The office presents this city design through a diagrammatic video (MVRDV, 2013): Initially, a two-dimensional city plan is shown, followed by buildings rising into the third dimension while the traffic on the ground starts to lift into the air. New ‘grounds’ are created at higher levels where buildings can form new networks. During the design thinking and research phase, examples of built or unbuilt designs that could serve as prototypes for the 'skycar' are visualized on a timeline, overlapping with data - such as world population and skyscraper heights - from the eras that inspired them. This data diagram is a tool that facilitates a better understanding of the city's design process. (Buraya görsel gelebilir.) While focusing on the issue of congestion and density, the design creates an even denser city model, but the aim is to design a city that can carry this capacities, reaching a truly three-dimensional city beyond the traditional two-dimensional understanding. However, as the density continues, it is evident that new roads will be created, and regulations for urgent and unexpected situations will need to be made. With this awareness, at the end of the work, many unanswered questions regarding the future of Skycar City are raised. This also serves as a reminder of de Landa's (1998) emphasis on the relationship between diagrammatic thinking and asking the right questions.



**Figure 3.** Skycar City (MVRDV, n.d., Skycar City).

**China Hills (2009):** A visionary proposal is developed at the intersection of architecture, urban design, and landscape architecture, addressing the increasing demand for space in response to China's growing population. Future projections, based on current demographic data of China, indicate a dramatic rise in urban population, while the monotonous and homogeneous structure of urban developments calls for innovative experimentation. The idea that density will necessitate vertical architecture, when paired with the inadequacy of current skyscraper typologies in integrating natural light, gives rise to the need for a new typology: 'Hill' shaped structures with wide, sloped terraces, placed within and around existing cities, support diversity with mixed programs such as retail, leisure, and industry, while also allowing for food and energy production as they rise above ground level (MVRDV, n.d., China Hills) (Figure 4).

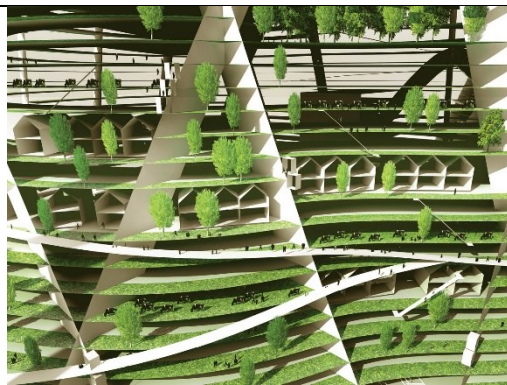


Figure 4. Skycar City (MVRDV, n.d., China Hills).

**Vertical Village (2011):** Designed in collaboration with MVRDV and its research institute The Why Factory (T?F), the Vertical Village addresses the threat faced by the individual identities and social ties of East Asian cities, which have been preserved for centuries, in the face of demographic and economic changes and the emergence of monotonous, homogenous mega-structures that erase diversity. The book “The Vertical Village” (The Why Factory and Maas, 2012) thoroughly explores this urban proposal through diagrams, maps, and visuals, examining all its stages. The study investigates how density can be increased without losing the urban fabric, starting from the issue of the disappearance of urban villages. The current state and future of nine different Asian cities are explored, focusing on the "block attack" dominance situation. The plans, facades, and relationships/non-relationships between existing housing units are analyzed. These representations are significant in both understanding the current situation and emphasizing the necessity of action. In the book, urban villages are conceptualized through qualities as density, individuality, critical mass, flexibility, collectivity, evolutionary growth, diversity, human scale, publicness, informality, and identity. How can these concepts, integrated into a circular diagram, be reintroduced to the city? The proposal suggests that by combining housing and offices with terraces and rooftop gardens, a more comfortable and less fragmented lifestyle could be created for everyone. To construct the Vertical Village, a self-organizing city model that combines individuality, diversity, and collectivity with the need for density is required. Scenarios are discussed through different forms of volumes stacked on top of each other using blue foam models. The book also introduces digital tools, VillageMaker and HouseMaker, which allow individuals to design their own houses (The Why Factory and Maas, 2012). Initially exhibited in Taipei in 2011, the project’s models were later presented in Seoul in 2012 and Hamburg in 2013, engaging with urban dwellers in each city (Figure 5).



Figure 5. Vertical Village Taipei (MVRDV, n.d., Vertical Village Taipei).

**Rooftop Catalogue (2021):** MVRDV discusses the issue of density in the city through the concept of ‘rooftops’ in their work “Rooftop Catalogue” (MVRDV, Maas & van Manen, 2021). According to their argument, the rooftops, which are still an underutilized element in increasingly dense cities, present countless possibilities for designers, developers, and urban dwellers. A comparative analysis is first conducted through diagrams of urban data: for instance, if 40% of the flat roofs in Rotterdam were dedicated to green space, it would create an area twice the size of New York’s Central Park. Following this analysis, twelve building typologies, which typically feature flat roofs and are common in urban contexts, are visualized. The 130 proposals derived from these defined typologies are explained through holistic visuals, detailing the type of typologies they can be applied to, the UN Sustainable Development Goals they address, and the urban challenges they aim to solve. Among the proposals, a ‘bee roof’ designed specifically for bees, a ‘vertical park’ offering diverse activities for humans and animals, a speculative ‘nature cemetery’ free from fences and tombstones, and ‘single-family homes’ placed on top of apartment buildings, offering more space for families, are presented. Other suggestions include placing ‘tiny houses’ on rooftops, creating ‘urban skate parks’ or ‘climbing walls,’ ‘rooftop murals,’ ‘sculpture gardens,’ ‘roller coasters,’ ‘outdoor cinemas,’ ‘wind turbines,’ ‘helicopter platforms,’ ‘hyperloop stations,’ and many more. While not all of these proposals are applicable, the primary aim is to highlight how a typically underutilized space, rooftops, could take on different forms. Following the catalogue, MVRDV’s technology team, MVRDV NEXT, in collaboration with Superworld and the Municipality of Rotterdam, developed RoofScape, a digital visualization tool for the rooftops of Rotterdam. This software, which allows urban planners and individuals to be informed about the more efficient use of rooftops, categorizes them based on their ability to support different functions using color codes, in accordance with existing

roof standards. Therefore, the software can be viewed as a bridge for the integration of the catalogue into real life and as a collaborative diagram expected to be used in other cities with new stakeholders. The installations “The Podium” and “Rotterdam Rooftop Walk”, temporarily exhibited in the same year in Rotterdam, can be considered the first examples of implementing the ideas from the catalogue in real life, which exemplifies the use of diagrams as idea carriers and prototypes for future practices.



Figure: Design examples from Rooftop Catalogue (MVRDV, Maas & van Manen, 2021, pp. 53-58, 96).

**What-If: Nederland 2100 (2024):** This study discusses the spatial and environmental challenges that the Netherlands may face in the future due to climate change and demographic transformations while presenting possible solution scenarios. It aims to guide the government's spatial planning policies and provide significant insights for people living in coastal areas threatened by climate change worldwide. Alongside the concepts of density, diversity, and digitality, a new phenomenon that designers—and diagrams—must engage with is introduced: dilemmas. To deal with dilemmas, in collaboration with design studios MVRDV, IMOSS, and Feddes/Olthof, a decision matrix diagram is developed to shape future scenarios. This diagram visualizes key spatial planning factors—such as global warming, population growth, and rising sea levels—using adjustable scales to generate different scenarios. Subsequently, an extreme scenario is examined, incorporating maximum global warming and population growth: the Netherlands ceases its battle against the sea level and adapts its way of life accordingly. With extreme sea level rise, the Netherlands will be divided into two distinct regions: "water-logged cities" in the west and "sand cities" in the east. According to the proposed scenario, the sand cities will become highly dense, evolving into the country's economic and population center. Agriculture will shift to vertical farms, and green spaces will be integrated into rooftops. In contrast, the water-logged cities in the west will feature historical centers protected by large barriers and new living spaces designed to coexist with water. Bio-based production and water-based transportation will become widespread. Winy Maas emphasized that the goal of this study is to highlight that even the most extreme conditions can be overcome with innovative decision-making which redefines the conventional planning approaches (MVRDV, IMOSS & Feddes/Olthof, 2024).



Figure: MVRDV Scenario in the decision matrix (MVRDV, IMOSS & Feddes/Olthof, 2024, s.21).

#### 4. Discussions

The 21st century is evolving within the framework of density, diversity, and digitalization-based phenomena, placing a responsibility on architecture to develop solutions for the challenges arising from these factors. Since the late 1990s, the Dutch office MVRDV has produced numerous academic and practical works on these subjects. Their projects serve as a rich data source for discussing how the diagram, a crucial tool in architectural design, facilitates design processes. Accordingly, six projects produced by the office between 2001 and 2024 have been analyzed through content analysis. These projects remain unbuilt and at a diagrammatic level, focusing on density, diversity, and digitalization while instrumentalizing diagrams to develop innovative solutions.

In Pig City, proposals that spatial needs in the livestock industry can be addressed through a vertically organized system to solve the problem of 'density' are presented in layered section diagrams. Diagrams showing the placement of different functions (such as animal shelters, feed storage, gas production, and fish farming) within the system visualize the internal dynamics of a 'diverse' production model.

Skycar City is a design proposal that addresses the density of existing cities while seeking a more efficient solution in the face of increased urban congestion. Diagrams are used as tools to illustrate how spatial distribution intensifies as the city transitions from two-dimensional to three-dimensional. The design processes for flying cars are defined through process diagrams, which outline how these vehicles operate in the vertical city environment. New 'grounds' created

between the elevated buildings, formed by flying cars, allow for the development of innovative functional networks and connections, showing how the variety of uses and activities within the city can spread over a wider area. Data from the past and existing projects are placed on a timeline to illustrate how various prototypes can carry different and multiple functions within the city. The aim is not to propose a completed and applicable project, but rather to stimulate thinking by posing questions on how to coexist with current problems.

Pig City and Skycar City are significant examples of MVRDV's 'datascapes,' diagrams that visually convey urban realities and changing urban processes using digital tools. This diagrammatic approach, which supports the production of scenarios where existing urban data evolves into futuristic and extreme conditions, fosters the creation of the 'new' by establishing relationships between the real urban scenario and its highly abstracted forms. In this data-driven approach, design can change through digital tools and take on new forms in light of new data (Rankin, 2005; Amoroso, 2010). Using data offers a criticality and innovativeness that goes beyond reductive formalism (Maas, 1999a). Moreover, as these visualizations integrate pure data into design, they also hold power in the bureaucratic decision-making processes of contemporary cities (Corner, 1998). The office's Metacity/Datatown project, designed just before entering the new millennium, is described in the eponymous book as "...is based only upon data. It is a city that wants to be described by information" (Maas, 1999b, p.58). The effects of this pioneering city are evident in both Pig City and Skycar City, as well as in subsequent futuristic/diagrammatic urban designs. The datascapes, emerging before the widespread implementation of Building Information Modeling (BIM) techniques, are significant in that they serve as early precursors to the foundational principles that BIM would later adopt.

In China Hills, which offers a spatial proposal against China's growing population problem through vertical architecture inspired by the 'hill' analogy, diagrammatic representations illustrate how various functions such as housing, commerce, and food production can coexist. In this project, which aims to accommodate as many people as possible in a sustainable and livable setup on a hypothetical site, diagrams are used in the integration of current issues with digital technologies. The Vertical Village redefines the characteristics of urban villages by using concepts such as 'density', 'individuality', 'evolutionary growth', 'flexibility', 'collectivity', and 'public space' to discuss how these elements can be re-integrated into the city through diagrams. Digital tools and participatory platforms are employed to allow urban dwellers to design their own living spaces. Digital tools like VillageMaker and HouseMaker encourage individual participation in the design process.

The Rooftop Catalogue utilizes diagrams as tools for analysis, exploration, and design. The diagrams present 130 proposals based on 12 different building typologies, showing where each proposal could be applied and how they could create diversity within the city. The RoofScape software developed for the rooftops of Rotterdam offers a tool categorized with color codes to show urban planners and individuals what functions can be applied on rooftops. This software visualizes how the diagrams and proposals can be implemented in the real world and encourages collaboration between different stakeholders.

In What-If: Nederland 2100, diagrams are used to represent projections about how cities might evolve in the future and to analyze how various functions in cities can diversify across different scenarios. The decision matrix diagram visualizes key spatial planning factors such as global warming, population growth, and rising sea levels, facilitating the emergence of diverse scenarios. These diagrams provide a way to analyze large data sets and make decisions via digital platforms.

The utilization of diagrams in the analyzed projects has been conceptualized in Table 2 in relation to the themes of 'density,' 'diversity,' and 'digitization'.

**Table 2.** The utilization of diagrams through analysis.

	<b>Density</b>	<b>Diversity</b>	<b>Digitization</b>
<b>Pig City</b>	-Section diagrams and visuals which represent the vertical pig farming	-Combining different programs together	-Datascapes
<b>Skycar City</b>	-Using timelines, data diagrams, urban maps to show the precursors of the process	-Designing different prototypes for flying cars	-Datascapes -Producing 3d digital models to show the idea
<b>China Hills</b>	-Diagrammatic representations of the 'hill' analogy	-A mix of urban program and nature	-Digital modelling
<b>Vertical Village</b>	-Highlighting the 'density' problem through diagrams, timelines and maps	-Achieving 'individuality' in cities using different typologies together	-Digital design tools - VillageMaker and HouseMaker- -3d urban modelling
<b>Rooftop Catalogue</b>	-Making the necessity of the proposal visible by visualizing it through urban data.	Offering 'rooftops' through different typologies as a solution to density	-Digital visualization tools -RoofScape- for collaboration between different stakeholders
<b>What-If: Nederland 2100</b>	- Predicting the impacts of density on the city through future scenarios developed using diagrams and matrices	-Developing different design strategies for different scenarios	-3d modelling

Therefore, based on the research question "How can diagrams be utilized in addressing the challenges of density, diversity, and digitization in 21st-century architecture, and what are their potential future practices in architectural design?", the following answers can be generated through the ways diagrams are instrumentalized in the examined projects:

- drawing attention to contemporary issues and the necessity of innovative explorations through informative diagrams and maps
- transforming abstract data into concrete, visible, and comprehensible design input
- generating different typologies
- developing design concepts and analogies
- utilizing digital diagrams during the design and representation phase
- bridging contrasts together such as urban-rural and individual-society
- developing future-oriented, scenario-based design strategies through matrices and diagrams
- visualizing the design process step by step to enhance the clarity of both the design and the final product
- facilitating the necessary flow of information between different stakeholders.

## 5. Conclusions

This study aimed to analyze how diagrams address the density, diversity, and digitization in 21st-century architecture. A qualitative content analysis of six diagrammatic projects by MVRDV has demonstrated that diagrams serve not only as representation tools in design processes but also as critical instruments for generating speculative future scenarios. The examined projects highlight the capacity of diagrams to transform abstract data into spatial proposals and support innovative design approaches at various scales. Functioning as strategic tools in projects where digital data analysis and speculative design are intertwined, diagrams act as "datascapes" rather than conventional architectural representations. They serve as analytical and conceptual guides in the development of spatial typologies that integrate density and diversity in a balanced manner and as dynamic structures that inform decision-making processes.

In conclusion, diagrams offer a dynamic framework that organizes design processes, supports data-driven thinking, and facilitates the flow of information among various stakeholders. This study explores the instrumentalization of diagrams in relation to density, diversity, and digitization—key phenomena of the 21st century—while opening up possibilities for further research on different concepts and issues. In this context, future studies could examine how diagrams, positioned as both a tool and a mode of thinking in contemporary architecture, are instrumentalized across different architectural discourse and practices, expanding the understanding of their role in producing both speculative and applicable design solutions.

## Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflict of Interests

The Author(s) declare(s) that there is no conflict of interest.

## References

- Allen, S. (1998). Diagrams matter. *ANY: Diagram Work, Data Mechanics for a Topological Age*, 23, 16–19.
- Amore, M. P. (2023). 'Abstract machine'. Diagrams in project narrative. *Disegno*, 13, 43–56. <https://doi.org/10.26375/diseño.13.2023.7>
- Amen, M. A. (2024). AI-driven sustainable habitat design: Key policy frameworks and ethical safeguards. *Smart Design Policies*, 1(1), 23–32. <https://doi.org/10.38027/SMART-V1N1-4>
- Amoroso, N. (2010). *The exposed city: Mapping the urban invisibles*. Routledge.
- Basulto, D. (2012, April 23). AD interviews: Winy Maas / MVRDV. *ArchDaily*. <https://www.archdaily.com/210344/ad-interviews-winy-maas-mvrdv>
- Bunschoten, R. (1998). Stirring the city: CHORA's diagrammatics. *OASE*, 48, 72–82.
- Cano-Ciborro, V. (2023). Diagram and project: The relevance of representing and thinking contextual forces, focusing on Peter Eisenman and Chora's founder, Raoul Bunschoten. *Expresión Gráfica Arquitectónica*, 48(1), 268–279. <https://doi.org/10.4995/ega.2023.18760>
- Corbellini, G. (2006). Diagrams: Instructions for use. *Lotus International*, 127, 88–95.
- Corner, J. (1999). Operational eidetics: Forging new landscapes. *Harvard Design Magazine*, Fall, 22–26.
- Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). SAGE Publications.
- De Landa, M. (1998). Deleuze, diagrams, and the genesis of form. *ANY: Diagram Work, Data Mechanics for a Topological Age*, 23, 30–34.
- Deen, W., & Garritzmann, U. (1998). Between ideogram and image-diagram. *OASE*, 48, 83–92.
- Eisenman, P. (2014). Aspects of modernism: Maison Dom-ino and the self-referential sign. *Log*, 30, 139–151.
- Fuad-Luke, A. G. R. (2017). An ecosophical inquiry into digital mediation and design in relation to alternative food networks (AFNs) in an 'expanded field' of 'agri-culture'. *Estudos em Comunicação*, 22(25), 35–60. <https://doi.org/10.20287/ec.n25.v2.a04>
- Groat, L. N., & Wang, D. (2013). *Architectural research methods* (2nd ed.). John Wiley & Sons.

- Hays, K. M. (2010). Afterward. In A. K. Sykes (Ed.), *Constructing a new agenda: Architectural theory 1993–2009* (pp. 472–476). Princeton Architectural Press.
- Lucas, R. (2016). *Research methods for architecture*. Laurence King Publishing.
- Luscombe, D. (2014). Architectural concepts in Peter Eisenman's axonometric drawings of House VI. *The Journal of Architecture*, 19(4), 560–611. <https://doi.org/10.1080/13602365.2014.951064>
- Maas, W. (1999a). Datascape: The final extravaganza. *Daidalos: Architecture, Art, Culture*, 69/70, 48–49.
- Maas, W. (1999b). *Metacity/Datatown*. Rotterdam: MVRDV/010 Publishers.
- Maas, W., & La, G. (2007). *Skycar city: A pre-emptive history*. Actar.
- Maryńczuk, P. (2023). Essential characteristics of diagrammatic representations in creative architectural design. *Space & Form*, 53, 57–72. <https://doi.org/10.21005/pif.2023.53.B-03>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). SAGE Publications.
- MVRDV, IMOSS, & Feddes/Olthof. (2024). *Ontwerp NL*. Platform Ontwerp NL.
- MVRDV, Maas, W., & van Manen, S. (2021). *Rooftop catalogue*. Rotterdamse Dakendagen.
- MVRDV. (2005). *MVRDV KM3: Excursions on capacities*. Actar.
- MVRDV. (2013, June 19). MVRDV | Skycar City | 2006 [Video]. *YouTube*. <https://www.youtube.com/watch?v=qwhmehaMsKM>
- MVRDV. (2018). Pig City included in Eco-Visionaries: Art, Architecture and New Media after the Anthropocene, MAAT Lisbon. *MVRDV*. <https://www.mvrdv.com/projects/134/pig-city>
- MVRDV. (n.d.-a). China Hills. *MVRDV*. <https://www.mvrdv.com/projects/181/china-hills>
- MVRDV. (n.d.-b). Skycar City. *MVRDV*. <https://www.mvrdv.com/projects/209/skycar-city>
- MVRDV. (n.d.-c). Vertical Village Taipei. *MVRDV*. <https://www.mvrdv.com/projects/180/vertical-village-taipei>
- Nafa, H., & Husain, H. R. (2021). Modelling macro scale spatial analysis: Location. *Civil Engineering and Architecture*, 2556–2569. <https://doi.org/10.13189/cea.2021.090738>
- Neuman, W. L. (2012). *Toplumsal araştırma yöntemleri: Nicel ve nitel yaklaşımlar I-II* (5th ed.). Yayın Odası.
- Peirce, C. S. (1998). *The essential Peirce: Selected philosophical writings (1893–1913)* (Peirce Edition Project, Eds.). Indiana University Press.
- Pinnegar, S., & Daynes, J. G. (2007). Locating narrative inquiry historically: Thematics in the turn to narrative. In D. J. Clandinin (Ed.), *Handbook of narrative inquiry: Mapping a methodology* (pp. 3–34). SAGE Publications.
- Rankin, W. (2005). Noise, mapping, and the architecture of statistics. *93rd ACSA Annual Meeting Proceedings, The Art of Architecture/The Science of Architecture*, 371–382.
- Ruby, I., & Ruby, A. (Eds.). (2015). *MVRDV buildings*. nai010 Publishers.
- Somol, R. E. (2007). Dummy text, or the diagrammatic basis of contemporary architecture. *Revista de Pesquisa em Arquitetura e Urbanismo*, 5, 168–178.
- Stott, R. (2022, November 16). MVRDV, Superworld, and the City of Rotterdam create software for reimagining rooftops. *ArchDaily*. <https://www.archdaily.com/992273/mvrdv-superworld-and-the-city-of-rotterdam-create-software-for-reimagining-rooftops>
- The Why Factory, & Maas, W. (2012). *The vertical village*. NAI Uitgevers.
- Van Berkel, B., & Bos, C. (1998). Diagram work. *ANY: Diagram Work, Data Mechanics for a Topological Age*, 23, 14–15.
- Vidler, A. (2005). Diagrams of diagrams: Architectural abstraction and modern representation. *Representations*, 72, 1–20.
- Vinella-Brusher, E. (2016). MVRDV: Innovative and sustainable problem-solvers. *Undergraduate Journal of Humanistic Studies*, 3, 1–12.
- Yücel, A., & Düzgün Bekdaş, H. (2024). Diagram as a productive instrument in contemporary architecture. In H. A. Nia & R. Rahbarianyazd (Eds.), *Innovative approaches to cultural heritage and sustainable urban development: Integrating tradition and modernity* (pp. 32–41). Cinius Yayınları. <https://doi.org/10.38027/N3ICCAUA2024EN0262>