DESIGN PROCESSES IN BIG'S OFFICES.

An analysis of the company principles and approaches, the role of Bjarke Ingels as a starchitect, the design method, and tools.

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ABSTRACT

This study delves into the strategies employed by the Bjarke Ingels Group (BIG), a globally recognized architectural studio, to attain international acclaim while investigating potential disparities between its professed principles and practical actions. Commencing with an exploration of BIG's history since its inception in 2005, this research analyses pivotal projects contributing to its success, alongside the studio's global expansion and structural evolution. The focus then shifts to BIG's ethos articulated through its manifesto, contextualized within published works to elucidate how values shape its approach. A central tenet, "hedonistic sustainability," underscores BIG's design philosophy, emphasizing responsiveness, reincarnation, productization, and biophilia as guiding principles.

Moreover, tracing BIG's trajectory underscores the transformative role of its founder, Bjarke Ingels, whose talent, charisma, and evolving public persona have propelled him into an iconic figure within and beyond the architectural realm. This evolution prompts an examination of the broader societal and architectural implications of the "starchitect" phenomenon, contextualized through comparative case studies of influential figures like Rem Koolhaas, Frank Gehry, and Frank Lloyd Wright.

Transitioning to methodology, the study outlines a project path model derived from interdisciplinary theories, integrating concepts from Rittel, McLuhan, Darwin, and Mendel to delineate BIG's iterative design process. Tools employed in generating and refining design variations, including language, sketches, models, and technology, are scrutinized for their efficacy and impact on architectural production.

This theoretical framework is substantiated through a real case analysis, leveraging firsthand experience within BIG to evaluate the alignment between theory and practice. The examination reveals prevalent strategies such as prototyping, while also highlighting challenges in realizing "hedonistic sustainability" due to an overreliance on superficial green design tactics.

However, the company actively invests in initiatives to adapt and address current and future demands. BIG's particular emphasis lies in the realms of sustainability and technology. These overarching interests are then tailored to the individual studios, considering factors such as available budget and the regulatory and market landscapes specific to each area of operation.

By meticulously comparing theoretical concepts with real-world practices, it uncovers discrepancies that challenge conventional notions of firm development. Nevertheless, this analysis highlights the factors contributing to BIG's success, underscoring its potential. Ultimately, this critical evaluation contributes significantly to the architectural discourse, fostering a deeper and more nuanced comprehension of what drives success within the field.

I. INTRODUCTION

This thesis represents the culmination of both theoretical research and practical experience gained by the author during their internship at the esteemed firm of BIG Barcelona.

The theoretical foundation was established through an exhaustive analysis of primary sources, including BIG's seminal publications "Yes is More" and "Formgiving," as well as insights gleaned from interviews, TEDx Talks, and documentaries featuring Bjarke Ingels. "Yes is More" and "Formgiving" go beyond the typical project showcase format commonly found in architectural publications. Instead, they delve deeply into the theoretical underpinnings of BIG's approach to architecture and design. These books contain essential theoretical declarations by Bjarke Ingels himself, offering insights into the firm's innovative thinking, design processes, and conceptual frameworks. Additionally, the author delved into secondary sources such as scientific papers available on platforms like ScienceDirect, Wiley Online Library, Google Scholar, ResearchGate, and Pico (the virtual library of Politecnico of Turin), along with architectural articles from leading online platforms like ArchDaily and Dezeen.

The first chapters of this thesis serve as a comprehensive exploration of the values, methodologies, and approaches that define BIG as a whole. By delving into Ingels' innovative design philosophies, collaborative ethos, emphasis on sustainability, and human-centric architecture, the first part of the research offers insights into the core values that permeate BIG's diverse projects and offices.

However, as the thesis progresses, the focus shifts to the practical component of the study, informed by a year-long immersion in the Barcelona studio, introducing real-life case scenarios and project dynamics that are distinctly influenced by the unique context of the Barcelona office. From the studio's specific project portfolio to its organizational structure and internal processes, the experiences detailed in the later chapters are deeply shaped by the dynamics of the Barcelona studio.

Therefore, it is essential to recognize that while the first chapter provides a broad understanding of BIG's overarching methodologies and values, the subsequent chapters, which draw heavily from the author's experiences within the Barcelona office, must be contextualized within the distinct operational framework and culture of BIG Barcelona. This contextualization ensures a nuanced understanding of how the firm's principles manifest in practice within a specific office setting, acknowledging that the Barcelona studio's approach may differ from that of other BIG offices globally.

The chapter will be structured with an introductory leaflet providing a rationale for the topic's relevance, delineating the methodology and sources employed (in grey); the main body will elucidate key themes, concepts, and findings (in white); and a schematic representation will summarize the chapter's takeaways (in black).

Prominent architectural firms possess the remarkable ability to navigate intricate complexities while delivering captivating solutions that wield a global impact. This study endeavors to unveil the concealed strategies employed by the renowned global architectural studio, Bjarke Ingels Group, commonly referred to as BIG.

The primary objective of this research is not solely to comprehend how this influential and innovative studio achieved international acclaim and continues to do so but also to unearth any disparities between BIG's professed principles and their practical actions.

The first chapter will start with a brief introduction to the history of the company, from its foundation in 2005, until now. Therefore, understanding which projects have caused such great success, how the company has expanded worldwide, which is the structure of the studio, and the changes it underwent due to its quick success and therefore increment of employees. The growth of BIG Barcellona will be analyzed more in-depth, understanding how it has grown and which consequences it brought to the structure of the company.

The focus then shifts from these operational aspects of the company to the studio's principles and ethics which have been expressed in their manifesto. This document has not been published as a standalone manuscript but has been included in a book, contextually with projects to demonstrate and better explain how values influence the company's work. Since the concept of "Hedonistic sustainability" has emerged as the leading principle to fulfill for the BIG, the chapter will continue further investigating the meaning and practical applications of this principle. The constituent values on which hedonistic sustainability is built are the ones of response, reincarnation, productization, and biophilia, therefore becoming the foundation of the project development. Nonetheless, through an analysis of the project realized by the company, the coherence between the manifesto and production will be verified. This will lead to the verification of the company's capability and willingness to reach its goals.

Having retraced BIG's history, it becomes evident the crucial role that the founder Bjarke Ingels filled and still fills for the whole company. Not only did his knowledge and talent allow him to start a successful career very early in life, obtaining great results, but his character and charisma made him a hero, an example to look up to for young architects, a symbol of success and innovation. It is clear then that the role of Ingels throughout the years has drastically and quickly evolved. He is not only an architect but also a public figure and an icon. Ingels is not only an architect but also a star.

This shift has led to the analysis of the role of the "starchitect" (Gabriella Lo Ricco, 2003) in society and architecture. The analysis starts from the general definition of the starchitects, together with the characteristics and situations that defined them, therefore understanding what distinguishes such important professionals from the

rest of the architects, allowing them to emerge. Subsequentially, Rem Koolhaas, Frank Owen Gehry, and Frank Loyd Wright will be taken as case studies with the aim of understanding peculiarities and common features to finally compare them with Bjarke Ingels.

In the second chapter, the attention will transition from the organizational framework and architectural output of the company to its methodologies and approach.

To start, a general schematization to describe the typical project path in BIG will be defined. The result comes from the intersection of different theories and fields. Rittel and McLuhan will be the foundation of the model with their idea of design path as a process of generation and reduction of variation. To this simplified representation of the architectural process, Ingels adds the different complexity levels such as the ones of iteration and reiteration. Next, Rittel and McLuhan's theories will intersect with the evolutionary theory of Darwin and with Mendel's concepts of crossbreeding and interbreeding. The last step consists of the implementation of the prototipization principle.

At this point a satisfactory representation of the project path in BIG has been obtained, therefore, it seems necessary to investigate which are the tools necessary to produce variation and then to reduce it through a process of selection and verification.

Language, sketches, drawings, physical models, perspective views, diagrams, software, and Artificial Intelligence, are the tools that have been taken into consideration in this section. The potential and the limits of each of these instruments have been studied together with the consequences that the use of the tool can have on architectural production. To develop this last step several examples have been introduced and compared when thought necessary. Nonetheless, the use that BIG makes of the different tools has been investigated. Finally, the project path and generation tools' results have been crossed, defining a structure that describes the whole process.

In the fifth chapter, all the methodologies and theories observed in the previous chapters will be finally verified thanks to the analysis of a real case. The possibility to confront theory and reality has been made possible because of the direct experience of the author in the company of BIG Barcelona. One specific case has been chosen based on the involvement of the author in the project. The full process, from the call of the competition until the submission of the materials, has been followed, allowing to understand how the project is developed and what is mostly influencing it. This chapter will be crucial to understanding how theory and reality differ, again unveiling the inconsistencies between what BIG declares to do, and what is put into action, especially focusing on all the criticalities related to sustainability practices.

To conclude, an overview of how BIG is ensuring its capability to adapt to future and present needs of society, particularly focusing on the technological and environmental interests.

II.   ABOUT BJARKE INGELS GROUP

The initial chapter of this research delves into the structure and values of the Bjarke Ingels Group. A first overview of the company's organization and manifesto resulted essential to understanding the worldwide relevance of the firm, the responsibility they have toward society, and therefore the importance of the values that the company aims to fulfill.

Thematic related to sustainability emerged as a fundamental pillar of the company manifesto, therefore the concept has been further studied to better comprehend how BIG intends to obtain sustainability while having fun, as expressed in their manifesto.

For what concerns sources, the brief introduction about the company's history was developed mainly using secondary sources such as scientific papers and architectural articles. The section related to the manifesto of the company has been developed based on BIG's publications, in which the firm's vision, values, and goals are explained. While "Yes is more" has been used to better comprehend the concept of "evolutionary architecture" and "hedonistic sustainability", "Formgiving" has been crucial to further investigate the sustainability strategies exploited by the company to achieve it. More in detail to understand the ideas of response, reincarnation, productization, and biophilia. The firm public website, as much as the internal resource archive has been consulted to find practical applications of the company production.

Bjarke Ingels Group, also known as *BIG* is an international architectural studio established by the homonym architect in 2005. The company was born in Copenhagen, Denmark, which is also the native city of the founder. The newborn company has almost immediately received national and international recognition and has since maintained consistent growth.

COMPANY'S ORGANIZATION

The great success of the company had nonetheless a great impact on the firm internal structure and organization, allowing the firm to expand quickly both in terms of staff and geographical presence around the globe.

By 2010 the studio had already expanded its presence in New York, then London in 2016, Barcellona in 2019, Shenzhen in 2019, and recently inaugurated a studio in Los Angeles. Now more than 700 people are part of the team.

New studios are usually opened to get closer to clients. Therefore, the studio's location follows the market's requests. The projects and commissions are distributed among the different offices of the group mainly by proximity (time zone) and cultural connections.
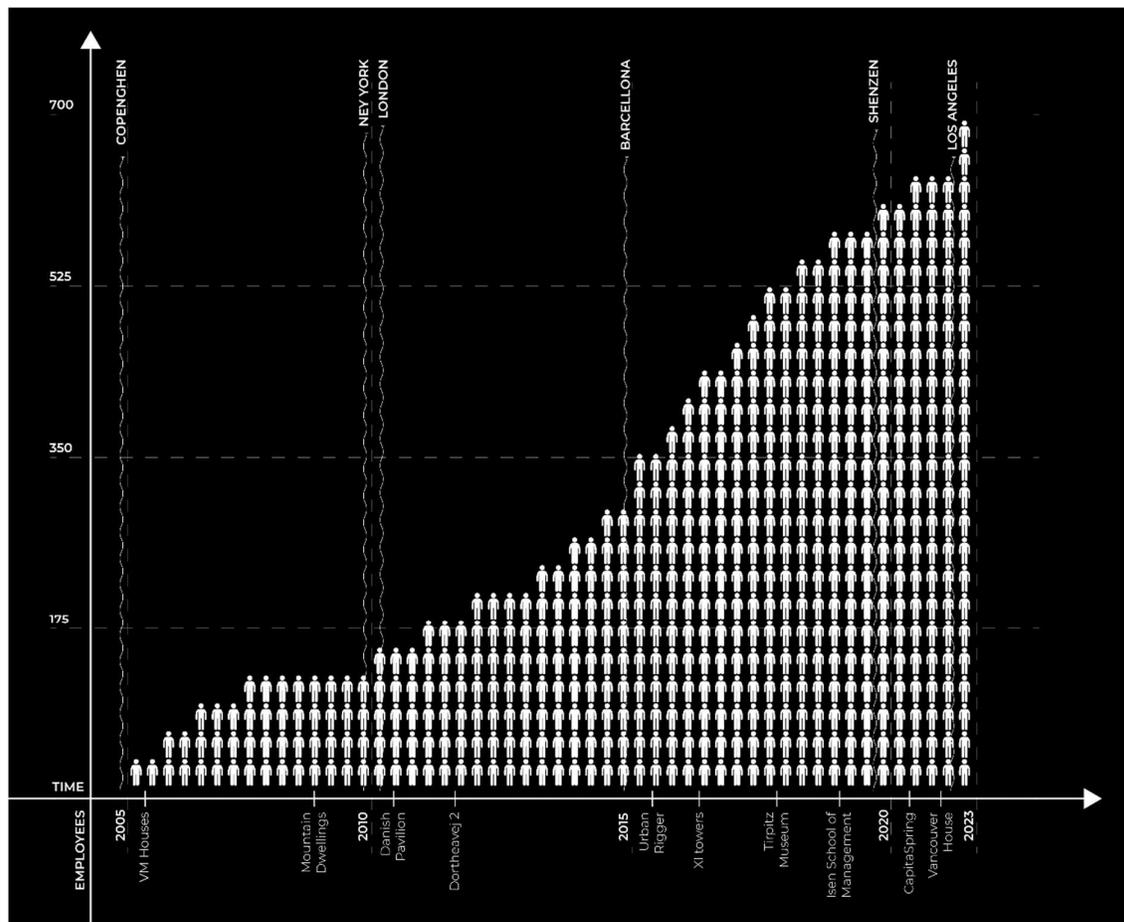
Figure 1 Diagram of the increasing number of employees of BIG during time. Data from (Elias, Head of Labour Relations , 2024), diagram by the Author

As the size of the studio increases, the complexity of the firm's structure also grows.

Focusing on the case of BIG Barcelona, the studio has expanded significantly, evolving from a small group of four individuals in 2019 to employing 67 staff members by 2023. The studio's growth has been consistent, with no picks nor a period of decline in employee numbers.

The studio started in 2019 with two associates. Right from the beginning the firm started growing welcoming in the group several architects and interns. It has been only one year later that another associate has been included in the studio. A few months later, due to the increasing number of projects that had to be developed, a managing director was hired. In 2022 the studio introduced several new professional figures and departments to deal with the great amount of employees and increased complexity of projects that needed to be controlled in-house. Therefore, landscape architects and a project manager were hired, and bidding, IT, and HR departments were created (Elias, Head of Labour Relations , 2024).
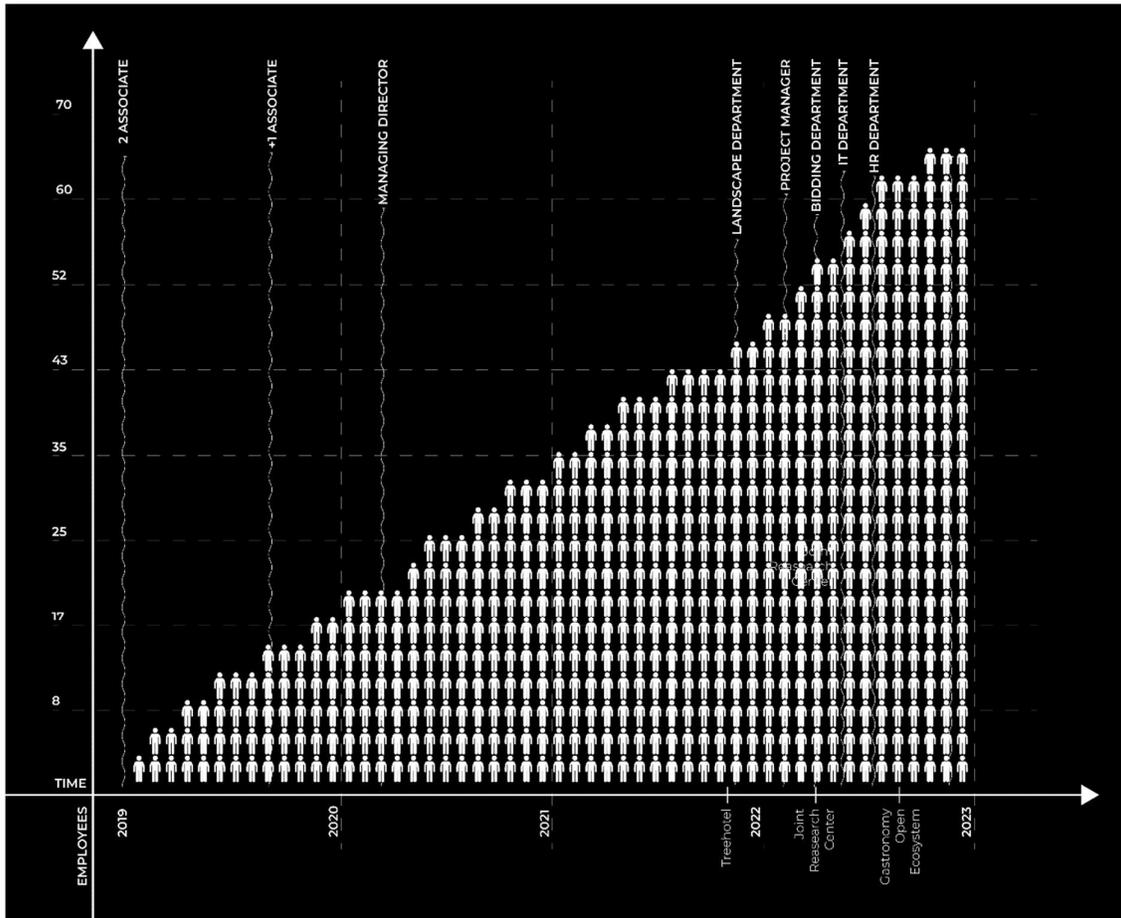
Figure 2 Diagram of the evolution of BIG Barcellona. Data from (Elias, Head of Labour Relations, 2024), diagram by the Author

REPRESENTATIVE PROJECTS

The initial defining moments in BIG's journey can be traced to two key projects: the VM Houses and the Mountain. The former included two residential blocks built in Copenhagen, Denmark in 2005. The uniqueness of the design can be found in its massing, deviating from the typical square configuration to form distinctive V and M shapes, thus enhancing the interior layout and overall functional quality of the buildings. Inspired by Le Corbusier's "Unite d' Habitation [1]" this project reimagined the conventional long corridors, shortening them to facilitate natural light from both sides of the aisle. The "M" building has especially been dubbed the "Unite d' Habitation version 2.0" where instead of designing narrow flats surrounded by huge dead-end corridors, the zig-zag shape ensures all corridors have views and ventilation from both sides. The residential complex offers more than 80 different apartment types that are programmatically flexible and open to the individual needs of contemporary life - a mosaic of different life forms. Another eye-catching characteristic is the triangular-shaped balcony that has been designed to permit passage of abundant natural light and ventilation in every home, without compromising the vision on other balconies.
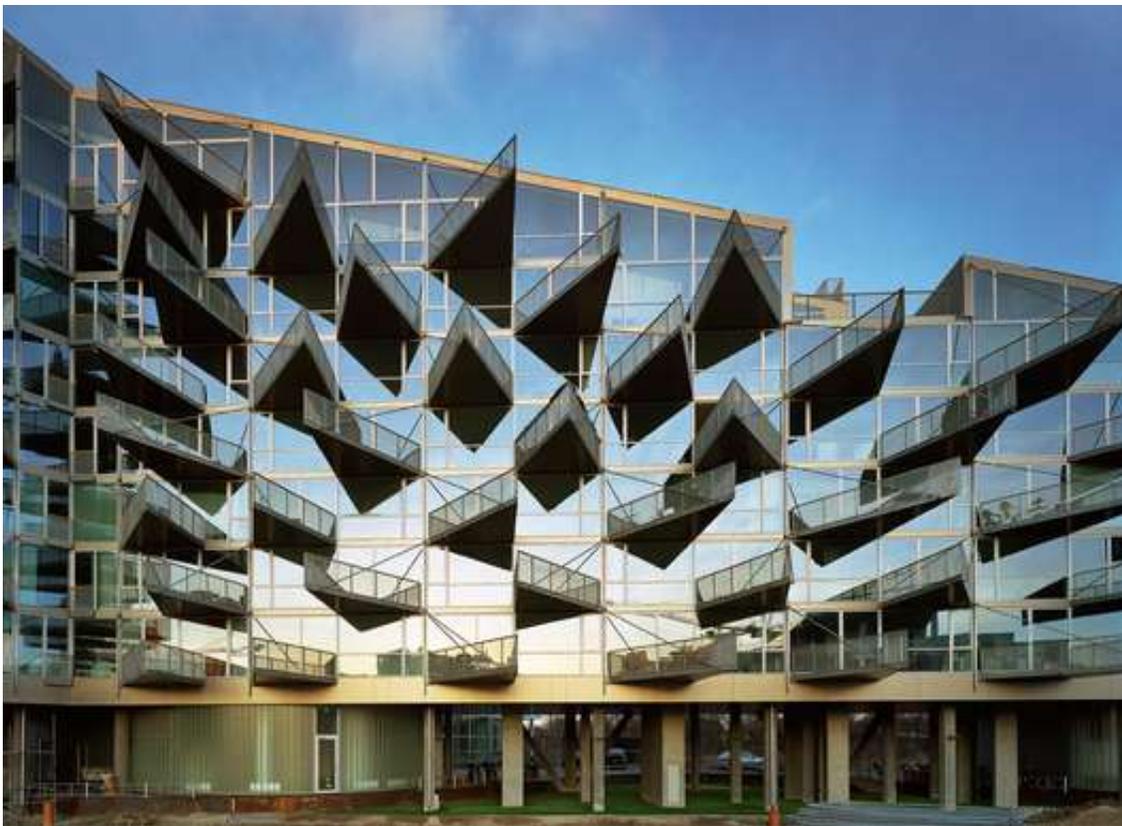
Figure 3 VM Houses, Copenhagen, Denmark (Bjarke Ingels Group, n.d.)

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[1] "Unité d'habitation" is a new housing model developed by Le Corbusier based on a balance between the individual and the collective. The Unite habitation completed in 1952 in Marseille, France was the first large scale prototype for the famed architect. (UNESCO, s.d.)

The next significant milestone of the BIG is its remarkable residential project the Mountain Dwellings, built in Copenhagen directly in front of the VM Houses in 2008.

The central concept behind this project is the stratification of multiple uses. While the client envisioned two independent structures, one for parking and one for residential purposes, the architect proposed to stack the two uses on top of each other. Thanks to the new configuration Ingels has been able to defeat the flatness of Denmark creating an artificial mountain from which to enjoy the view and the outdoor spaces thanks to the presence of a terrace for each unit. The resulting courtyard penthouses are an attempt to balance "the splendors of the suburban backyard with the intensity of an urban lifestyle" (Fairs, Mountain Dwellings by BIG, 2008). Throughout the building, it plays on a mountain metaphor as well as the clash between the urban vibe of the interior parking space but also with the surroundings and the peaceful and organic hillside. This project has received numerous Awards such as the Jorn Utzon Statuette Concrete Element (BIG, s.d.).

Figure 4 Mountain Dwellings, Copenhagen, Denmark (Bjarke Ingels Group, n.d.)

The success of the company has never stopped since that moment, with CopenHill, Surperkilen, the Sweden pavilion for the China expo of 2010, and many other remarkable projects throughout Europe, North America, Asia, and the Middle East.

BIG MANIFESTO

Architectural manifestos, as political and artistic ones, are advanced sets of ideas, opinions, or views, which can also lay out a plan of action. (Enciclopedia Britannica, 2023)

While in the past manifestos were loud and simple-minded calls through architecture for the suppression of the past to designate a visionary future or, in certain cases, the revival of an ancient style to bring back an ideal past, in the modern era architects got rid of the ideologies, and consequently the role of the manifesto is vehemently different. (Turan, 2013).

In the present era, manifestos seem to be a mere foundational document that articulates the values, approaches, and priorities of an architectural studio, which will consequently influence the firm's goals and strategies to tackle modern world issues.

In reality, they have a much more crucial and indispensable role in the architectural world.

According to Bernard Tschumi manifestos are what is between "ideas and real spaces, [...] abstract concept and the sensuality of special experiences" (Tschumi B. , 1979). He believes that manifestos are contracts that architects make with society and themselves intending to achieve status of universal or general proposition, which are never self-evident but can be demonstrated by arguments: projects. In this scenario design proposals are not the mere result of the manifesto's intention, but the base on which the manifesto's validity is built.

It becomes evident how the role of the manifesto shifted from being a call for action to becoming a tool to legitimate one's work.

Given the inextricable relation between manifestos and design, their respective coherence becomes the most essential feature of any architect's work. This requirement is a double-edged sword as it imprisons the architect's work within a defined limit.

While the role of the manifests in society has drastically changed, their importance in the architectural field remains crucial.

BIG's manifesto was published in 2009 through the release of a book titled "Yes is More." The principles presented in the book have consistently guided and legitimized the architectural production of the office.

In the following paragraph BIG's manifesto will be analysed and enriched with concepts introduced in subsequent publications. Nonetheless, the coherence between the manifest and BIG's project will be encompassed to define whether the company has been able to demonstrate its arguments.

Bjarke Ingels starts its manifesto by asserting that architecture, much like life itself, is an ongoing process of evolution. Its conception of architecture sharply contrasts with the

idea of avant-gardes, which, as he describes, define themselves by what they oppose and exist primarily in contradistinction to something else. Avant-gardes represent the conception of architecture as a revolution rather than a continuous evolutionary one. Bjarke Ingels draws inspiration from Darwin's theory of evolution to underpin his perspective. BIG is the result of decades and decades of history, and instead of denying the changes in society, the firm aims to adapt and align with them.

Considering this foundational outlook, it is only natural to further expound on the manifesto by providing an overview of what has happened in the past, describing what has preceded Bjarke Ingels Group, describing the precedents that paved the way for Bjarke Ingels and highlighting the remarkable achievements of others who have successfully responded to the real-world needs of society.

Bjarke Ingels' historical narrative starts with a reflection on the modernist and minimalist era, acknowledging the work of Ludwig Mies van der Rohe. The architect liberated architecture from excess ornament and redundant forms. However, the unintended consequence of its approach has been a tendency toward anonymity and repetition.

Follows, Robert Charles Venturi JR., as a key figure for the postmodernist movement. Venturi and Denise Scoot Brown have been able to see the contemporary city with new eyes, surpassing the realm of modern architecture. In his manifesto "Learning from Las Vegas", Venturi reintroduced the use of symbolism and signs, seemingly aiming to diverge from the ideals of Mies van der Rohe. Yet, regrettably, this departure led to a similar outcome: an "epidemic (Bjarke Ingels Group, 2009)" of indistinguishable towers, mirroring the homogeny seen during the modernist era.

The third (r)evolutionary architect is Philip Cortelyou Johnson. Bjarke Ingels accredits Johnson with the remarkable achievement of identifying and absorbing a myriad of architectural styles. Johnson's exceptional capacity in this regard enabled him to curate both the Modern Architecture Exhibition in 1932 and the Deconstructivism Exhibition in 1988 with great success. His profound understanding of architectural history is vividly mirrored in his projects, which can be viewed as a comprehensive compilation of diverse architectural principles and epochs.

Renowned as the "Le Corbusier of our time," (Bjarke Ingels Group, 2009), has made another step toward BIG's ideas, particularly through his interpretation of contemporary architecture, which could be summarized in a few words: "more is more". The motto must be interpreted as a negative vision of the architecture evolution, signifying a somewhat pessimistic perspective on the evolution of architecture. It represents a departure from the traditional ideals of noble forms, like hierarchy and composition, shifting instead toward a process characterized by excess and accumulation.

Surprisingly, the book then diverges from architectural figures to discuss a prominent political personality: Barack Obama, the former President of the United States. The

politician has been mentioned because of its campaign approach, which was not based on contraposition nor contradiction but centered on fostering change through unity. This concept of unity closely aligns with Bjarke Ingels' vision of architecture, especially when he overcomes the perpetual conflict between "pure literary utopia" and "the worst pragmatic oversimplification" (Gregotti, 1983), as well as the struggle between avant-garde's radical ideas and predictable boring boxes. In Bjarke's architectural realm, these contradictions dissolve, resulting in the creation of harmonious spaces that are socially, economically, and environmentally ideal, driven by unity and positivity.

Architecture should adapt progressively to the evolving dynamics of life, aligning with the course of human existence rather than impeding its progress with outdated concepts from the past. According to Ingels, the perfect architecture should wholeheartedly embrace and fulfill every desire and need, offering an unequivocal "yes!" to all (Nita Dwi Estika, 2020). This comprehensive concept underlying Bjarke Ingels' work is eloquently encapsulated in a succinct motto: "Yes is more." With these few words, the architect conveys his optimism toward the contemporary era and his unwavering resolve to confront its challenges with a positive and affirming perspective.

HEDONISTIC SUSTAINABILITY

Hedonistic Sustainability is an innovative concept introduced by the architect Bjarke Ingels. It essentially merges the principles of sustainability with the pursuit of joy and pleasure. While the exact terminology of "Hedonistic Sustainability" may not be explicitly found in the manifesto "Yes is More," its fundamental values and ideas permeate the book extensively.

Hedonism, derived from the Greek word hedonê, meaning "pleasure" or "will," encompasses a diverse range of theories that accentuate the significance of pleasure. Psychological or motivational hedonism asserts that human behaviors are driven by a fundamental desire to maximize pleasure and minimize discomfort. In this context, pleasure is not just a simple aspect of life, rather, it is considered the ultimate good, a guiding principle, and the moral foundation underpinning one's existence. Sustainability, on the other hand, is about meeting the world's needs of today and tomorrow by creating systems that "allow us to live well and within the limits of our planet" (European Environment Agency, 2023).

Many of the fundamental principles underpinning the concept of hedonistic sustainability find expression in the description of the Danish Pavilion for the 2010 Shanghai EXPO (Bjarke Ingels Group, 2009). The whole pavilion has been conceived as a demonstration of how sustainability could enhance the quality of life, transforming it from a notion of burden into one of pleasure for its users. To do so Ingels created a spiral-shaped pavilion which will serve as a bike rent space for the whole expo. The bikes are ingeniously parked atop the structure and to exit the pavilion people must go down a playful spiral ramp. On the ground floor, a small exposition area had been set up while in the core of the structure, BIG placed a small artificial lake, filled with clean water from

the port of Copenhagen, famous for being one of the cleanest port waters of the world, so clean that people can safely swim in it. The whole pavilion challenges the user to have fun while being sustainable. On one hand, the pavilion may not have adhered rigorously to every sustainability principle, (such as the debate surrounding the transport of water from one part of the world to another) it undeniably excelled in its central objective of becoming an emblematic symbol of what sustainability could represent: an enjoyable experience.

Figure 5 Danish Pavilion for the 2010 Shanghai EXPO, BIG (Bjarke Ingels Group, n.d.)

"Sustainability cannot be like a moral sacrifice or political dilemma or a philanthropic cause. It has to be a design challenge" (Mark Callis Sanders, 2018).

Ingels's primary goal is to create architecture that can adapt to the lifestyles and needs of contemporary the world's citizens, upholding sustainability as a paramount principle. The idea that sustainable living requires austerity and sacrifice is challenged by Ingels' method at a time when environmental issues and climate change are major concerns. He promotes a world in which hedonism and eco-consciousness live in harmony, demonstrating that sustainability can be fulfilling and pleasurable.

As a young architect, he realized that conventional sustainability often is solely perceived as a constraint, as boundaries and rules that eliminate community values built in architecture. This approach could result in uninspiring and dreary environments, hardly conducive to attracting people to eco-friendly solutions. He believed that this approach was not conducive to attracting people to eco-friendly solutions. Ingels saw

an opportunity to reshape the narrative and create a sustainable world that people would willingly embrace. The vision of BIG is to design buildings that not only have a positive impact on society and the environment but also infuse an element of enjoyment into the process.

To underscore this perspective, in his work "Yes is More," Bjarke Ingels critically reinterprets the "Ten Commandments of Good Consumption," infusing them with a far more enjoyable and playful spirit, emphasizing the idea that sustainable choices can be delightful and engaging.
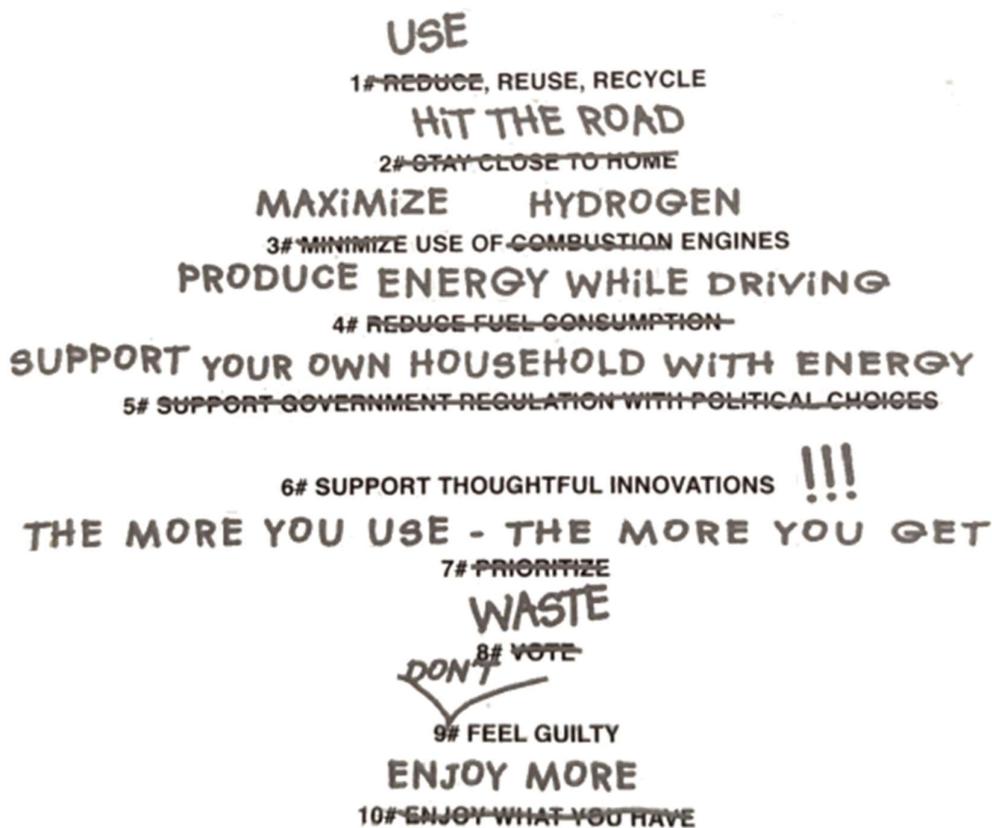
Figure 6 "Ten Commandments of Good Consumption" (Bjarke Ingels Group, 2009)

What Ingels seeks to support through this critique is precisely what he will next call "Hedonistic Sustainability": a vision to address current challenges in line with the ever-evolving nature of modern life.

Ingels puts forth the belief that humans can inhabit a utopian architectural realm that is not only aesthetically pleasing but also socially and environmentally responsible. Sustainable design provides fun and enthusiasm and can improve the quality of life for individuals and communities (Stephen M. Fiore, 2014).

The concept of hedonistic sustainability has also been defined as "a joke" by Szczegielniak (Szczegielniak, 2015) but not in a negative way. Oppositely, it is perceived

as a valuable tool to infuse the design process with a sense of enjoyment, making it more accessible and understandable to society. This, in turn, accelerates the process of community acceptance and involvement in sustainable initiatives.

SUSTAINABILITY

Ingels's ideas of sustainability have surely not come out of the blue, on the contrary, they have emerged as a response to the growing awareness of climate change and the subsequent development of policies that are gradually reshaping global priorities. Sustainability is increasingly establishing itself as the fundamental pillar of the new world order, influencing both markets and the lives of individuals, at least in theory. In this scenario, architects have a great responsibility, especially considering that building stock accounts for 40% of energy consumption and 36% of GHG emissions. Furthermore, 75% of the European building stock is currently energy-inefficient (European Environment Agency, 2023). This situation is poised to deteriorate as countries experience economic growth, leading to a surge in the construction of facilities like factories, offices, and residential buildings. In this scenario, BIG appears not only to have accepted the situation but also to have transformed this problem into an opportunity.

To translate these insights into concrete actions, BIG also makes use of other leading principles. For example, as articulated on its website, BIG declares that its designs do not take as a reference the Golden Ratio[2], but the UN's 17 Sustainable Development Goals[3]. The message they aim to convey is that design principles have evolved, with sustainability now assuming the foremost and most crucial role.

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[2] Golden ratio, in mathematics, the irrational number (1 + Square root of√5)/2, often denoted by the Greek letter ϕ or τ , which is approximately equal to 1.618. The ancient Greeks recognized this "dividing" or "sectioning" property, a phrase that was ultimately shortened to simply "the section." 2,000 years later both "ratio" and "section" were designated as "golden" by German mathematician Martin Ohm in 1835. The Greeks also had observed that the golden ratio provided the most aesthetically pleasing proportion of sides of a rectangle. (Encyclopaedia Britannica, 2023)

[3] The United Nations' 17 Sustainable Development Goals (SDGs) are a set of global objectives aimed at addressing various social, economic, and environmental challenges by the year 2030. They are interconnected and seek to address a wide range of global challenges, in this scenario architect can significantly impact sustainability, social well-being, and economic development, making them important contributors to several of the Sustainable Development Goals.

Other design strategies have been explained in the publication of BIG "Formgiving".

Among the most relevant there are the concepts of "Response", "Reincarnation", "Productization", and "Biophilia", which will therefore be studied thoroughly.

RESPONSE

From Bjarke Inges' perspective, a project should never be developed with a "tabula rasa as a point of departure" (Bjarke Ingels Group, 2020). On the opposite, it should always find its roots in "contextualism", which can be understood as a form of architecture that "responds to its surroundings by respecting what is already there" (Curl, 2006). In an interview at the UIA World Congress 2023, Ingels underlined that if every building and architecture were built as an independent object we would end up "with a city of self-centered individuals" (STIR, 2023). Therefore, initiating a project with considerations for the context contributes to the creation of a community rather than a standalone architectural piece. The outcome of a design that takes into consideration factors such as culture, landscape, climate, and city can be also called "responsive design".

The aim of such an approach is not to replicate the existing but rather adapt to it, creating a seamless continuation of the existing condition. Architecture should respond to the context and the climate with the same rationality that an answer is given to a question: designing is an "architectural dialogue" (Bjarke Ingels Group, 2020).

While during the development of the design, all the contextual characteristics need to be taken into consideration, the resulting design can focus on a specific characteristic considered more relevant in the specific case.

An illustrative example of a responsive project by BIG is The XI towers in New York City, USA. The main objective of the design was to adapt to the urban context in which the towers were to emerge to maximize the views from the towers.

The development of the feature of the view in relation to the urban context has been considered essential for the success of the design. The goal is not only to maximize the view from the building but also to orient it toward the most attractive points of the surrounding environment. In this specific case, the new two towers would rise along the neighborhood of the High Line[4]. Given the relevance of the project, it is important to maintain alignment with the structure. Conversely, in the lower part of the volume the view is mainly obstructed due to the high urban density of the surrounding, except for the view toward the river. Therefore, the main alignments of the structure are defined by the context, and they are different in the higher and lower part. To meet both conditions, the volume morphs to maximize the view toward the river in the lower floors, and to align to the High Line in the higher part. As the towers were positioned close to each other, they naturally obstructed each other's views. The architect minimized the vis-à-vis creating asymmetrical towers that twist to free the view. Ingels described it as "almost like a dance or a mutual courtesy between the two towers" (Howarth, 2018).
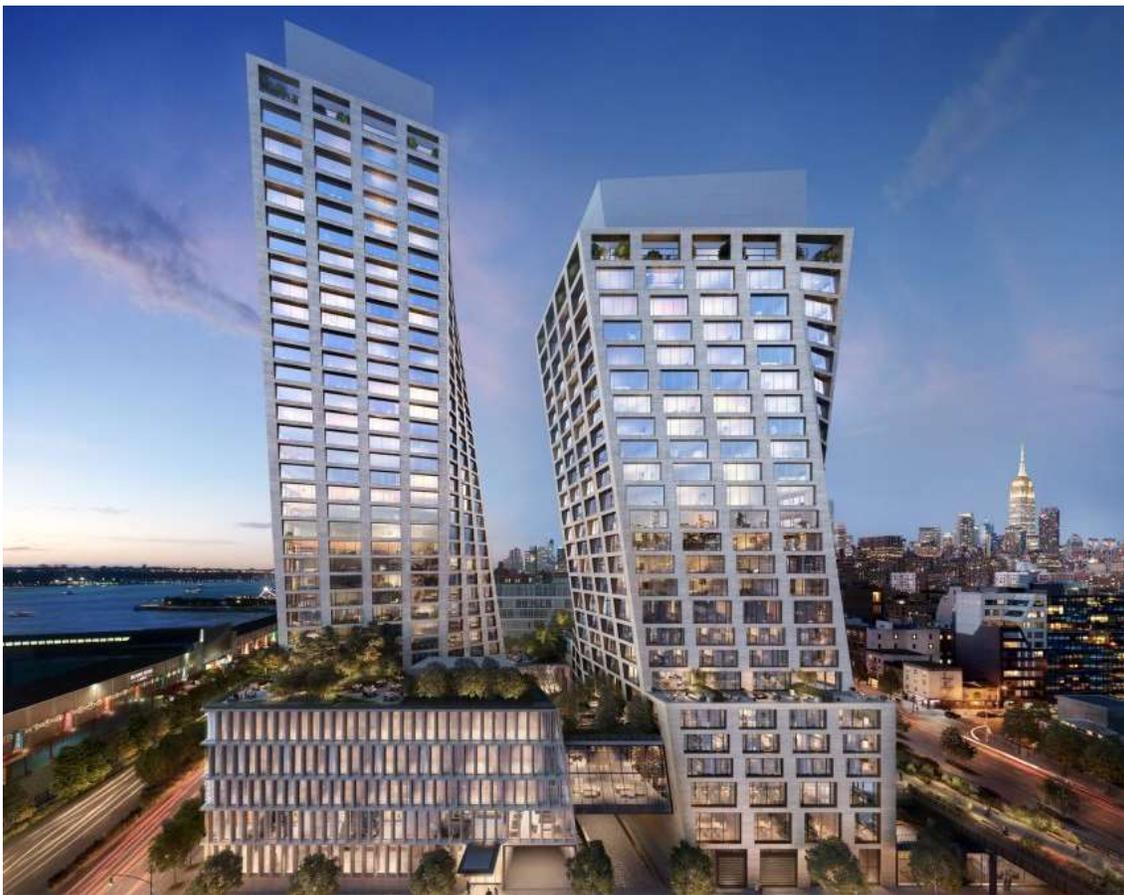
Figure 8 The XI towers, New York City, USA (Bjarke Ingels Group, n.d.)

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[4] The High Line is a 2.33 km elevated linear park, greenway and rail trail created on a former New York Central Railroad spur on the west side of Manhattan in New York City. The High Line's design is a collaboration between James Corner Field Operations, Diller Scofidio + Renfro, and Piet Oudolf. (Cilento, The New York High Line officially open, 2009)

Another instance of adaptive architecture is exemplified by the "Honeycomb and the Sanctuary" project. Positioned on the south coast of New Providence Island, this development will encompass 34 apartments ranging from 3,000 to 8,000 square feet, each featuring a private outdoor pool and a summer kitchen seamlessly integrated into the hexagonal-shaped facade of the structure. BIG declared that the design responded to the typical Bahamian lifestyle. While this could look like a noble choice made by the architect, it is most likely a well-structured narrative that justifies the construction of an extremely luxurious design. The true contextual features lie in the high-end Bahamian market, upon which a significant portion of the local economy is reliant (Harris, 2023).

It is essential to not fall into the narrative but to be able to understand the underlying reasons to which, in some cases, architecture is adapting may be obscured, with only the more marketable aspects being presented.

Figure 9 Honeycomb and The Sanctuary, New Providence Island, Bahamas Island (Bjarke Ingels Group, n.d.).

Regulation can also play an important role in the project development, such as in the case of the Vancouver House in Canada.

The 149-meter-high residential tower accommodates mixed-use offices and residential spaces, with connections to cycling and pedestrian pathways in their platforms. Situated at Vancouver's primary entrance, adjacent to the Granville Bridge and an adjacent park, the tower's location necessitated the careful consideration of numerous urban constraints and setbacks on the site.

Of these regulations, one of the most impactful stipulates the minimum distance between new buildings and bridges. Specifically, a minimum separation of 30 meters must be maintained between the two until the building reaches a height of 30 meters, beyond which it is permitted to expand. As a direct consequence, the tower grows from a triangular base on the lower floor to a full rectangle on the higher floors. Visual access to the breadth of Vancouver's natural surroundings was granted while adapting to local regulations.

Figure 10 Vancouver House, Canada, USA, (Bjarke Ingels Group, n.d.)

REINCARNATION

Another pivotal design concept that BIG explores in "Formgiving" is the notion of reincarnation. Bjarke stated that "the only constant in life is change" (Bjarke Ingels Group, 2020), therefore as life evolves, so do human habits and needs, and so should do architecture. In this context, ensuring flexibility and adaptability may be even more crucial than selecting long-lasting materials. Architecture can withstand the test of time uniquely by remaining relevant in terms of its functionality and purpose.

The potential for future change must be taken into consideration, even when architects are designing new structures. For this reason, buildings should be conceptualized as adaptive bodies, essentially as empty containers ready to accommodate various purposes based on momentaneous needs. This approach extends beyond the known

idea of adaptive reuse[5]. Architects do not only have to make the most of what is already present on earth but also facilitate this process for future generations by preparing their new buildings for potential future reinvention. The consequences of adaptive reuse are highly significant in terms of sustainability, as it contributes to saving high percentages of embodied energy [6] (Baldwin, 2021) and significantly reduces the environmental impact associated with demolishing a structure and constructing a new one in its place. This is particularly important because a large portion of a building's carbon emissions arises from its materials, from their fabrication and delivery to assembly.

Among the list of projects that BIG inserts in this section of its book, there is the Tirpitz Museum, the Isenberg School of Management, and the 3 Xemeneies.

The first project has been developed in 2017 in Blåvand, Denmark. The new building is placed right in front of a historically relevant bunker in Denmark's Jutland and complements the preexisting building with a new pavilion. Together, they form a 2,500-square-meter complex that comprises the Tirpitz Bunker Museum, the Amber Museum, a museum of local history called the "Histolarium", and a gallery for temporary exhibitions. The new structure is "carved out of the dunes" (Bjarke Ingels Group, 2020) and establishes a fluid dialogue between the old and the new. Four incisions in the terrain – all connected to preexisting paths – lead to a likewise buried central court, from which visitors proceed to the various parts of the program.

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[5] Adaptive reuse is a form of sustainable urban renewal as it prolongs the building's life. It's not just a way to repurpose buildings by recycling their reusable components for new applications; it's also a tactic and way to protect cultural heritage. It involves restoring the old, dilapidated structure while preserving its historical and cultural significance and bringing it up to date with modern needs and demands. (Zahraa Adil Abdulameer, 2020)

[6] The amount of energy consumed in the production of a building. It includes all stages from the mining and processing of the natural material to manufacture, transportation, maintenance, and disposal. (Christopher Gorse, 2020)

The second example is the intervention made in Massachusetts, USA, on the Isen School of Management. The original structure has been present on the territory since 1964, was no longer capable of meeting the needs of its ever-expanding alumni community. BIG and Goody Clancy were commissioned in 2015 to design a flexible space that would inspire and facilitate collaboration for every Isenberg student.

The Business Innovation Hub directly extends the school's existing 1964 building from the north and east sides in a wide circular loop, linking back to the upper floors to maintain connectivity. The loop consolidates Isenberg's faculty and staff under one roof, creating a singular place of arrival and a strong visual identity for the entire Isenberg School of Management.

Figure 12 Isen School of Management, Massachusetts, USA, (Bjarke Ingels Group, n.d.)

The last example of the many presented in the book that is worth reporting is the 3 Xemeneies. This intervention aims to bring back to life a former steam power plant in Barcellona, Spain, that was built 50 years ago. The complex is characterized by three iconic chimneys that have been preserved as sculptural elements but revitalized by wrapping them around with a new program.

Figura 1 3 Xemeneies, Barcelona, (Bjarke Ingels Group, 2020)

While the goals and objectives of architecture as reincarnation are clear and undeniably positive, applying the concept during the design process resulted in being much more challenging. First, the idea of reincarnation as presented in the book, seemed to be much more an architectural approach to apply to the new structure, to avoid future decay due to the change of society's needs, however all the examples that have been presented in the book, are simply a case of adaptive reuse of existing structures. The latter is, without doubt, a great approach to apply in architecture, which, as said, can help to minimize the building's impact on the planet, but it is not enough to fulfill the expectation of BIG's definition of reincarnation.

Secondly, the three examples do not strictly fit the classification of adaptive reuse projects. For instance, in the case of the Tirpitz Museum and the 3 Xemeneies, a new structure was built. While the two buildings complement each other and serve to attract people to keep the area alive, the whole concept of reuse as a sustainable approach to reduce material and energy resources is largely lost.

The solution for the school also seems to diverge from the essence of reincarnation. The additional spaces needed by the school are obtained with the construction of a new

structure rather than exploiting the structural flexibility of the existing building. Furthermore, the choice of a closed loop minimizes the structural flexibility, consequently reducing the possibility of future interventions. If during the design process also the future needs of the school had been taken into consideration, the closed loop would have not been the result of the process. A much more regular shape or even an open loop could have served a much better purpose, as they both could easily expand in the future.

The difficulty in applying these concepts is evident. One of the causes can be traced to the firm's need to meet the client's immediate needs and expectations, often without much concern for what might happen in 50 or 100 years. However, it is not impossible to achieve excellent results, and several examples of success can be found among BIG's numerous projects. These examples are often located in different sections of the book as they respond to various concepts simultaneously. In the following section, we will analyze Urban Rigger, a compelling example of reincarnation.

PRODUCTIZATION

In "Yes is more" BIG highlights that the automation technology, which has drastically changed many industrial fields, did not have a significant impact on architectural production. This is largely because architecture is generally conceived as a unique irreplicable piece of art. Ingels denies this theory, and its opposite: the complete modularization of architecture with the consequent uniformity of building that could be applied everywhere. Instead, he invites to think about architecture as a productization exercise, which corresponds to an interpretation of architecture that could be compared to the idea of a Lego game: a finite number of elements that can be assembled into an infinite number of combinations. This approach allows for modularization, prefabrication, and efficient resource utilization while ensuring adaptability, variation, and personalization in each architectural experience.

Two successful examples could be used to better illustrate this approach: the Urban Rigger and the Dortheavej 2. The former is a cheap student housing structure in Copenhagen, Denmark, in the underdeveloped area of the arbor. The main idea is to turn standard container systems into modular apartments that can be stuck one on top of the other creating a small community along the water edge. Modular, high-quality architecture is guaranteed by applying a unique solution. Furthermore, the element can easily change location in case the needs of the community change. This example also exemplifies the concept of reincarnation, as discarded elements are transformed to meet current societal needs and can be easily moved and readapted to address different temporary requirements.

Figure 13 The Urban Rigger, Copenhagen, Denmark, (Bjarke Ingels Group, n.d.)

A second example is a housing complex named after the Northwest part of the Danish City in which it is located: Dortheavej 2. This project consists of 66 apartments for low-income citizens. The whole Building is composed of cubic prefabricated modules alternately stacked on top of each other. This strategic arrangement avoids technical difficulties such as the doubling of walls and creates variation in the façade. The modules are also slightly tilted to create a curved massing which defines an internal intimate courtyard.

These blocks could easily be replicated in different areas with different needs, the overall volume could be shaped according to the context, while the modular quality would be maintained.

Figure 14 Dortheavej 2, Copenhagen, Denmark, (Bjarke Ingels Group, n.d.)

BIOPHILIA

"The more space there is for nature and different species, the more welcoming it becomes for humans." (STIR, 2023)

In the last ten years, 'nature' and biophilic design have received widespread attention in architecture, especially in response to the growing environmental challenges.

The term biophilia was defined as "love of life" in ancient Greece. It was first introduced by psychologist Erich Fromm in 1964 and then popularized in the 1980s by the biologist Edward O. Wilson, who studied the lack of connection with nature caused by urban life (Baratto, Biophilia in Architecture: Nature Indoors and Outdoors, 2023). Wilson defined 'biophilia' as 'the innate tendency to focus on life and lifelike processes' (Wilson, 2007).

At the beginning of the 21st century, the notion of biophilia was developed and adapted within the architectural domain, drawing attention to the emotional aspect of humans' needs for interactions with the natural environment in the building environment. Exposure time to 'nature' and contact frequency can have an extremely positive impact on people, for example, it has been proved that spending at least 120 minutes a week in urban green spaces improves people's health and well-being (Mathew P. White, 2019).

Biophilic design has the potential to contribute to sustainability in architecture in numerous ways. As defined in the article "Biophilic Design in Architecture and its contributions to health, well-being, and sustainability: A critical review" (Weijie Zhong, 2022), most of the benefits of biophilic design directly or indirectly address the goals

defined by the 17 SDGs. Direct responses include, for example, decreasing the urban heat island effect (climate action), providing habitats for plants and animals, improving biodiversity (life on land), reducing air pollution, optimizing air quality and thermal comfort, and utilizing non-toxic substances for healthy indoor environments (good health and well-being), among others. Indirect responses include, such as enabling urban farming for food production (zero hunger), offering accessible and public green or blue spaces, and improving the accessibility of public infrastructures (reduced inequalities).

However, natural' designs are double-edged swords that become 'risk, danger, and side-effects' (Beck, 1999). The negative aspects of incorporating nature into buildings have rarely been discussed in previous publications. Bringing nature into architecture involves careful planning and maintenance. For example, plants may cause structural problems, excessive humidity, insect troubles, and odor issues, or they may simply die, and highly artificial 'green' designs require intensive energy use and maintenance (J. Barton, 2010)

BIG makes extensive use of the biophilic strategies. Not only does the firm envision a greener urban environment, but it also aims to blur the distinction between City and Countryside.

One of the most iconic biophilic designs by BIG is the CapitaSpring. The project is located at the heart of Singapore's financial district on the site of a former public car park and a hawker center, the 93,000 m2 mixed-use high-rise is defined by a dynamic interplay of orthogonal lines, lush greenery, and contrasting textures. At the core of the building between the hardscapes of the offices and residences are four connected levels of organic softscape dubbed the "Green Oasis" – a 35m open-air garden for work, casual strolls, relaxation, exercise, and events. The Green Oasis seamlessly weaves nature vertically into the architecture and satisfies the spatial limitations of the locals while granting tenants and residents abundant access to green spaces – animating the elegant smoothness of modern architecture with the ubiquitous tropical nature of the region. CapitaSpring's rooftop garden, with views of the city, is home to 1-Arden Food Forest.

Currently, over 150 species of fruits, vegetables, herbs, and flowers, are grown across five thematic plots to supply the building's restaurants with fresh greens.

Figure 15 CapitaSpring, Singapore, (Bjarke Ingels Group, n.d.)

Another example of biophilic design, but at a different scale, is the NOMA 2.0 project. It is a restaurant that has been built in Christiania on the protected site of a former mine store of the Royal Danish Navy. The design consists of a set of different volumes, connected by glass elements. Natural elements are treated as part of the design: light and landscape enter the space becoming part of the experience. A large skylight and an expansive set of windows that slide to reveal the outdoor permagarden[7] allow guests to truly sense all the seasons and the restaurant's natural surroundings. Outside, the restaurant's three greenhouses are used as a garden, test kitchen, and bakery. Also, the choice of natural materials, such as wood and stone, amplifies the sense of connection with the surrounding nature.

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[7] The permagarden method combines components of permaculture, an agricultural approach using design principles to utilize natural systems for production, and bio-intensive agriculture, an agricultural approach to maximize production on a small amount of land through sustainable practices that increase biodiversity, to create a highly productive garden using a small amount of land. (The TOPS Program, 2017)

Figure 16 NOMA 2.0, Copenhagen, Denmark, (Bjarke Ingels Group, n.d.)

The presence of natural elements is a constant also in residential projects. An example is the IQON residences at Quinto, Ecuador, which included the design of a 390,000 sq. ft mixed-use residential building, including 215 residences, commercial units, office spaces, and a variety of amenities. IQON is designed as a vertical community, and an extension of the neighboring La Carolina Park, which continues up onto the building facade. Celebrating native trees and plants, the building integrates greenery wherever possible to take advantage of Ecuador's temperate climate and ecology – the country with the most plant species per square meter in the world.

Quito's biophilia is brought from the public spaces below into the private domain of each home via a sculptural planter integrated into the architecture of the building more in detail, it is obtained by inclining one wall and creating a pocket that will host the substrate for the vegetation. The inclined wall that constitutes the planter is visible in each apartment.

Figure 17 IQON residences, Quinto, Ecuador, (Bjarke Ingels Group, n.d.)

While is it extremely important to understand the potential of green elements both for their great impact on human beings, but also for the well-being of the urban environment, it is important to not confuse biophilic strategies with sustainability.

Including greenery, especially in high-rises, causes a significant impact in terms of structure element optimization, consequently increasing the need for material, which is not optimal both in resource consumption and energy use nor in terms of economic investments. The inclusion of nature in architecture should always guarantee overall sustainability and resource optimization.

TAKEAWAYS

Manifestos have experienced an evolution throughout history, and presently, they constitute a pivotal publication for every architectural firm. Through this medium, a company articulates its intentions and values, intending for these principles to be manifested in their architectural output to legitimize it. Within BIG's manifesto, exemplified by "Yes is more" and other publications over the years, the concepts of response, reincarnation, productization, and biophilia emerge as the foundational elements of the Ingel concept of "hedonistic sustainability." This concept serves as the driving force behind his entire architectural production.

RESPONSE

REINCAR-NATION

BIG

PRODUCTI-ZATION

BIOPHILIA

THE SPIRAL
New York

THE TWIST
Norway

THE PLUS
Norway

UPPSALA PLANT
Sweden

SNEGLEHUSENE
Denmark

THE HONEYCOMB
Bahamas

EL COSMICO
United States

LA SCALA TOWER
Denmark

KING STREET
Canada

79 & PARK
Sweden

EXPOSITIO

NOMA 2.0
Denmark

BIOSPHERE
Sweden

ONE HIGH LINE
New York

CITYWAVE
Italy

BEACH HUT
Denmark

MARITIME MUSEUM
Denmark

EXPOSITIO

VANCOUVER HOUSE
British Columbia

OCEANIC CITY

TELUS SKY
Canada

CAPITASPRINGNS
Singapore

RED LION COURT
England

IQON
Ecuador

AARHUS HARBOR
Denmark

FARFETCH HQ
Portugal

URBAN RIGGER
Denmark

HUALIEN
Taiwan

While the choice of BIG's design seems to reflect the values declared in the manifesto, closer scrutiny reveals that each project tends to emphasize only two principles at most. This creates a notable problem as it dilutes the overarching intent of the manifesto, resulting in values being pursued only partially. Furthermore, the lack of genuine coherence between projects and the manifesto diminishes the overall value of the firm's production. Design proposals should not simply stem ꞏns but serve as the foundation upon which the manifesto's validity is established.

III.   STARCHITECTS

In the exploration of company values and organizational structure, the distinctive character of Bjarke Ingels comes to the forefront. Like many architects worldwide, he transcends the conventional role of a professional to become an idol figure.

Ingels belongs to a select group of architects whose influence extends far beyond the realms of project construction: the starchitects. In this context, a comprehensive analysis of the role of starchitects in both society and architecture becomes imperative.

This analysis starts from an examination of the past prominent architects and their strategies for achieving stardom. Comparisons will then be drawn with the trajectory of Bjarke Ingels.

Central to this theoretical inquiry is Lo Ricco's seminal work, "Lo spettacolo dell'architettura. Profilo dell'archistar." This publication marks a significant milestone in architectural discourse, as it represents one of the earliest attempts to define and investigate the concept of the starchitect, exploring their societal relevance and the strategies employed to attain such status.

The study extends to renowned architects such as Rem Koolhaas, Frank Gehry, and Frank Lloyd Wright, drawing inspiration from Lo Ricco's work while delving deeper into the architects' own publications, official awards pages, brand profiles, and architectural magazines like El Croquis. This comprehensive approach ensures a nuanced understanding of the multifaceted roles and influences of starchitects throughout architectural history and in contemporary practice.

The examination and analysis of BIG's architectural prowess offer insight into a dynamic interplay of innovative design, sustainable practices, and a forward-thinking ethos. This exploration reveals that the ethos of distinguished architectural firms often aligns with the persona of the "starchitect".

Unlike traditional architects, the starchitect embodies a charismatic fusion of artistic vision, global recognition, and a transformative impact on the architectural landscape. This connection signals a pivotal shift in the architectural paradigm, where individual professionals evolve into iconic figures whose influence extends beyond blueprints and structures, shaping the very identity of contemporary architectural discourse.

Consequently, the focus now decisively turns toward "starchitects", delving into their distinctive characteristics, roles, and the profound implications they have for the ever-evolving fabric of modern society.

The term "starchitect" has gained widespread recognition and usage, despite being a relatively recent neologism. Its initial appearance can be traced back to the book "Lo spettacolo dell'architettura. Profilo dell'archistar" (Gabriella Lo Ricco, 2003). In this work "starchitects" ("archistar" in Italian) are defined as "architects whose work does not only focus on the design of structures and buildings, but also the spread of their image". The author strategically borrowed the term "star" from the film industry, drawing on its connotations of immense success, widespread renown, and a career built significantly on the cultivation of a distinctive public persona.

In the next paragraphs the key characters of "starchitects" will be analyzed, together with the strategies that need to be put in place to obtain such a title. Aligned with this theoretical inquiry, the career paths of three distinguished architects will be examined. The ultimate aim is to comprehensively grasp and draw comparisons between Bjarke Ingels's professional journey and those of his precursors.

STARCHITECT'S TOOLKIT

The status of being a "starchitect" is not an inherent trait at birth; rather, it is a distinction achieved by only a select few, and once attained, it becomes an irreversible milestone.

According to the analysis provided by Lo Ricco, talent, epiphany, and exposure, seem to be the three essential key factors that an architect faces to become a starchitect.

The cultivation of talent in architecture is a multifaceted process influenced by both innate characteristics and personal qualities. Moreover, it is shaped by the concerted efforts and experiences accumulated over the years, significantly contributing to the acquisition of knowledge and expertise. Notably, it is not a mere coincidence that many starchitects have benefited from the guidance of renowned and insightful mentors who have played a crucial role in introducing them to the intricacies of the architectural realm.

Epiphany, in this scenario, is intended as a moment of manifestation of the architect's ideas, values, approach, and overall professional capabilities. This revelation becomes the cornerstone of the architect's career, defining their public identity. The way the architect exposes himself to the public is not decided, it could be the design of a groundbreaking structure, the publication of a book, a captivating interview, or any medium capable of conveying their idea and values the specific communication tools are not as important as the architect's ability to create interest in their audience. The epiphany should not be confused with the manifesto, which, as explained in the previous chapter, is a declaration of values goals, and methods that the company intends to apply in every design challenge.

The last but essential feature of a successful starchitect is a strong public image, which is not built through sporadic moments of media exposure but through a consistent presence in both the architectural and non-architectural realms.

When these three conditions are met, the architect could achieve a state of "iper-succes" (Gabriella Lo Ricco, 2003), which means that the opera and the author become inseparable. This situation contrasts sharply with historical perceptions, where the "opera" (work) held paramount importance in the design process, and knowledge of the author's biography served merely as a tool to better understand the outcome of the work—the framework within which the art was produced. The shift in public attention from the work to the artist marks the emergence of the starchitect and its "ipersuccess." This paradigm shift reflects broader transformations in society, communication, the market, and lifestyle. Nevertheless, globalization and the development of new communication tools have played pivotal roles in shaping the history of starchitects.

It is noteworthy to highlight a profound distinction between starchitects and other influential professionals. While writers, painters, directors, technology developers, and other professionals can achieve notable results relatively quickly, architects often face lengthy and complex timelines. Many architectural projects exist only in the virtual realm, and if they ever succeed in being constructed, they can take years or even decades to complete. Consequently, it is extremely challenging for architects to keep the interest of the public constantly high. To maintain public interest, starchitects diversify their activities, participating in events, conferences, interviews, lectures, documentaries, and more. They also expand their creative scope to include smaller-scale objects like furniture, lighting, pavilions, and books, which have shorter design processes and allow for continuous production and therefore income, but most importantly, give the public something to comment on, magazines something to write, social media something to post, therefore achieving the higher goal of spreading and keeping high the name of the starchitects.

Similar to other professionals whose work relies on public engagement, architects meticulously curate their public image. Everything, from their clothing to their attitude, and facial expressions, or their personal information, is carefully considered to control

how the public perceives them and the values they represent. The architect's image takes on a higher meaning, becoming a symbol of ideals and values. Architects, akin to famous athletes, singers, and artists, have played a role in creating strong and communicative branding for products. This fusion of culture and marketing blurs the lines between the two. Brands associate their products with the faces of idols, turning the act of buying them into an investment in value. On the other side, architects leverage the media exposure resulting from this process to enhance their fame.

Another intersection of culture and branding, this time tightly related to the architectural field, occurs in the design of structures for corporate entities, including shops, headquarters, offices, and other spaces. These spaces, directly associated with a brand, must not only be functional but also distinctive, leaving a lasting impression on users. They are designed not only for aesthetic pleasure but also to embody the values of the company they represent. To achieve this goal, renowned architects like Zaha Hadid, Rem Koolhaas, and Jean Nouvel have received commissions from companies such as BMW, Prada, and the Cartier Foundation. Starchitects embody values and when they are associated with a brand those ideas are directly connected to the latter, therefore the choice of a professional must be carefully studied.

A significant step toward defining the starchitect as we understand it today is the establishment of the Pritzker Architecture Prize, an international award given annually to recognize the contributions of a living architect. In 1979, Chicagoans Jay and Cindy Pritzker established the prize, funding it as a foundation through the Hyatt Corporation, their family business. The primary objectives of the award, as originally stated, were to increase public awareness of architecture and architects and to underscore the idea that architectural structures have a profound impact on people's lives. It is structured to recognize architects for their whole body of constructed work. The Pritzker Prize ceremony takes place in different locations each year and has become so relevant that, in 2011, the White House hosted the ceremony, with the participation of the aforementioned former President Barack Obama.

When an architect is awarded a prizkers almost automatically enter the system of the starchitects due to the enormous exposure that typically accompanies the win. Their face and names become widely recognized, and featured in architectural and non-architectural publications alike. The fame obtained through winning the Pritzker Prize often results in an increased number of commissions, creating a virtuous cycle where the more they build, the more renowned they become, and the more famous they are, the more people seek their architectural services.

Among the most recognized Starchitects there are renowned figures like Zaha Hadid (1950–2016), Rem Koolhaas (Born 1944), Frank Gehry (Born 1929), Jean Nouvel (Born 1945), Norman Foster (Born 1935), Renzo Piano (Born 1937), Santiago Calatrava (Born 1951), Tadao Ando (Born 1941), Daniel Libeskind (Born 1946), Herzog & de Meuron (Founded

1978 by Jacques Herzog and Pierre de Meuron), Richard Rogers (Born 1933), Toyo Ito (Born 1941), and others.

Professionals of this magnitude are characterized by their innovative vision, a pivotal career epiphany, and a consistent, impactful presence in both architectural and non-architectural realms. They strategically navigate the challenges of maintaining public interest, diversifying their activities, and curating a carefully crafted public image that serves as a symbol of values and ideals. The establishment of the Pritzker Architecture Prize marks a significant milestone, propelling architects into the realm of starchitects through increased exposure and prestigious recognition.

Distinguishing starchitects from normal architects involves recognizing their broader influence beyond the architectural domain, encompassing branding, cultural impact, and their ability to embody values associated with both their identity and the entities they collaborate with. Starchitects often extend their creative scope to smaller-scale projects, such as furniture and books, to sustain continuous production and public engagement. Their meticulously curated public image, akin to famous figures in other fields, blurs the lines between culture and marketing, transforming the act of engaging with their work into an investment in shared values.

In a historical context, figures like Rem Koolhaas, Frank Gehry, and Frank Lloyd Wright have been selected as explanatory examples to illustrate the evolution of the starchitect phenomenon across different movements—modernism, postmodernism, and contemporary design. Each professional, spanning a significant historical continuum, reflects the dynamic nature of architectural paradigms and the evolving roles of starchitects in shaping the built environment. Together, they showcase the enduring impact of starchitects across diverse cultural and temporal contexts, emphasizing the dynamic and influential nature of their contributions to the field of architecture.
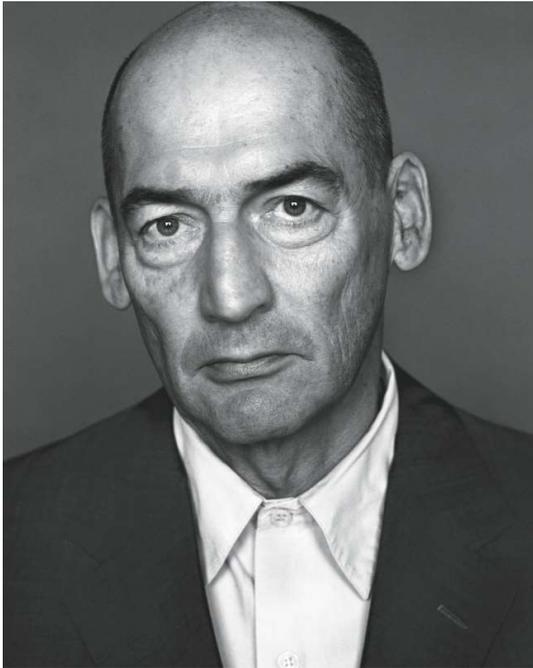
REM KOOLHAAS

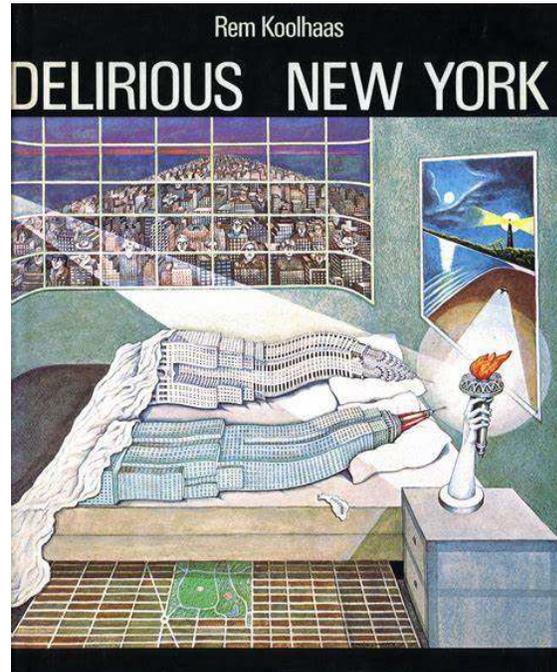Figure 18 Rem Koolhaas, (Portrait by Dave Gray).

Figure 19 Cover page of "Delirious New York" (OMA, s.f.)

TALENT Rem Koolhaas was born in Rotterdam, the Netherlands, in 1944. He embarked on his career as a journalist before shifting his focus to architecture which he studied at the Architectural Association in London first, and at Cornell University in Ithaca, New York later. In 1975, he founded his architectural studio, known as the Office for Metropolitan Architecture (OMA), in collaboration with Elia and Zoe Zenghelis and Madelon Vrisendorp (Encyclopedias Britannica, s.d.).

Rem Koolhaas is widely regarded as a visionary in the same league as architectural luminaries like Le Corbusier and Frank Lloyd Wright. His work has garnered particular acclaim for his innovative and groundbreaking approach to design, and his penchant for challenging established norms and conventions in the field of architecture. This unconventional approach has solidified his position as one of the most influential architects of his generation.

EPIPHANY His first publication, as well as his architectural manifesto and epiphany, was "Delirious New York", published in 1978, three years after the opening of his studio. The book and the fact that he hadn't built anything until 1985 made him win the nickname "paper architect" (SELF, 2018).

The book analyzes the evolution of architecture and urban planning throughout New York's history, from the Dutch establishment of New Amsterdam to Le Corbusier's design of the United Nations Headquarters, and functions as a retroactive manifesto for Manhattan between 1850 and 1960. During these

insightful journeys through the making of Manhattan's history, Koolhaas emphasizes his duty to modernity. He focuses on Manhattan's ability to re-invent the 'modern' typology a fitting parallel to Corbusier's European Ideologies and on how the city's buildings are not advocated as architectural masterpieces, but the tools for reinventing lifestyle in the city. The Appendix provides a non-canonical conclusion to what New York would have been, by giving a plethora of evidence on unbuilt projects. The second coming of Manhattanism[8], this time as an explicit doctrine that can claim its place among contemporary urbanisms. Impressive documentation of original materials and unpublished projects provides evidence for this architectural manifesto.

The publication initially faced a bit of resistance, but after a few years has been not only embraced by society but also compared to "Vers une architecture[9]" of Le Corbusier. Despite its inception dating back to 1978, the content matter of the book stays relevant, 43 years later, and gives a comprehensive account of the making of the city we now know as New York.

Thanks to this publication Koolhaas has been able to get the initial mediatic exposition he needed to take the first step toward his future career as a "starchitect".

EXPOSURE

Publications
While it might appear that Rem Koolhaas did not actively seek to cultivate a public image or pursue the limelight through appearances in magazines, interviews, or public events, he managed to quietly establish his notoriety primarily through the publication of books. His seminal work, "Delirious New York", served as the inaugural entry in a series of publications that allowed him to articulate his ideas and garner recognition and success.

In 1995, Koolhaas released his second book, "S, M, L, XL," a revolutionary publication notable for both its content and layout, which catapulted the architect into global recognition. "S, M, L, XL" is a monumental compendium spanning 20 years of OMA's projects, organized by size, offering insight into the innovative thinking of the office during an era when architecture found itself relegated to a bystander's role amidst the market economy's explosion and globalization. The book achieved immediate popularity, with the initial edition's

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[8] A style of architecture and urban design associated with the American borough of Manhattan, New York, with tall buildings that support the norms of congestion and overpopulation. (Wiktionary, s.d.)

[9] Toward a New Architecture is a manifesto written by the influential Swiss French architect and urban planner Le Corbusier, originally published in 1923. It is a seminal work in architectural theory and modernist design. It is composed by seven essays under the title of arguments. These essays can be listed as the engineer's aesthetic and architecture, three reminders to architecture, regulating lines, eyes which do not see, architecture, mass-production houses and architecture or revolution. Each of them, under an influence from Adolf Loos's ideas, are rejecting eclectism as common idea and heading to functualism. "Vers une architecture" had a profound impact on the field of architecture and played a significant role in the development of modernist architecture in the 20th century.

30,000 copies selling out within months and even facing counterfeiting in China. The subsequent second edition, with 70,000 copies, was likewise swiftly exhausted. (Linda Eerme, 2023).

Follows the publication of "Mutation", in 2001. In this case, Koolhaas delved into a reflection on the contemporary phenomenon of urbanization, exploring how it was influenced by evolving communication networks and the gradual dissolution of borders under the influence of economic forces. The fact that Koolhass hired a full-time designer for years to work on the books, testify to what extent the activity was considered crucial (OMA, s.d.).

The publications of books continue to be constant with one book per year on average, but also with peaks of three books per year, such as in 2023 with the publication of "OMA Asia: Bold / Humble" (OMA, 2023), "The Metropolitan Stage: Taipei Performing Arts Center" (OMA, 2023), and "Architect, verb" (Graaf, 2023).

Lectures and interviews
A distinctly curated section of OMA's website is dedicated to lectures and interviews conducted by OMA's associates and founder, Koolhass. This endeavor serves as a significant indication of the company's recognition and appreciation for these activities, understanding their pivotal role in shaping the architect's and the company's overall image.

All company lectures are accompanied by recorded interventions and concise descriptions introducing the respective topics. As for the renowned architect, Koolhaas commenced his career as a lecturer in 1989 with the presentation of "Très Grande Bibliothèque," wherein he delved into the history of the site and the library typology, elucidating their influence on the conceptualization and design of OMA's proposal. Six years later, in 1995, his second lecture occurred with the presentation of his book "S, M, L, XL" at the Architectural Association in London, UK. Thirteen years thereafter, Koolhaas reemerged with the "The Hermitage: Masterplan 2014" lecture hosted by The State Hermitage Museum in St. Petersburg, Russia.

After this moment the architect began delivering approximately one lecture per year until 2016 when he participated in his final event organized by La Nuit des Idées—an organization uniting leading thinkers, writers, researchers, and artists globally for dialogues on the future of our planet. The dialogue between Rem Koolhaas and Bruno Latour, moderated by Mathieu Potte-Bonneville, addressed their recent concerns, focusing on the countryside and the impacts of global warming.

The success of the architect's strategies is testified by the publication of his pictures in magazines and journals such as El Croquis, Architecture and Urbanism Magazine (A+U), TOTO, Archis, and many others.

Moving forward, the company continued to offer classes through other associates, although Rem Koolhaas stopped personally participating.

For what concerns interview, as said the architect tried to avoid them as much as possible, but still, given his relevance, it was impossible to avoid them completely. Among the several relevant interviews that the architect released there is the one with Vanity Fair (Vanity Fair, 2014), Google Zeitgeist (Google Zeitgeist, 2016), Dezeen (Dezeen, 2014), and many others.

Awards
In 2000 Koolhaas won his first and most prestigious award: the Pritzker Prize (The Pritzker Architecture Prize, s.d.).

In 2003 he was bestowed with The Praemium Imperiale which is a global arts prize assigned annually by the Japan Art Association. Since its inauguration in 1988, it has become a mark of the arts. (The Praemium Imperiale, s.d.). Among the several relevant architects that have won this prize, are Norman Forster, Jean Nouvelle, Zaha Hadid, David Chipperfield, and many other "starchitects".

The following year the architect was awarded the Royal Gold Medal 2004 an annual architecture award given by the Royal Institute of British Architects on behalf of the British monarch, recognizing an individual or group who has made a substantial contribution to international architecture. (RIBA, s.d.)

Again, the year after Koolhass was nominated winner of the Mies van Der Rohe Award. The Mies van der Rohe Awards (EUmies Awards), has been founded in 1988 in Barcelona by Fundació Mies van der Rohe and the European Union's program to support the cultural and creative sectors. (Fondacio' mies van der rohe barcellona, s.d.)

In 2008, Time magazine included him in their list of "The World's Most Influential People" (Lacayo, 2008).

In 2010 The Golden Lion for Lifetime Achievement at the 12th International Architecture Exhibition was awarded to Rem Koolhaas. (Etherington, 2010) In the context of architecture and the Venice Biennale, the Golden Lion for Lifetime Achievement is a prestigious award presented to architects in recognition of their outstanding contributions to the field throughout their careers.

In 2012, Koolhaas added to his impressive collection of awards by receiving The Johannes Vermeer Prize, the state prize for the arts in the Netherlands. Established in 2008, this prize aims to honor and stimulate exceptional artistic talent across various disciplines, providing a cash prize for the realization of a special project within the recipient's field of activity.

Further expanding his recognition, Koolhaas was elected to the American Philosophical Society in 2014, an organization founded by Benjamin Franklin in

1743. The society is the nation's oldest continuously operating learned organization, engaging in research, conferences, article publications, library resources, and community engagement (Encyclopedia Britannica, s.d.).

The most recent recognition has been the Rolf Schock Prize in 2022. This biennial award spans diverse areas such as science, visual arts, and music, with laureates sharing a total of 2 million Swedish krona (Royal Swedish Academy of Sciences, 2022).

The long collection of awards has helped Koolas to remain popular throughout the years, as the awards, directly and indirectly, increment the architect's fame in the whole world.

Public image
As said, it seemed that Koolhaas did not put much effort into creating a strong public image. He demonstrated a tendency to avoid interviews when possible and did not appear often in public events. Therefore it is not clear if the publication of his face in several articles was his intentional choice or the magazines' necessity to satiate public curiosity with novel and enigmatic content. Nonetheless, his sharp features and his extremely simple style have become worldwide known. The architect is portrayed as a mysterious figure awaiting discovery, transcending time to become a character belonging both to the past and the present.

Figure 20 Rem Koolhaas' portrait (El croquis, 1998)

Branding

For the architectural production of Koolhass, branding became a relevant activity.

In his early career, Koolhaas started a lifelong collaboration with fashion brands Prada and Miu Miu contributing to the realization of showrooms and fashion shows for both entities. Especially with Prada, the architect has been able to create an intense relationship not only by taking care of the scenography of his fashion show yearly but also by designing numerous Prada shops around the world. The architect's collaborative ventures extended to other notable brands, including Phillips in 1997, Porsche in 2006, Dior in 2018, BVLGARI in 2021, and Tiffany and Bershka in 2023.

Social media

In the realm of social media, OMA places considerable emphasis on the accessibility and richness of its website and media platforms. The website is crafted to be user-friendly, providing comprehensive information about the studio's intentions and achievements, enabling anyone to grasp the essence of the studio within a few hours. While the Instagram page may not be consistently active, it serves as a valuable snapshot of the company's current endeavors. Recognizing the pivotal role of social media as the studio's virtual cover letter, clear and effective communication is maintained.

Films

In 2016 Rem Koolhaas was cast by Tomas Koolhaas for a docu-film about him, his life, his approach to architecture, and his insatiable need to provoke. The architect did not accept the offer and the role went to a young actor, but still, the film was based on Koolhass' life and experiences.

Koolhaas's undeniable talent, combined with his growing notoriety and his ability to maintain public interest in his work over the years, has firmly established him as one of the most renowned architects to have ever graced the profession.
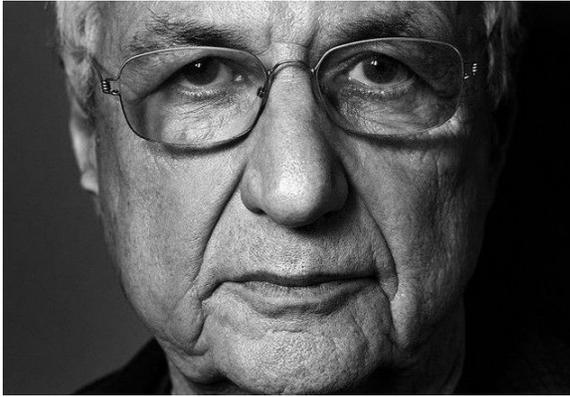
FRANK OWEN GEHRY

Figure 21 Frank Owen Ghery, (Gallego, 2021)

Figure 22 Santa Monica House (Fairs, Frank Gehry's Santa Monica home, 2021)

TALENT

Another exemplary figure in the world of architecture is Frank Owen Goldberg, better known as Frank Owen Gehry, due to a name change he undertook in 1954 due to concerns related to antisemitism. Born in 1929 in Toronto, Gehry's life took a significant turn in 1947 when he relocated to Los Angeles. This change in environment had a profound and largely negative impact on the young architect, as he grappled with crises about his political, historical, and professional identity. During high school, when young Gehry was still lost, some of his professors encouraged him to explore the field of architecture. He Consequently gained admission to Harvard but decided to withdraw from the institution due to the lack of intellectual stimulation and non-conformist environment he sought. Moreover, the prevalent approach to architecture at the university did not align with Gehry's values. His aspirations transcended the desire to construct private residences for affluent individuals; he yearned for alternative guidance and reference points to express his liberal and idealistic principles.

In pursuit of his vision, Gehry returned to Los Angeles, where he commenced his collaboration with Victor Gruen, an Austrian-American architect renowned for pioneering the design of shopping malls in the United States. Under Gruen's tutelage, Gehry absorbed valuable insights and was able to more effectively apply his own values. However, he encountered resistance from his colleagues, who were not always receptive to his innovative ideas.

In 1961, Gehry embarked on a transformative journey to Europe, where he found profound inspiration in the work of luminaries such as Le Corbusier, Tourette, and Rinchamp. Upon returning to Los Angeles, he resolved to establish his own architectural studio. This decision granted Gehry the creative freedom he had long yearned for, unburdened by the need to persuade others.

Gehry embarked on an extended therapeutic odyssey with Doctor Milton Wecler, an experience that enabled him to perceive the world through unconventional lenses, develop his unspoken ideas, and learn how to convey his concepts to the world. This unique process contributed to constructing the

image of a tormented yet brilliant artist, someone whose genius often left people struggling to comprehend.

In 1976, Frank Owen Gehry tied the knot with Bertha Isabel Aguilera, and by 1978, they had completed the construction of their residence in Santa Monica. This project marked a significant turning point in the architect's professional journey, as it unequivocally exposed him to a global audience, ingeniously transforming an unremarkable, pink-painted house into a celebrated work of architecture.

Being a self-commissioned project, Gehry was in the unique position of fully exploring his creative ideas without any external constraints. The impact of this project was profound, catapulting Gehry into the limelight and generating substantial attention.

The newfound fame resulting from this transformative project opened the doors to a plethora of commissions for the architect, thereby further enhancing his renown and allowing him to achieve a level of recognition that had eluded him during the initial years of his career.

Publications
Ghery surely did not base his career and mediatic exposition on publication he did not publish a book in his life. What he did instead was punctual collaborations with another author who wanted to include his point of view such as in the case of the book "Frank O. Gehry special" by Luciano Rubino, where he wrote part of the text.

Lectures and interviews:
For what concerned lectures and interviews the architect has been much more active. He assumed the role of an assistant professor at the University of Southern California in 1972 and delivered lectures at the Cooper Union in New York, and the University of Texas from 1978 onwards, nonetheless, he acted as a visiting critic at the University of California from 1967 to 1969. From 1980, he continued to serve as a visiting critic at the Harvard Graduate School of Design. Additionally, Gehry began teaching at Yale University in 1988.

Gehry released interviews with the Time (Luscombe, 2023), Archdaily (Minner, 2011), Fortune Magazine (Fortune Magazine, 2018), Luisiana Channel (Luisiana Channel, 2019), The New York Times (The New York Times, 2014), and many other relevant journals. As a young architect, Ghery also participated in a performance titled "The Course of the Knife", in Venice, in 1985, where he showed himself as an innovator who wanted to awaken the sleeping world.

Ghery appeared several times in the extremely notorious program TEDx Talks, which is a showcase for speakers presenting great, well-formed ideas in under 18 minutes. Usually, guests present new and surprising ideas and inventions, or a basic idea that the audience already knows, but with a compelling new

argument behind it that challenges beliefs and perspectives. (TEDx Talk, s.d.). In his first lecture "My days as a young rebel" the architect gives an overview of the first steps of his career (TEDx Talk, 1990). In the following speech "A master architect asks, now what? ", Gehry gives his take on the power of failure, his recent buildings, and the all-important "Then what?" factor (TEDx Talks, 2002). In both lectures, the architect expresses his feelings, failure, and success with an extremely cynical charisma that captures the public attention and affection.

In 2023 Gehry produced a series of online classes about his philosophy on architecture, design, and art, in collaboration with Masterclass which is an American online education subscription platform on which students can access tutorials and lectures pre-recorded by experts in various fields. (Masterclass, 2023).

Awards
Throughout his career, Gehry achieved several significant recognitions. An example is the American Institute of Architecture's College of Fellows he was inducted into in 1974. Or again, in 1980, he was among the architects selected by Paolo Portoghesi to participate in the "Strada Novissima" exhibit at the Venice Biennale, which served as a manifesto for the postmodern architecture movement. His contributions to the field were further acknowledged when he was admitted to the American Academy of Arts and Letters in Rome in 1987.

The pinnacle of Gehry's career came in 1989 when he was awarded the prestigious Pritzker Prize. This recognition allowed him the freedom to pursue and actualize his architectural ideas without constraints. Notably, in 1992 the architect received two nominations both for the Praemium Imperiale awarded by the Japan Art Association and, the Wolf Prize which is awarded annually to Scientists and Artists for their achievements in the interest of humankind and friendly relations amongst peoples (Wolf Foundation, s.d.).

Public image
Following the success obtained thanks to the construction of his house, Frank Owen Gehry increasingly became a prominent figure at public events, often adopting eye-catching and unconventional looks. Through his distinctive appearance and unconventional attitude, Gehry employed his image as a means to communicate and challenge the mundane aspects of everyday life.

In stark contrast, his portraits typically conveyed a sense of seriousness, laden with emphasis and drama. These portraits aimed to depict Gehry as a romantic and tormented soul, highlighting his ability to overcome adversity and combat the challenges he faced. He portrayed himself as the unfortunate young man whom contemporary architects failed to appreciate due to their lack of understanding, a theme consistently emphasized in all his portraits.

Social media

The official company website is not user-friendly due to an extremely old interface that has never been updated, furthermore, other social media are not set up. This shows how Ghery is still attached to old methods of communication and architectural production.

Branding
Gerhy as well has been able to build proficuous branding relationships with several international brands. Vitra was among the first brands that decided to use the architect's work to elevate his name, more in particular Gehry was commissioned to participate in the design of the Vitra Design Museum in 1989.

Another collaboration that lasted for decades is the one with the Walt Disney family. The visionary has been called to realize several structures for them starting from the Disney village, realized in 1992.

Nonetheless, Gerhy became the representative architect for Luis Vitton, similarly to what Prada has been for Koolhaas, although with much less intensity.

The aforementioned series of classes realized with Masterclass can also be considered a branding activity the company was trying to collect as much audience as possible involving a famous teacher in the activity while the architect exploited this exposition to share his idea and spread his name among new people.

Films
If books are not a tool that Gehry seemed to love, films are something that he exploit. The first documentary he participated in was "Beyond Utopia: Changing Attitudes in American Architecture" (IMDb, 1983). The film documents how attitudes are changing in American architecture. It features Robert Venturi, Denise Scott Brown, Frank Gehry, Michael Graves, and Peter Eisenman, all of whom are protégés of Philip Johnson. These innovators rejected the European modernism of Mies and Corbusier in search of alternative directions. Their buildings of the time are shown and discussed in their offices and on location.

Next comes another documentary named "Deconstructivist Architects" (IMDb, 1990) in which again the movement of post-modernism is analyzed. In the film, architects urge people to be conscious of the space they move through.

After a small break in 2005, the architect participated in another documentary named "Frank Gehry: An Architecture of Joy" (IMDb, 2005). In an hour video Gehry explores his work of the 1990s including The Guggenheim Museum in Bilbao and the Frederick R. Weisman Museum in Minneapolis, as well as his first European commission, the EMR Communication and Technology Center in Bad Oeynhausen, Germany.

A documentary by Pollack named "Frank Gehry - Sketches of Frank Gehry" devotes 83 minutes to the well-known architect and his architectural creations.

portrait of his longtime friend, the famed and somewhat controversial architect Frank Gehry (who selected Pollack for the project himself). Here, Gehry and Pollack converse easily, at times drawing apt comparisons between the demands of architecture and filmmaking. Pollack also assumes the role of student, playing the audience's surrogate to allow Gehry the opportunity to present what amounts to introductory-level explanations of his work. (Amazon Prime, 2006).

Again, it has been possible to document how the construction of the starchitect has happened starting from the aforementioned three main pillars. For what concerns the exposition, Gehry's favorite tools have been lectures and videos, or in general, where he could exploit his incredible presence and charisma.
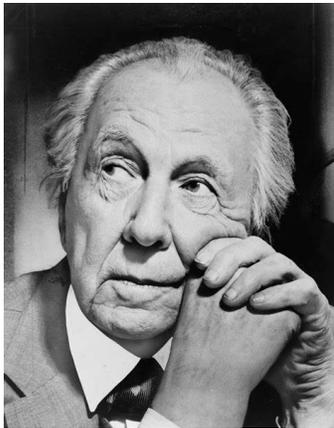
FRANK LOYD WRIGHT

Figure 23 Frank Loyd Wright (Delaqua, 2015)

Figure 24 Winslow House, 1893, Frank Lloyd Wright (BETSKY, 2016)

TALENT

The third architect to be examined in this research is Frank Lloyd Wright. The architect was born in 1867 in a family of Unitarian preachers with Welsh roots. His early education was shaped by his mother, who instilled in him the principles of Friedrich Fröbel's pedagogy. An essential element of this pedagogy was the concept of "Spielgabe" or "gifts for playing," which consisted of a series of activities with various geometric shapes such as spheres, cubes, cylinders, and other basic solids, crafted from diverse materials. These objects were designed to be manipulated and assembled in countless variations and, according to some critics, might have had a major influence on Wright's artistic imagination.

Wright embarked on his professional career as an apprentice in two notable architectural studios. His first apprenticeship was under J. L. Silsbee, and he subsequently joined the Chicago office of Dankmar Adler and Louis Henry Sullivan. During his tenure with Adler and Sullivan, spanning approximately six years from 1887 to 1893, he primarily focused on the design of single-family residences. Nevertheless, he also gained valuable exposure to the development of skyscrapers and commercial buildings, reflecting the spirit of the Chicago School and the emerging principles of organic architecture, which Wright would later come to personify as its undisputed leader (Domus, s.d.).

In 1893, Frank Lloyd Wright took a significant step toward independence by establishing his architectural studio within the Schiller Theater Building. This marked a pivotal moment in his career.

Drawing from moral principles such as family unity and a strong connection to local traditions, Wright began to develop the initial examples of what would come to be known as "Prairie houses"[10]. In 1893, he realized his first Prairie Style house, known as the "Winslow House". Herman Winslow, the client for this project, provided Wright with the opportunity to work freely and collaboratively, as they shared remarkably similar ideals, sharing a common disillusionment with hypocrisy, yearning for a return to genuine authenticity.

The Winslow House embodied Wright's innovative design approach, characterized by a low-lying structure with horizontal lines, a hipped roof, clerestory windows, and a central fireplace as a dominant feature. This new architectural style, what we now recognize as "Prairie Style", garnered considerable attention in the local community. Wright himself noted the public's reaction to this groundbreaking architectural venture.

Publications
During his successful career, Wright produced several written elaborations. While abroad, he sets to work on two books, both published in Germany, which are a double portfolio of his drawings ("Studies and Executed Buildings", 1910) and a smaller but full photographic record of his buildings ("Executed Buildings", 1911).

After a series a family family-related and economic difficulties Wright got to work on one of his most significant publications: "An autobiography." In this book, he cast himself as a heroic figure and as a savior of the world from its enemy: clichés. His narrative style is imbued with drama, portraying himself as a larger-than-life hero. Wright's strong and egocentric character shines through as he primarily focuses on his successes, omitting any mention of defeats and difficulties. This selective portrayal serves to grant him an almost divine aura. Contemporarily Wright's first book on the urban problem "The Disappearing City" was also published.

Follows "An Organic Architecture", published in 1939, in which the architect articulated his philosophy on architecture, advocating for an approach that is harmoniously integrated with its natural surroundings. He rejects the prevailing trends of his time, which heavily relied on historical styles and ornamentation.

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[10] Prairie style, in architecture, American style exemplified by the low-lying "prairie houses" such as Robie House (1908) that were for the most part built in the Midwest between 1900 and 1917 by Frank Lloyd Wright. Prairie houses were generally two-story structures with single-story wings. They utilized horizontal lines, ribbon windows, gently sloping roofs, suppressed, heavy-set chimneys, overhangs, and sequestered gardens. (The Editors of Encyclopedia Britannica, s.d.)

Central to Wright's concept of organic architecture is the idea that buildings should be conceived as living organisms, seamlessly connected to the environment and reflecting the organic principles of nature.

He continues his work as an author with "An American Architecture", and "A Testament", in which he clarifies his thoughts and his projects.

Lectures and interviews
During the first years of success, Wright lectured repeatedly. His most famous talk, "The Art and Craft of the Machine," obtained such success that has also been printed in 1901. Nonetheless, his works were featured in local exhibitions from 1894 through 1902 (Britannica, 2023).

During The stock market crash of 1929, all architectural activity was stopped in the United States, consequently, Wright spent the next years lecturing in Chicago, New York City, and Princeton, New Jersey. Meanwhile, an exhibition of his architecture toured Europe and the United States.

Interviews were another activity in which Wright was often participating. In 1957 he was interviewed by Mike Wallace (Namsill, 2014), while in 1953 he participated in an event with Hugs Downs of NBC Chicago (Intellect, 2019). In both of them, he discussed his ideas about the modern world, how it will change, and how it will affect or will be affected by architecture. Gehry also discussed specific projects such as the case in the interview with Alistair Cooke always in 1953, where he discussed his son's house. (Cooke, 2020).

Exhibitions
Frank Lloyd Wright's prolific architectural production continued undebated. In the meantime, his fame spread to Europe, thanks to a monographic exhibition held in Berlin in 1910. This exhibition featured a sumptuous portfolio of 100 plates showcasing his architectural work. Coinciding with this, a collaboration with Professor Eugene J. Johnson's seminar, titled "Wright Writing," led to twenty-six of these plates of Wright's architectural designs being displayed at WCMA, courtesy of Chapin Library. As part of the "Wright Writing" seminar, students were tasked with crafting descriptive labels for these plates, inviting visitors to engage in a dialogue through their written responses. This innovative approach fostered an ongoing and dynamic conversation between the students and the public, allowing for a deeper understanding and appreciation of Wright's architectural contributions. (Williams College Museum of Art, s.d.)

Awards
Wright's talent has also been recognized by the architect's community through the assignment of different awards. In 1941 Wright won the RIBA Gold Medal.

In 1949 the architect was awarded the AIA Gold Medal which is awarded by the American Institute of Architects conferred "by the national AIA Board of

Directors in recognition of a significant body of work of lasting influence on the theory and practice of architecture (American Institute of Architects, 2023).

And last, he was assigned to Wright the Twenty-five Year in 1983 for his building Price Tower Bartlesville, Oklahoma.

Public image
Wright was acutely aware of the importance of imagery and the role that photography played in constructing a powerful and influential persona. Therefore, in photographs taken inside his studio, the composition consistently emphasized his superiority, portraying him as a regal figure surrounded by seemingly insignificant individuals. Even in public events, he ensured that he was never pictured alongside someone more influential than himself. His posture and gaze in portraits were meticulously crafted to convey a sense of aristocratic superiority.

Branding
Wright did not collaborate with any major brand, therefore he did not build his fame exploiting this strategy. Nonetheless, the architect collaborated with several famous private clients which allowed him to create some of the most iconic architectural works of the 20th century.

Among the most prominent figures, there is Edgar Kaufmann Sr., a wealthy businessperson and the owner of Kaufmann's, a prominent department store in Pittsburgh; Frederick C. Robie, a successful businessperson in Chicago, involved in the bicycle and automobile industries; or Solomon R. Guggenheim who was a wealthy industrialist and art collector. He founded the Solomon R. Guggenheim Foundation to promote modern art, and he commissioned Frank Lloyd Wright to design the Guggenheim Museum in New York City to house his collection.

Films
In 1949, one of Wright's clients asked him to play the protagonist in the film adaptation of "The Fountainhead." The story was based on the book by Ayn Rand and closely mirrored Wright's career. The protagonist of the story was an individualistic, idealist architect who fought against mediocrity, corruption, and anyone who did not appreciate his vision.

Gossip
Wright's fame was also built on scandals and gossip. He was frequently spotted in his car, aptly nicknamed "the yellow devil," in the company of different women. While he denied it, he maintained significant control over what the press published, effectively leveraging the attention of the press to his advantage. He often wrote letters to either accuse or defend his designs, which would subsequently be featured in various publications.

Again, Frank Lloyd Wright was able to distinguish himself from his contemporary colleagues and show the world his innovative vision. The exposition obtained has been maintained both with a wise construction of his image and by exploiting the tools of the time: journals.

His eccentric character surely helped him to play this role and consequently to achieve great success. What distinguishes Wright from other analyzed architects is his wise employment of gossip.

BJARKE INGELS

Figure 25 Bjarke Ingels (GQ, 2020)

Figure 26 The Mountain Dwelling (Bjarke Ingels Group, n.d.)

TALENT

Born in 1974 in Copenhagen, Bjarke Ingels started his architectural studies at the Royal Academy in 1993. Initially, his dream was to become a cartoonist, and he entered architecture school intending to hone his sketching skills. However, during his studies, he discovered a profound passion for architecture, prompting him to continue his educational journey at Barcelona's Technica Superior de Arquitectura.

Upon completing his formal education, Ingels ventured into the professional world and joined the Office for Metropolitan Architecture (OMA) in Rotterdam, working under the guidance of the aforementioned Rem Koolhaas from 1998 to 2001. This experience provided him with invaluable insights and mentorship from one of the most influential and recognized architects of our time.

In 2001, Ingels returned to his native Copenhagen and, alongside his Belgian colleague from OMA, Julien de Smedt, founded PLOT, an architectural practice. PLOT quickly gained recognition and acclaim for its innovative and imaginative designs, both within Denmark and on the international stage. In 2004, their proposal for a new music house in Stavanger, Norway, earned them a prestigious Golden Lion at the Venice Biennale of Architecture. A pivotal moment for PLOT came in 2005 when they achieved significant success with the award-winning VM Houses in Ørestad, Copenhagen.

With his combined experiences of working with one of the architectural industry's most influential figures and co-founding a dynamic and creative firm, Ingels had amassed the knowledge and expertise required to establish his studio. This move

allowed him to showcase to the world his distinctive architectural vision and the remarkable designs he was capable of creating.

Following the disbandment of PLOT at the close of 2005, Bjarke Ingels wasted no time. In January 2006, he established his firm, Bjarke Ingels Group (BIG), as an independent and distinct architectural company. With this move, Ingels was ready to apply the lessons he had learned from his prior experiences to not only ensure the efficient operation of his new studio but also to pursue remarkable success.

Ingels's inaugural project was the Mountain Dwellings, a 25-meter-high (82 ft) residential complex. Ingels managed to secure an investor who believed in his vision and provided the necessary support to bring this project to fruition. This endeavor not only captured the attention of the public but also garnered several prestigious awards. It marked the successful launch of BIG and demonstrated that the studio could build something entirely new, revolutionary, and daring while maintaining a balanced and informed approach.

With these early achievements, BIG quickly established itself as a trailblazing force in the world of contemporary architecture, with Bjarke Ingels at its helm, ready to continue pushing boundaries and reshaping the architectural landscape.

Publications
The first and most conventional tool used by the architect is books. Through this media, Ingels has been able to express his ideas and values while maintaining a prominent presence in the public eye. To balance the conventional nature of the media, Ingels adopted an innovative format for his first book and manifesto "Yes Is More," published in 2009. This work presented a catalog of 30 projects from his practice, structured in the style of a comic book, a format he believed was the most effective for narrating stories about architecture.

Cartoons have long been recognized as a direct and efficient method of communication, characterized by their condensed form and the ability to convey significant messages with minimal content. Cartoonists employ techniques like exaggeration, irony, symbolism, stereotypes, and humor to illustrate conflicts, satirize subjects, or convey desired messages. In contrast to manifestos published in traditional book form, the comic book format allowed for a broader audience, including non-technical individuals outside the field, to engage with architectural concepts. While this simplification may have posed a risk of losing complexity and depth, it fostered an environment in which clients, architects, and the public could establish a friendly and mutually comprehensible relationship. This strategy was further reinforced using a non-formal language, enabling Ingels to present himself not as a superior authority who impose his ideas, but as a friendly figure capable of listening and understanding the desires of clients, translating those needs into spectacular architecture.
The book not only showcased BIG's successes but also candidly addressed failures and challenges encountered during the design process.

In 2015 BIG published a second book: "Hot to Cold". It is an Odyssey of Architectural Adaptation, exploring sixty case studies through a climatic lens, to examine where and how people live on the planet, working from the warmest regions to the coldest. Its structure could be compared to the one of "S, M, L, XL".

In 2021 BIG published a third book: "Formgiving. An Architectural Future History", in which the architect explores the past, present, and future, drawing a timeline of the built environment from taking shape to giving form. (Stouhi, 2021). A further publication that showcases the latest project of the company is published yearly.

Lectures and interviews
A much less traditional platform exploited by the architect is the TEDx Talk. In 2009, Bjarke Ingels participated in his inaugural event in Oxford, UK, where he presented his book "Yes Is More". During this talk, he elucidated his design processes to the public, with a particular emphasis on the phenomena of mutation that occur during the design process. Combining efficient verbal communication with a captivating and funny presentation, complemented by minimal written content and a wealth of striking images, Ingels demonstrated his remarkable presentation skills. The video of this speech garnered a total of 2,719,966 views (TED, 2009) , significantly enhancing his visibility and recognition, particularly among non-architect audiences.

Ingels was subsequently invited to deliver another Talk in 2012, where he expounded on his concept of hedonistic sustainability. Once again, he displayed his ability to captivate and entertain thousands of people (TED, 2012). His last and third lecture in the program, held in 2019, revealed the background and evolution of his latest projects. (TED, 2019).

In 2007, Ingels extended his impact by exhibiting at the Storefront for Art and Architecture in New York City and receiving a commission to design the Danish Maritime Museum in Helsingør.

The architect's formidable reputation was not solely established through globally acclaimed designs, TED Talks, and awards, but also through his active participation in numerous interviews, conferences, and lectures throughout his career. During these activities, the architect covered a vast range of topics, including personal anecdotes about his family and childhood, insights into his studio's growth, and how he manages complex projects. Examples include an interview with Inside the Business of Design in 2013, in which he reveals a lot of information about his family and childhood, but also speaks about the studio's growth and how he organizes the work when in need to manage complex projects (Inside the Business of Design, 2013), or at Zumtobel, were he explained his approach to architecture and how his studio is organized, how the multidisciplinary and multiethnicity of the studio allows having a strong creative environment (Zumtobel, 2015), or again with Vester where Ingels Bjarke Ingels Group unveils "The Plus" project as the world's most sustainable furniture factory tucked in the heart of the Norwegian forest (Vestre, 2020), and many other interviews that helped him the get more and more famous throughout the years.

Awards

Ingels has won an incredible amount of awards. Among the most relevant there are the Nykredit Architecture Prize, which is the largest Danish architecture prize; European Prize for Architecture, given annually to any living architect whose built work exemplifies the highest ideals of European civilization and embodies the vision and for the social and physical environment (The European Center, s.d.), the Dreyer Honorary Award, the Danish Crown Prince Couple's Culture Prize, the French Academy of Architecture Prix Delarue Award, 40 Under 40 Award, and The National German Sustainability Award Honor Award.

Although Ingels did not receive the most important award of all (the Pritzker), the quantity and constance with which the architect is recognized with prizes, definitely make up for the lower relevance.

Among his numerous accomplishments, in 2006, Bjarke Ingels was also honored as one of TIME's "100 Most Influential People" in the magazine's annual list, featuring individuals who have broken new ground in five distinct categories: Pioneers, Titans, Artists, Leaders, and Icons. (Gintoff, Bjarke Ingels Named One of TIME's 100 Most Influential People, 2016). Other giants of the same field endorse the authority of each selected figure, and, in Ingels' case, former boss Rem Koolhaas offers poignant words of praise. "Bjarke is the first major architect who disconnected the profession completely from angst," says Koolhaas. "He threw out the ballast and soared. With that, he is completely in tune with the thinkers of Silicon Valley, who want to make the world a better place without the existential hand-wringing that previous generations felt was crucial to earn utopianist credibility." (Gintoff, Bjarke Ingels Named One of TIME's 100 Most Influential People, 2016).
Furthermore, in 2010, Fast Company magazine recognized Ingels on its list of the "100 Most Creative People in Business," citing his design of the Danish pavilion (Cilento, 100 Most Creative People / Fast Company, 2010).

Branding

As previously explained, often enterprises and notorious architects collaborate to create iconic spaces or products to exploit at their maximum the beneficial consequences of branding: significant exposure and advertising.
In 2017, Ingels was commissioned to design the Lego House in Billund, Denmark. When reflecting on this project, Ingels stated, "We felt that if BIG had been created with the single purpose of building only one building, it would be to design the house for Lego." For this project, the architect wholeheartedly embraced the spirit of the company and sought to create a distinctive and iconic structure that would leave a long-lasting impression on visitors. To achieve this objective, BIG translated the iconic toy scale of the classic LEGO brick into architectural scale within the Lego House, resulting in the creation of expansive exhibition spaces and public squares that embody the culture and values at the core of all LEGO experiences.

Figure 27 LEGO House, Billund, Denmark, (Bjarke Ingels Group, n.d.)

Another brand that decided to be associated with BIG is Google, a multinational technology company that specializes in internet-related services and products, including search engines, online advertising technologies, and cloud computing. The company first commissioned Ingels's group for a headquarters in London in 2015, and again in 2022 with a 350000 sqm structure to become Google's first-ever ground-up campus with the mission to operate on carbon-free energy, 24 hours a day, seven days a week by 2030 in Mountain View, United States. The buildings deliver on Google's ambition to create human-centric, sustainable innovations for the future of Google's workplace as well as scalable, replicable solutions for the construction industry and beyond. Anchored in three themes defined by Google's design brief at the beginning of the project – innovation, nature, and community – the design is driven by flexibility and extraordinary user experience that inspires collaboration and co-creation.
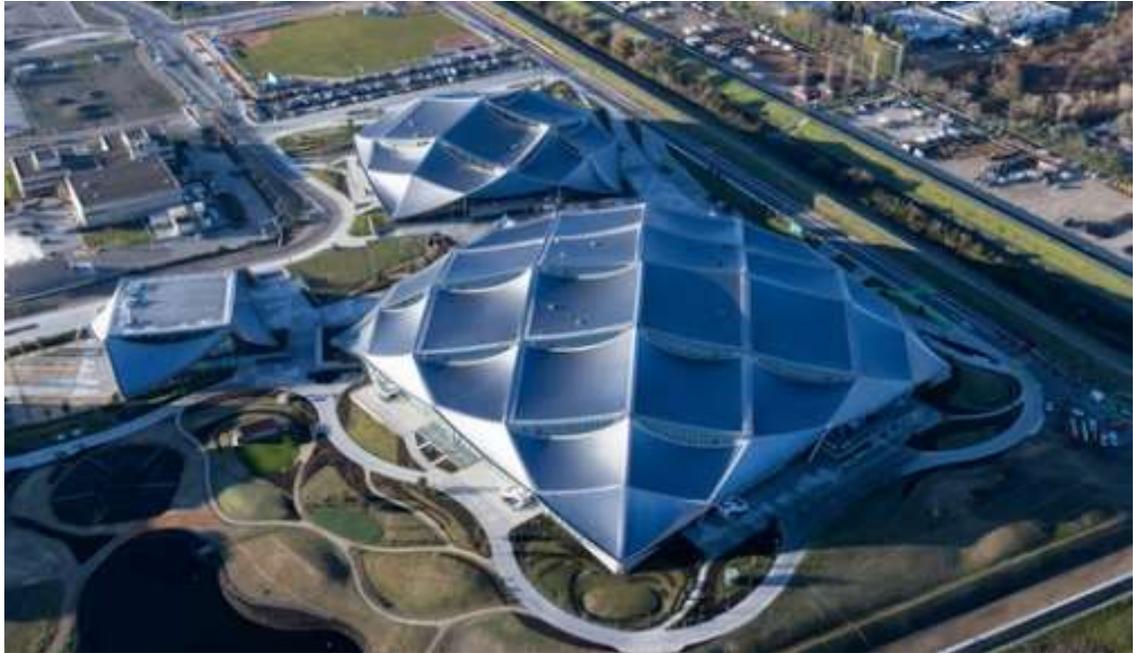
Figure 28 Google HQ, Mountain View, United States, (Bjarke Ingels Group, n.d.)

While proceeding with the typical strategy based on the realization of the whole structure for brands, which has been pursued not only by BIG but by all the architects analyzed until now, the company decided to collaborate with different brands to produce smaller-scale objects that will help to keep constant the company's production and help to increase the visibility of both the parties involved in the project. An example is the Stella Nebula Lamps realized in collaboration with Artemide in 2021, one of the most known illumination brands in the world, with products originating from research and high-quality manufacturing. (Artemide, s.d.) Or the Brick Sofa designed with Jot.jot, a venture Founded and owned by Jurgis Garmus (Jot.jot, 2015).

Figure 29 Stellar Nebula lamps, BIG, (Bjarke Ingels Group, n.d.)

Social media
In the digital age, social media has become an indispensable tool for firms of all sizes and industries. Its importance lies in its ability to connect businesses directly with their target audience, fostering engagement, building brand recognition, and driving growth. Social media platforms offer a dynamic and cost-effective means of marketing, allowing companies to reach a global audience and promote their products or services.

Instagram[11] is one of the several social media that the company exploits to constantly engage with the public. The platform allows subscribers to share pictures and videos in different formats. Each user can follow and be followed by other profiles. Bjarke Ingels currently has 679k followers and daily publishes pictures, videos, and articles in which they are mentioned, and reposts other people's posts about their architecture. This tool efficiently allows to have daily interaction with a variegated public composed of architects and non-architect. Other similar platforms used by the firm are Facebook and Twitter.

Films
Ingels participated in the production of different films and documentaries. His first experience is the one of "My Playground", by Kaspar Astrup Schröder. The production explores parkour and free running, with much of the action taking place on and around BIG projects. (Adventure Sports TV, 2020)

Nonetheless, he was also part of the documentary film "Genre de Vie", about bicycles, cities, and personal awareness. The film documents urban life empowered by the simplicity of the bicycle (Faithful to the Subject, 2012).

Ingels was profiled in the first season of the Netflix documentary series: "Abstract: The Art of Design," a Netflix original documentary series highlighting artists in the field of design. In his episode, Bjarke Ingels explained his process of design, his philosophy of architecture, and how he wanted to change the world (IMDb, 2017).

Public image
Bjarke Ingels conveys several key messages through his image and public persona. First and foremost, he seeks to portray an approachable and relatable image. He often appears easy-going, with a friendly and down-to-earth demeanor, which communicates that he is accessible to the public, clients, and fellow professionals. His image also reflects his positive outlook, often seen smiling, which aligns with the idea of embracing the future with optimism and innovation.

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[11] Application for smartphones designed by K. Systrom and M. Krieger, available since 2010 for iOS devices and since April 2012 also for Android. In just two years it exceeded twenty-five million users and revolutionized image sharing via the web. In April 2012 M. Zuckerberg announced the purchase of I. by Facebook for one billion dollars and in September of the same year the acquisition was completed for 741 million. In 2021, Instagram surpassed 1 billion active users, and over 500 million daily logins.

Photo by Steve Benisty

(Konigsberg, 2011)

(Ravenscroft, 2021)

Bjarke has successfully been able to enter the "hall of fame" of the starchitect, not by chance, but by applying several strategies. Firstly, he often engages in interviews and participates in public events to present his face to a wide audience. Secondly, he has maximized the use of contemporary platforms that enable him to connect with a much broader public compared to architects of previous generations. Importantly, he refrains from positioning himself in a stance of superiority, not only in terms of physical posture, imagery, and attitude but also in his communication style.

To ensure the sustained operation of his architectural firm, Bjarke Ingels allocates a portion of the company's resources to smaller projects. This approach not only keeps the creative engine running but also allows for the spread of Ingels names among different sectors. By engaging in the design of items such as lamps, tables, sofas, clothing, and accessories, Ingels bridges the gaps between major architectural projects and expands the firm's market presence (Bjarke Ingels Group, s.d.)

Left sidebar legend (top to bottom):
- EXPOSITIONS
- BOOKS
- BRANDING
- FILMS
- GOSSIP
- LECTURES
- INTERVIEWS
- SOCIAL MEDIA
- PUBLIC IMAGE
- BUILDING
- AWARDS

Timeline (right margin): 1800, 1825, 1850, 1875, 1900, 1925, 1950, 1975, 2000, 2025, 2050, 2075, 2100

Diagram labels: EPIPHANY, EXPOSITION, TALENT

TAKEAWAYS

While it may appear that each architect is a unique and exceptional case, a critical analysis of their lives and achievements reveals common paths that have propelled them from being average architects to becoming some of the most renowned professionals globally.
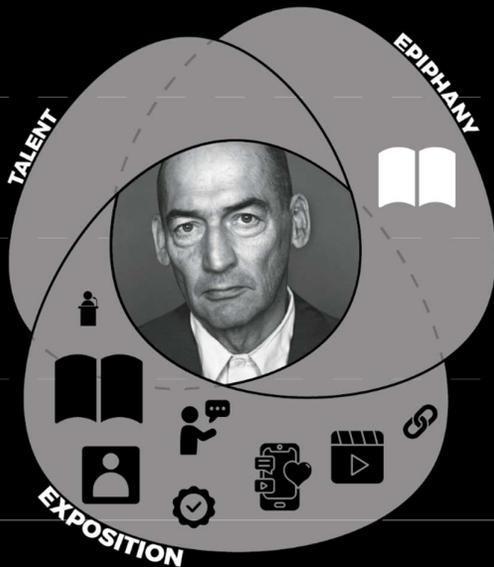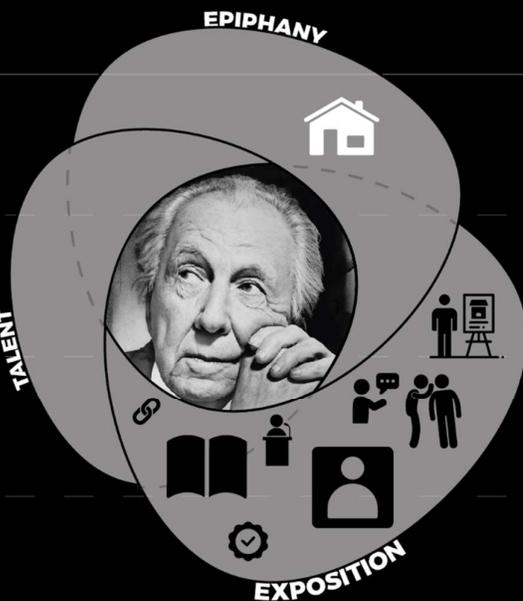
Wright, Gehry, Koolhaas, and Bjarke were inherently gifted and cultivated their expertise by collaborating with seasoned architects. The essence of being an architectural luminary lies in sustained prominence throughout one's career. This requires employing strategies tailored to individual attitudes, talents, and contemporary tools.

Koolhaas' protégé, Ingel, achieved success through exceptional skills in public relations and communication. His adept use of both traditional and non-traditional media ensured global awareness of his work and persona.

IV. METHODS OF DESIGN

Having established an understood the organizational structure and values of the firm, as well as the societal impact of Bjarke Ingels' contributions, the next objective is to unravel the mechanisms behind the firm's remarkable success. A crucial aspect to analyze in this regard is the path taken by projects, especially in term of evolution of ideas. This section of research draws heavily on theories put forth by Rittel, McLuhan, Darwin, and Mendel, synthesizing insights from both primary and secondary sources. Additionally, Ingels' own elucidation of his methodologies in publications such as "Yes is More" and various interviews provides valuable context.

Further, it becomes imperative to delve into the methodologies employed in project development, considering the diverse array of tools at architects' disposal. This exploration involves an assessment of the potential and limitations of each tool. To enrich this analysis, a comparative examination of BIG's approach with other notable architectural firms is undertaken.

The insights presented in this section are derived from various sources, including Christian Gänshirt's "Tools for Ideas: An Introduction to Architectural Design," official architect websites, scholarly papers, and articles. The consideration of BIG's tool utilization is informed by a synthesis of the author's direct experience within the firm and the wealth of information available in academic literature and publications.

Having grasped the significance of the Bjarke Ingels Group within the architectural realm, it becomes imperative to delve into methodologies employed by the studio to achieve such noteworthy outcomes.

To do so, a concise overview of the design process theory will be presented, leading to an in-depth analysis and comprehension of the tools that architects utilize in conceptualizing and actualizing ideas. This examination will be fortified through a comparative study of the methodologies and approaches of various architects, ultimately aiming to elucidate the distinctive qualities and flaws of Bjarke Ingels's practice.

PROJECT PATH

Horst Rittel (1930–1990), a German design theorist and professor of design and urban planning, defined the process of architecture as an "iterative process of generating variety and reducing variety" (Rittel, Ausgewählte Schriften zu Theorie und Methodik, 1992).

In other words, architectural production is made up of an initial stage characterized by the development of a wide range of design options. A moment of freedom and exploration, during which the architect is allowed to think creatively and experiment with different solutions, materialities, and ideas.

Follows a phase of assessment through which options are filtered and selected based on criteria such as functionality, aesthetics, sustainability, and feasibility. Nonetheless, technical constraints, budget limitations, and other practical aspects will naturally eliminate options. Feedback received by the different parties involved in the process could also help to define the preferred solution among the ones that have passed the first round of technical selection.

According to Ritter, the project paths can generally be grouped into four categories. The first and simpler representation (1) is the linear sequence. According to Rittel, this scheme describes how a "great master" would work, someone who already knows in advance what is to be done, and essentially no longer has to involve himself in the design adventure. He has already solved comparable design problems successfully and can simply work his way along a tried and tested design path step by step.

On the other hand, Rittel's "testing or scanning path" (2) describes an approach in which the first solution that happens to occur to the designer is used as an attempt to master a design problem. If further work shows that this approach is not going to produce the desired result, then the designer goes back to the beginning and tries a different route to the solution.

The third methodology, characterized by the development of several alternatives, is named by Rittel "systematic production" (3). In this case, the selection of the best option happens using an "evaluation filter" that covers all relevant aspects of the design.

The process could also be done by forming alternatives in a "multi-step process" (4). Therefore, from the initial idea several options are produced and then discarded from the outset. To efficiently cut down the variety of possible design solutions to a sensible number, Rittel recommends working with constraints and self-imposed limitations.
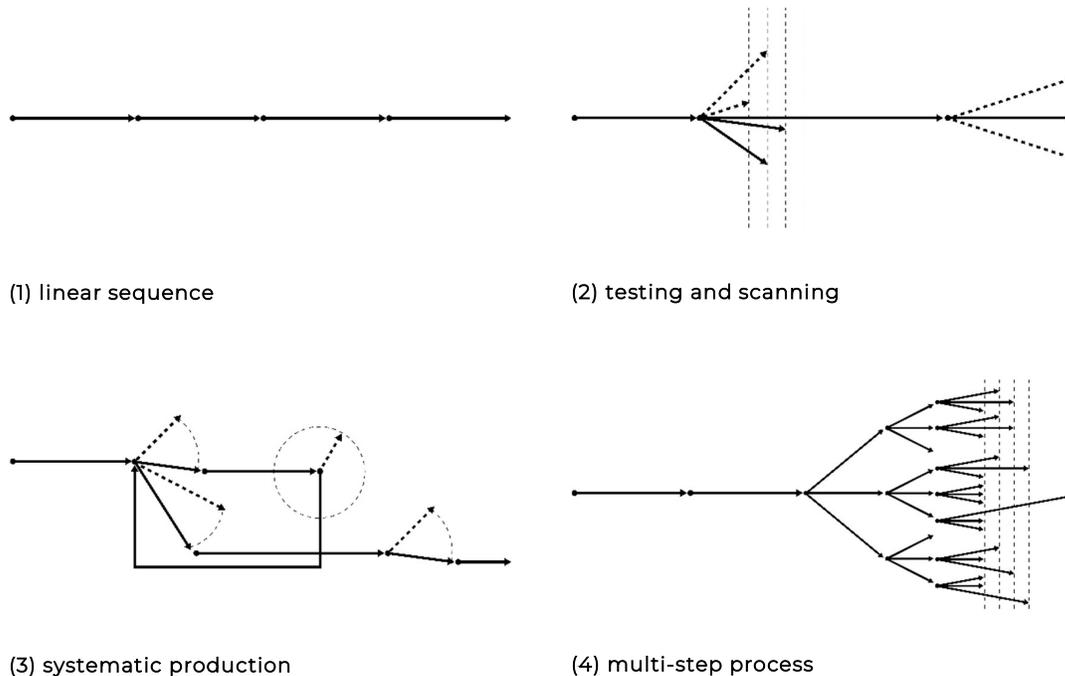

(1) linear sequence   (2) testing and scanning

(3) systematic production   (4) multi-step process

Figure 30 Horst Rittel: design processes of generating variety and reducing variety, (Rittel, Ausgewählte Schriften zu Theorie und Methodik, 1992)

Most certainly, Rittel's project path representation is an efficient picture of the design process, but still, it is a great simplification of how things work in reality.

For this reason, other approaches must be introduced and intersected to better grasp the complexity of the process.

In this scenario, it seems productive to rethink Marshall McLuhan's "spiral thinking" theories, using this explicative representation to explain the process of architectural production. The Canadian communication theorist believed that philosophers' thoughts and artists' creative process (In our case architects' generation process), could be represented by a spiral. This line represents a going back and forth in one dimension in one plane yet advancing in another dimension: time (Oldenhof & Logan, 2017).

He describes the process as follows:

> "All these subsist together, act and react upon one another at the same time. [...] The entire message is then traced and retraced, repeatedly, on the rounds of a concentric spiral with seeming redundancy. [...] But the concentric with its endless intersection of planes is necessary for insight. In fact, it is the technique

of insight, that is necessary for studying media, since no medium has its meaning or existence alone, but only in constant interplay with other media."
(McLuhan, 1964)

McLuhan highlights the simultaneous coexistence and interactivity of various media which, for its repetitive nature, is represented by a spiral. The apparent redundancy is not wasteful but serves as a method of understanding the complex relationships and influences among different media. This complexity is crucial as it entails transformations not only in the reality we live in but also in our way of perceiving and understanding it.
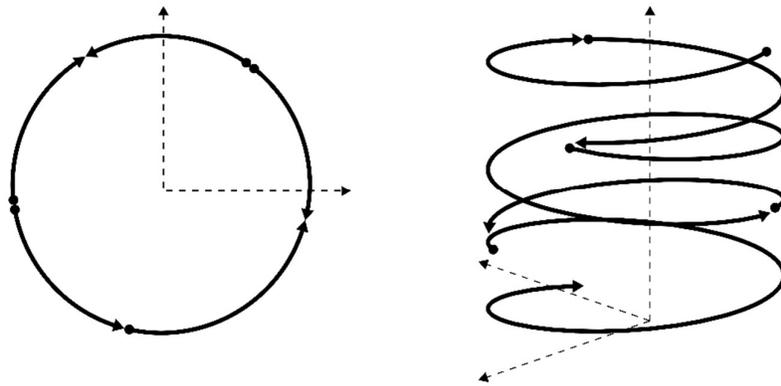

Figure 31 Application of McLuhan's "spiral thinking" architectural design processes, (diagram realized by the author)

But still, it could be argued that the more holistic, innovative, or personal a design is, the less it can be predetermined. Considering this last standpoint, both Rittel and McLuhan's explanations, appear to be idealized positions and abstract half-truths that fall short of connecting with the fundamentals of design. There are crucial moments when the design process does not move in a straight line or from the large to the small, nor in a spiral, but simultaneously, or not infrequently in unpredictable, chaotic quantum leaps.

Typically, various design factors converge in each decision-making process, requiring a determination of what is more or less suitable from the selected perspective—whether slightly superior or inferior, marginally more aesthetic or less appealing. Additionally, consideration is given to the potential ramifications of such decisions on other facets of the design.

Numerous attempts have been made at systematizing and rationalizing the evaluation of projects and buildings. However, determining the factors to be encompassed in such an assessment and establishing the appropriate weighting for various aspects cannot be succinctly quantified in terms of points or percentages. The choice of the standards

to be followed and of the arguments that will ultimately carry the greatest force in reaching a decision is unique and therefore must be specifically evaluated for each case.

The low predetermination of process paths and strategic approaches is a natural characteristic of the design process because of the complexity of the challenge. This kind of dilemma falls into Rittel's category of "wicked" problems, which are characterized by weakly determined processes that can be fixed only vaguely in advance. They can be described in retrospect, but this description either remains general and imprecise or becomes so specialized and detailed, that it is difficult to apply to other problems. This is not repeatable with a guarantee of success. In other words, wicked problems are problems with many interdependent factors making them seem impossible to solve. Because the variables are frequently ill-defined, incomplete, and dynamic, tackling wicked problems calls for creative problem-solving techniques like design thinking as well as a thorough comprehension of all relevant parties. An example of a wicked problem could be climate change which is a multifaceted problem involving environmental, social, economic, and political dimensions to be solved requires global cooperation and consensus, but countries, industries, and individuals often have conflicting interests. Developing a solution that will satisfy all the parties involved is impossible.

In summarizing the challenges and potential of wicked problems, it can be asserted that these issues lack a definitive formula, a stopping rule to determine solution finality and adherence to true-or-false distinctions. Solutions are instead categorized as good or bad, with no immediate means of testing. Addressing wicked problems is a one-shot operation, devoid of trial-and-error learning opportunities, making each attempt significantly consequential. These problems defy a predetermined number of potential solutions, each being essentially unique and symptomatic of other issues. Multiple explanations exist due to varying perspectives, necessitating planners and designers to bear full responsibility for their actions without the luxury of being wrong (Rittel, Dilemmas in a General Theory of Planning, 1973).

Considering this, it could be concluded that it is impossible to define a unique pathway that describes architectural development, but all the representation most likely coexists or even overlap during the design process.

Nonetheless, each architect and studio has a general approach that can be studied and compared. Follows an in-depth analysis of Bjarke Ingels's approach.

BIG
Bjarke Ingels explains his design process in his first book and manifesto "Yes is more". The architect highlights the similarities between his approach and Darwin's evolutionary theories, arguing that his tree of evolution might be a diagram of BIG's way of working.

The process of design in BIG starts with a great number of options and ideas. Only some of them are developed creating further and further modifications until reaching the final result.

The process of selection and development can be linked to natural selection processes: the primary driver of evolution. The most favorable features within each design persist and pass on their positive attributes to subsequent iterations. Consequently, beneficial characteristics become more prevalent, while less favorable ones gradually diminish. Through this selective process, the evolving designs acquire an enhanced capacity for adaptation (Futuyma, 2006).

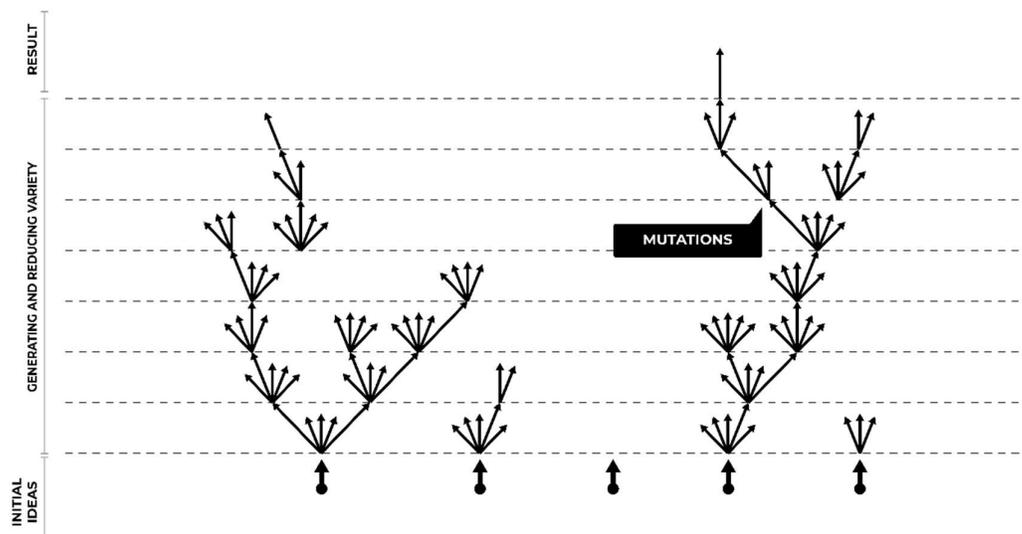This approach could easily be compared to Rittel's multi-step processes.

Figura 2 Ritttel's evolutionary diagram, a diagram realized by the author

While the Darwinian theories perfectly describe how the natural evolution of species happens, it is again not enough to represent the project path. For this reason, Ingels introduces further concepts to better explain how great architectures are born.

The first concept to be introduced in this scenario is the one of iteration. According to Bjarke, "The more iterations and reiterations a project goes through, the richer it will get, and the more refinement, and the more things will be tested (CLOG, 2011)." With iteration it means taking a step backward which, keeping in mind McLuhan's "spiral thinking", is not to be perceived as a negative process, but instead, as an opportunity to see things from a different perspective.
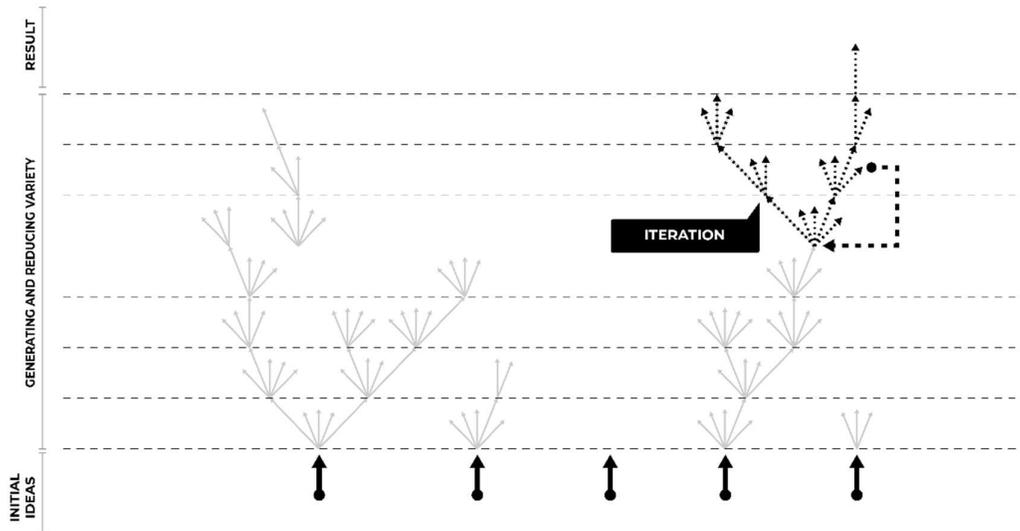
Figura 3 BIG's iteration process, diagram realized by the author

A further important process mentioned by the architect is crossbreeding (Bjarke Ingels Group, 2009). The scientist Gregor Mendel first introduced this concept to describe the theories of the evolution of genetics. While mutations are spontaneous, heritable changes in the DNA sequence of an organism that can occur naturally due to errors in DNA replication (the foundation of the evolutionary theory of Darwin), crossbreeding involves mating individuals from different populations, varieties, or species, combining desirable traits from different genetic backgrounds to produce offspring with a mix of characteristics, promoting genetic recombination.

There is a further distinction that can be made between "crossbreeding" and "interbreeding". The main principle is the same but, while the first refers to the mating or reproduction between individuals of the same species or closely related species, the second specifically involves the mating of individuals from different breeds.

All these principles can easily be applied in the architectural field and especially in BIG, where Mendel and Darwin meet.
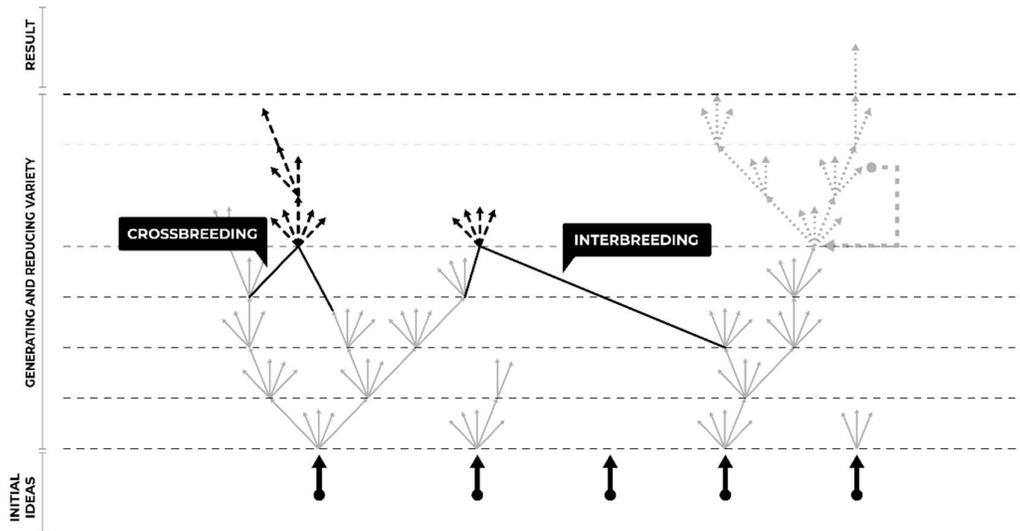
Figura 4 Big's crossbreeding and interbreeding, diagram realized by the author

Another phenomenon happening during BIG's project evolution is the one of prototipization.

At the base of the concept, which has already been studied in the first chapter, is the principle that powerful design ideas can be shaped in the process according to their location by gaining adaptation ability. Therefore, it is possible to develop prototypes that can be used multiple times thanks to their capacity to adapt to different contexts and situations.

In this sense, BIG has become an architectural laboratory that develops ideas by producing species that develop prototypes. Supporting BIG's inclination to proliferate in this manner, Ingels references Le Corbusier's 'Vers Une Architecture (1923)', underscoring the generation of typologies. Affirming this continuity with Le Corbusier asserts that various architects can build upon and utilize the established typology rather than initiating projects from the beginning (Ingel, 2012).

This situation is evaluated in BIG architecture as follows. Every idea spoken at project design meetings has value. If this did not work in the context of the project, there may be an answer to a different question from another client, culture, or time frame (Bjarke Ingels Group, 2009). A notable example of this approach is the "People's Building" project. The structure was initially designed as a hotel in Sweden, but as it did not win the competition, the whole idea has been reused for designing a tower in Shanghai, of course after a process of adaptation of the structure in scale.

The fact that ideas can be extracted by their initial context to be reused in a completely different context and time proves that, until reaching a certain level designing concepts, forms, and ornaments work independently of the program and context (Lægring, 2017).
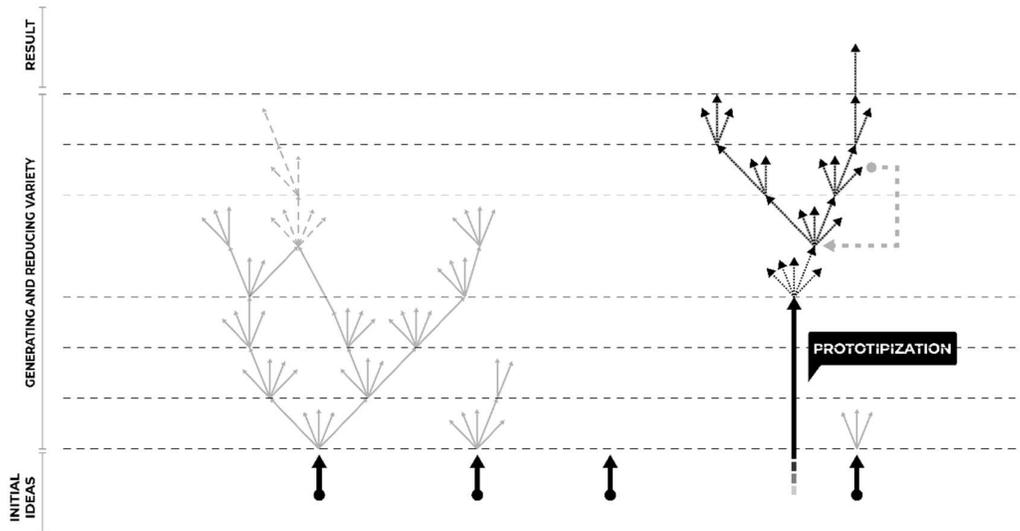
Figura 5 BIG' prototipization process, diagram realized by the author

An interesting aspect to take into consideration is the consequence that this approach has on the possible involvement of customers. The company usually values the input of the clients and tries to include them in the process as much as possible, therefore using their opinions to create new options or to develop existing ones. This approach aligns with Bjarke's ideas of architects as "midwives of the continuous birth of architectural species shaped by the countless criteria of multiple interests" (Bjarke Ingels Group, 2009). Nonetheless, it is not unusual to present to the client multiple options to leave him the final decision over the winning design.

GENERATION TOOLS

The complexity of the design process and the impossibility of defining a certain path to obtain the best result, define a situation in which each challenge will need a unique approach and a strategy of development. What all the paths have in common is the need to develop multiple options to experiment and finally select the best design. The phase of variation introduction is extremely relevant but exceedingly difficult to develop, as the chances of getting stuck in the same concept and thoughts are extremely high. While it is partially true that this process spontaneously happens in the architect's mind, it is even more important to stimulate the imagination with extended use of generation tools, which will help to explore new points of view, induce the process of abstraction, and verify the validity of the proposal. Most of the tools that are used to generate ideas, can subsequently become efficient communication media, finally determining the success of the project.

Different problem requires different solutions, but each architect or studio usually defines a general methodology to approach the issues, which can be adapted and applied in most situations.

The importance of the different uses that architects make of generation tools comes from the fact that they do not only shape our concrete actions but also our thinking, as Flusser clearly expressed with his quote:

"Tools change our behavior, and thus our thinking, feeling, and wanting. They are experience models." (Flusser, 1989).

Traditional design tools such as language, sketches, drawings, physical models, perspective, and diagrams will be analyzed together with the most recent tools such as software and artificial intelligence. More thoroughly, the discussion will focus on how these instruments can be exploited in the three main phases of the design process that have been previously analyzed: variation generation, selection, development, and finally, communication.

The study will be enriched with several examples of architect's methodologies, to finally compare what was found with Bjarke Ingels' approach. The choice of architects to be studied is justified based on their significant contributions to the field, their impact on architectural theory or practice, and the relevance of their methodologies to the research topic, although the comparison could be enriched with the introduction of several other great examples.

LANGUAGE

The crucial role that spoken and written language plays in the everyday practice of architects is indisputable. Verbal communication is used in every aspect of the development of the project: from the relationship with the clients to the discussions and conversations during meetings, the negotiations needed to put together all the different parties involved in the project, to the presentation of the project itself to a jury or the public. In this context, oratory skills can make the difference between success and failure.

What could seem unusual instead is to consider language as a generative design tool. Surprisingly, this instrument hides spectacular potential which could be incisive in the architectural process.

The first, and most powerful capability of language is the one of widening or narrowing perspective. When articulating ideas and concepts through written or oral communication, it implies that the matter has been approached from a distinct perspective. This will inevitably shape the evolution of the proposed solution.

This peculiarity could be exploited by architects in numerous ways. For instance, the simple exercise of rephrasing a sentence has the potential to profoundly alter its interpretation, steering the reader's thoughts in directions markedly different from the

originally intended meaning. The judicious utilization of linguistic capabilities can yield unforeseen outcomes.

A practical application of this strategy could be the interpretation of the brief. A brief is a written document that might be anything from a single page to a multiple-volume set of documents, that defines the challenges, opportunities, constraints, parameters, and goals of a project. (Makstutis, 2010). Thanks to a simple reformulation of the design expectation, it is possible to unveil new aspects of the situation. There is a striking difference between building a "house" or "constructing a machine à habiter."

Another aspect in which language is essential is the development and the spread of new concepts. As well pictured in the book "1984[12]" by George Orwell, the absence of words directly influences the possibility of developing thoughts. Designing often demands things or connections to be named for which everyday language has no term for. It is therefore essential to be able to title those new things. To respond to the issue, architects often make use of neologism, portmanteaus, and metaphors. Using these instruments, professionals can express new concepts, and efficiently communicate their thoughts and ideas to other people. The importance of this exercise lies in the fact that once a concept has been formulated, then it can be "worked on" with another design tool and subjected to criticism. This entails shifting viewpoints once more, separating oneself from the appealing picture of what has been constructed, and casting doubt on it.

One example of neologism in the architecture field could be the stark style of functionalist architecture now commonly known as "brutalism." This current once did not have a name the term emerged around the second half of the 20th century, as a distortion of the word 'beton brut" which in French is concrete (McLaughlin, 2023) (McLaughlin, 2023). Many believe that the word was used for the first time in 1949 to describe the brick residential structure Villa Göth by Swedish architect Hans Asplund. Nonetheless, the term gained popularity because of a 1955 essay titled "The New Brutalism" that British architectural critic Reyner Banham authored for Architectural Review.

Nonetheless, new concepts can also be expressed with portmanteaus. This figure of speech consists of combining or merging multiple existing to create new connections and concepts. An example in the architecture field could be the one of "Blobitecture", which derived from the fusion the word "blob" and "architecture," clearly with the intent

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[12] "1984" is dystopian novel by George Orwell, well express the crucial role of language in the development of ideas and concepts. The book explains how the ruling party of the Dystopian society of Oceania, where able to control population's thought through the introduction of "Newspeak", a new language designed to slowly eliminate words used to express dissent, and consequently eliminating the concept of dissent, elevating language "from a simple carrier of meaning to an active participant in the process of meaning formation". (Shadi, 2018)

of defining a new style that emerged in the 20th century characterized by fluid, organic, and amorphous architectural forms.

Metaphors are one of the most used and powerful tools to express newborn concepts. This figure of speech uses a word or phrase which usually refers to one kind of object or idea, in an atypical context to suggest a likeness or analogy between them. Therefore, new concepts are understood based on a previously unnoticed similarity between the two areas. But it needs this tension between similarity and difference to open new and surprising perspectives and create the power of suggestion which is the key feature of innovative metaphors. Citing another time Le Corbusier, in the famous quote "machine à habiter," combines the spheres of housing and industry in his "machine à habiter" metaphor, thus suggesting that housing can be designed rationally and effectively on the same basis as a industrial production plant.

A further potential of words is the capability to logically organize ideas and therefore clarify them, through the process of abstractions that take place when ideas are translated into oral or written form. This activity often triggers cognitive processes that sometimes surprise, because architects are compelled to make themselves aware of circumstances that they would not have considered otherwise. The logical organization of thoughts and their formulation in written words also define a first set of concepts that could be later analyzed, criticized, developed, and manipulated as many times as needed. This potential result is extremely useful in the process of variation reduction, as a clarifying idea will increase the awareness of the architect about the positive and negative aspects of each option.

A wise use of language can help architects to untangle the nonlinear process of design. Starting from the initial stages, thanks to the capability of language to introduce new points of view, professionals can increase variation. The clearness and rationality allow to better develop and filter options. To conclude, great communication skills together with wise use of figures of speech can help to better communicate the design ideas.

Oscar Niemeyer's incredible use of language will be analyzed and then compared to BIG's approach.

Oscar Niemeyer
Oscar Niemeyer (1907 –2012), is one of the most relevant architects in the Brazilian scenario, nonetheless considered to be a key figure in the development of modern architecture. He has been extensively studied both because of his remarkable success and for his peculiar design methodology which was strongly relying on the use of sketches and text. His graphic and synthetic talent was conveyed in incredible doodles accompanied by an explanatory text, which ultimately allowed him to express ideas clearly.

Delving further into the architect's methodology, its approach consists of two primary phases. In the initial stage, the architect actively seeks ideas, while the subsequent

phase involves the development of one among the identified options. The conception of an idea commences with an initial mental brainstorming session, comprehensively addressing all problems related to the project. Following this, he engages in the process of drawing until the final design distinguishes itself among numerous iterations. (Hiroki & Rozestraten, 2019).

If the preferred option meets all technical requirements, the architect proceeds to generate a written text. The purpose of this text is to scrutinize the validity of the design. If he can substantiate the design with ample and well-founded arguments, it signifies that the project serves as a commendable example of architecture and, consequently, is deemed worthy of construction.

Niemeyer is actively exploiting the potential of language to develop ideas, using the written text to change points of view and to verify the quality of his work.

BIG
Bjarke Ingels does not explicitly valid language as a generation tool. The written or oral production is not actively used to develop ideas, to change points of view, or to verify the validity of an architecture. But still, the way the company uses language influences its production.

One of the most affecting habits in BIG is to reduce the written text to its essential. This choice, which could be defined as a "passive approach," serves to prevent situations where the architect becomes entrenched in a singular perspective. In essence, it is a tactic employed to steer clear of mental rigidity.

The application of this tactic is particularly evident in the elaboration that each design team makes of the initial brief. The company methodology includes a further elaboration of the brief at the beginning of every design challenge, which consists of summarizing it in a presentation. In the process, the amount of written text is first reduced as much as possible and translated into graphical information where possible. Consequently, architects will remain uninfluenced by the perspectives of both the client and the presentation producer, enabling them to freely experiment with their designs.

The same approach is applied in all internal communications: the text is reduced to small titles and subtitles, and when it is not possible to avoid it, a bubble text is introduced. This led to a positive situation in which each reader could interpret and see different things out of the same slide, facilitating the process of variation production and implementation of the best viable option.

If during the design process text power derives from his absence, when it comes to spreading innovative ideas and concepts, language strategies are actively used by Bjarke Ingels.

The use of neologism, portmanteaus, and metaphors extends to every aspect of the design process. The most known concept developed by Ingels is the one of "hedonistic

sustainability", thoroughly explained in the first chapter. It is pertinent to observe that the concept has been articulated through the combination of two existing words, thereby engendering a novel meaning. Employing commonly recognized terms aids the audience in promptly comprehending the new concept, thereby accelerating the assimilation of the idea by the public. Another example of a concept introduced by Ingels is the one of "court-scraper" (TED, 2009). With this portmanteau, the architect is efficiently defining a new typology of architecture where the New York high-rise and the European courthouse blend.

Great attention is also put into the choice of the project name. BIG often uses explicative titles which alone can evoke the most relevant concepts behind the design. An example is the "Mountain," the "Twist," but also the "Spiral," "CopenHill," and many others.

In the Bjarke Ingels offices, the power of language is understood and exploited, both during the design process and for communication scope. A critical aspect of the company approach is the fact that text is not used actively during the design process. Therefore, the potential of abstraction and reformulation is not taken into consideration.

SKETCHES
Dating back to ancient civilizations, architects have relied on the art of sketching to manifest their visions and ideas. This enduring tradition not only underscores the historical significance of sketches but also highlights their indissoluble bond with architectural creativity. From the earliest architectural marvels to contemporary masterpieces, the use of handmade drawings has persisted, evolving as a timeless and indispensable tool that professionals employ in shaping the built environment.

Throughout their lifetimes, architects of the magnitude of Norman Foster or Álvaro Siza filled up countless sketchbooks with personal scribbles and jottings, exploiting them to flesh out their ideas, before delegating the creation of accurate drawings, models, and computations to associates or experts. Due to the amazing capability of sketches to represent and express ideas, they are exploited throughout the whole design process: from the preliminary stages, to make the first analysis and develop the initial ideas; during meetings, to better express concepts and discuss, and in the final stages, if the sketch becomes a descriptive tool.

Like language, drawings are an efficacious way to put oneself outside of the topic, see the issue from a different angle, and clarify thoughts. Consequently, the endemic mental process of architectural design, made up of a moment of review, modifications, and interaction, will thus become simpler. Nevertheless, the tool's simplicity compels the architect to deconstruct the concepts down to their most basic form.

Rapidity, impreciseness, and immediacy are three crucial characteristics of the instrument that contribute to its incredible versatility. Quickness enables the immediate fixation of an idea. The speed at which drawings are created undoubtedly contributes to their impreciseness, which is also an asset, since it leaves room for

interpretation and ambiguity, encouraging the architect to generate new concepts on its own. Finally, conciseness allows to rapidly understand concepts and evaluate them.

Sketches become the architect's lens to "suddenly see things shining out through several layers of tracing paper [...] things one had not drawn, they simply came about [...]" (Behnisch, 1996).

The role of sketches in the project development does not end when the optimal option has been identified but continues throughout the entire process. Fast sketches are used during each meeting to better explain ideas, issues, or potentials. On the other hand, as a verification tool sketches are not the best option due to their impreciseness which could lead to wrong evaluations. When it comes to communication instead, handmade drawings are considered strong assets.

Digitalizing the procedure is quite challenging due to the nature of this technique. When it comes to making exact drawings, computers are effective, but when it comes to being quick and expressive, they are not.

The different approaches of Frenk Gehry, Bernard Tschumi, and BIG will be compared.

Frank Gehry
Frank Gehry's incredible sketch technique, commonly known as "self-twisting uninterrupted line", is a crucial aspect of the architect's design process. Through this strategy, Gehry can free his imagination and consequently develop innovative architectural solutions.

The sketch process happens through a variation of intensity and rhythm of his hand gestures, resulting in an explicative "lineamenta[13]." Therefore, Gehry uses sketches not only as a mere medium for recording mental images but also as a dynamic and active tool to develop his thinking and design solutions. The fact that sketches are used in every stage of the design process, proves the higher role that the tool plays in Gehry's methodology.

What results being the most successful aspect of his approach, is not the realization of the drawing itself, but the act and the experience of drawing, which allow him to process and develop ideas until obtaining the most satisfactory result. The process' probability of success is enhanced by the strategy of visualizing various drawings of the same building on a single sheet of paper, allowing the architect to fully comprehend the potential impacts of each decision on the architectural result, considering several aspects contemporarily. Nonetheless, this exercise elevates the brainstorming process into an instrument that empowers the architect to explore boundaries beyond traditional, fixed forms of representation. It also demonstrates Gehry's concern for the

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[13] According to Leon Battista Alberti, architecture consists of 'lineamenta: "lines", and 'materiale' (construction materials). For him 'lineamenta' referred to the precise and correct outline, conceived in the mind, made up of lines and angles, perfected in the learned intellect and imagination' (Alberti, 1988)

interrelationships between the project's many components and his desire to create a comprehensive understanding of every facet of the project.

Sketches are a perfect representation of the architect's mind: in continuous evolutions. They could be considered as a snapshot of his imagination and mental process, where each new sketch is a step toward the concretization of his design ideas.

There is successful a neologism that could help to better grasp the role of sketches in the architectural methodology: 'drawdling' (Maclagan, 2014). David Maclagan has introduced the word to describe simple drawings that are repetitively reiterated and transformed until finding a satisfying solution.

The role of sketches in Gehry's practice is decisive. With one tool the architect can create and then reduce variety. With the continuous creation of different sketches and their comparison, stronger and more functional ideas will convey and become evident in the architect's mind.

Ultimately, sketches can serve as a communicative instrument, effectively conveying the core concepts underpinning the design proposal. In this instance, they not only

contribute to communication but also assume the role of a distinctive hallmark for the studio.

Figure 32 Frank Gehry, 'drawdlings' for the Jay Chiat Residence, Sagaponeck, New York, 1986 © Frank O. Gehry. Frank Gehry papers, Series I: Architectural Projects, Getty Research Institute, Los Angeles, CA. Digital image courtesy of the Getty Research Institute Digital Collections.

Bernard Tschumi

Bernard Tschumi, widely recognized as one of today's foremost architects, makes extensive use of sketches, which he refers to as "notation," highlighting his rapid and abstract approach to this tool.

While, in this sense, Tschumi and Gehry are aligned, their ideas are extremely far when it comes to the modalities of line-making. While the former's goal is to use the least number of lines possible, the latter makes use of long self-twisting uninterrupted lines to free his imagination. Therefore, while Tschumi's concern is mostly clarity, Gehry aims to grasp the final form during the sketches' genesis process (Tschumi B. , 2010). In other words, Tschumi uses sketches to freeze ideas in time. Clarity is essential as these ideas will then be compared and further studied through an interesting methodology which consists of varying or fixing different variables to see how various aspects affect the result. This process not only allows to verify the validity of the ideas already on the table

but also to find unseen practical solutions. This process is made through a comparative study where all the sketches are organized in a rigid grid, therefore allowing to easily understand the pros and cons of each configuration for finally assessing which is the best option.

Also for Tschumi, sketches play a decisive role during the design process. Due to his capability of intentionally using sketches, not only as an instrument to clearly express his thoughts but also to compare and experiment with ideas and concepts, the architect can exploit this tool at best.
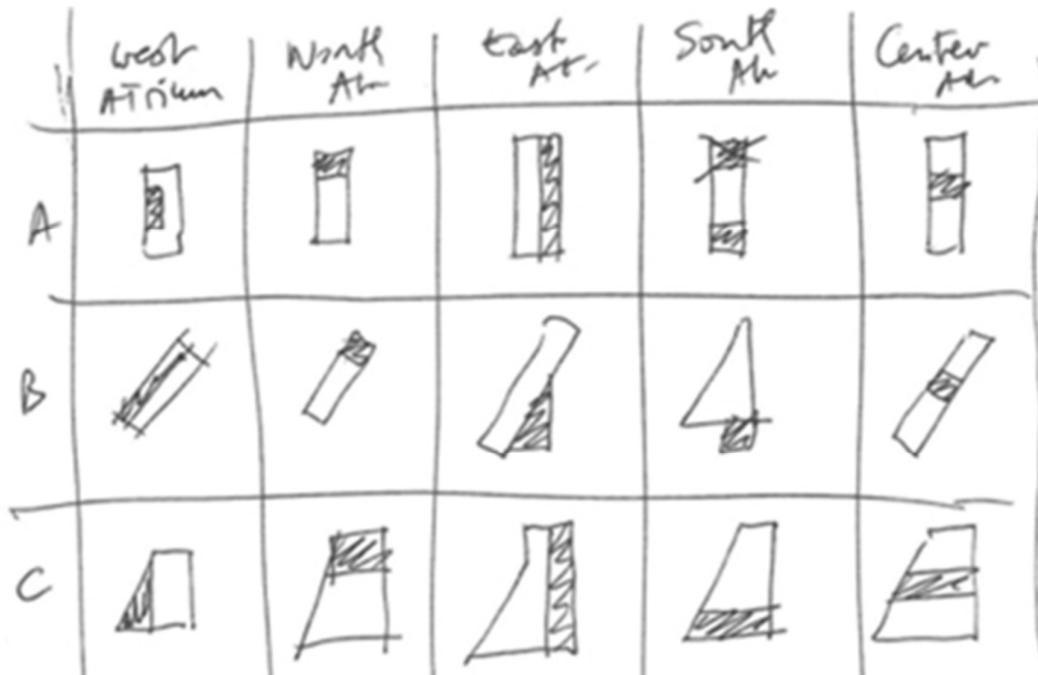

Figure 33 Bernard Tschumi, Richard E. Lindner Athletics Center, University of Cincinnati OH (2001-06). Comparative studies of alternative configurations of the envelope regarding the atrium's permutation. Credits: Bernard Tschumi Architects.

BIG
Bjarke Ingels's passion for cartoons seems contradictory to the fact that none of his sketches have been published nor used to present projects. This proves the little use that the architect makes of the tool, or at least his poor consideration of sketches as a communicative tool.

This situation is caused by the strong sculptural approach that characterizes the company. In the initial phases of the project, the starchitect develops an incredible amount of massing options. Then, a selection of massing undergoes a process of interpolation, variation, and discarding, until reaching the optimal shape, which is the one that most efficiently responds to the challenge of the design process. As the project is directly approached three-dimensionally, it seems natural that 3D tools, such as modeling software of physical models, are used to develop them. While this could seem

a reasonable approach, it leads to the loss of the most important aspects of sketches: immediacy and impreciseness. Consequently, this causes a lower efficiency and increases time loss.

The use of sketches is present during internal meetings where they are used to have deeper and clearer conversations among the people involved in the projects.

BIG approach to sketches is extremely unsuccessful. The tool is not exploited at its best therefore affecting the entire process of design.

Figure 34 Bjarke Ingels's sketch

DRAWINGS

While some of the tools analyzed exhibit varying degrees of utilization depending on the unique approach of each architect, there are specific instruments deemed obligatory. Drawings, construed as meticulous 2D representations of the project, unquestionably fall into this category.

This tool serves as an imperative means for verifying the project's functionality and validity. Moreover, drawings function as a vital mode of communication, enabling the effective conveyance of the project to other stakeholders who require a comprehensive understanding of the proposal.

The potential of drawings lies in their geometrical precision which makes it possible to check the proportions and the functionality of the design. This characteristic is the main reason drawings are an inevitable design tool for every architect.

Even if it could seem counterintuitive, especially given their supposed completeness and preciseness, drawings undergo the same process of abstraction and reduction that characterizes the process of translating concepts in written and oral language or a sketch. This is because ideas need to be simplified, ordered, and checked for correctness.

Given this situation, it is evident that the role of this tool becomes essential in the phase of project development when ideas need to be verified and developed in detail.

Nonetheless, drawings hold a paramount significance as a communicative tool, acting as a universal language that transcends verbal and cultural barriers. These meticulously crafted drawings serve as a precise and standardized means of conveying complex architectural ideas, designs, and specifications. Architects rely on technical drawings to articulate their vision with precision, providing detailed information on spatial arrangements, dimensions, material specifications, and construction methods. This visual language is indispensable in facilitating effective communication not only within the design team but also with various stakeholders, including builders, engineers, and clients. By serving as a shared reference point, technical drawings ensure a mutual understanding of the design intent, thereby minimizing the potential for misinterpretation and fostering a collaborative and streamlined construction process.

Despite its immense potential, technical drawings also present certain limitations. The foremost and conspicuous constraint lies in the inherent compromise of the project's tridimensionality. An impressive two-dimensional drawing may not translate seamlessly when brought into physical existence. Drawings, by nature, exist in a flat dimension, whereas reality unfolds within a three-dimensional space. Grasping spatial relationships solely through drawings poses a challenging endeavor. It is only when architecture is conceived as a three-dimensional entity that it can be accurately represented without distortion in ground plans, elevations, and sections. The transition from the two-dimensional representation to the three-dimensional reality requires a thoughtful and meticulous approach to ensure a faithful translation of the envisioned design.

Moreover, while technical drawings are indispensable tools, there exists an inherent risk of oversimplification that can compromise the fidelity of representation. The reduction of a complex three-dimensional structure into two-dimensional drawings may inadvertently lead to a loss of nuance and detail. In striving for clarity and simplicity, essential intricacies may be inadvertently overlooked or inadequately communicated. This oversimplification can result in a representation that fails to capture the richness and subtleties of the intended design.

Drawing are essential tool that allows to develop ideas and communicate efficiently. They are exploited in every studio without exception and as they are a common language.

Given this background, the comparative analysis will not be necessary.

PHYSICAL MODEL

The use of physical models in architecture dates back to ancient civilizations, marking an enduring tradition that spans centuries. From the maquettes of ancient Egyptians and Greeks to the intricate models crafted during the Renaissance, physical models have served as indispensable tools for architects throughout history.

Their historical relevance is a direct consequence of physical models' capability to deal with the tridimensionality of space. For this reason, they are considered one of the most efficient architectural tools.

Models can have different uses depending on the stage of the design process and on the goal of the model itself. In the initial phases, it can become a tool to understand the context, to experiment with different massing, or to start understanding the structure of a proposal. Models are extremely helpful in this stage since they can spark the imagination far more than computer models can. Errors and misunderstandings give rise to new forms and opportunities that unleash unexpected events. Errors frequently result in discoveries and novel ideas. When an accidental spill occurs on the model, or when items are inadvertently moved by passing people, an unexpected viewpoint may surface and an entirely new method of approaching the issue may be developed.
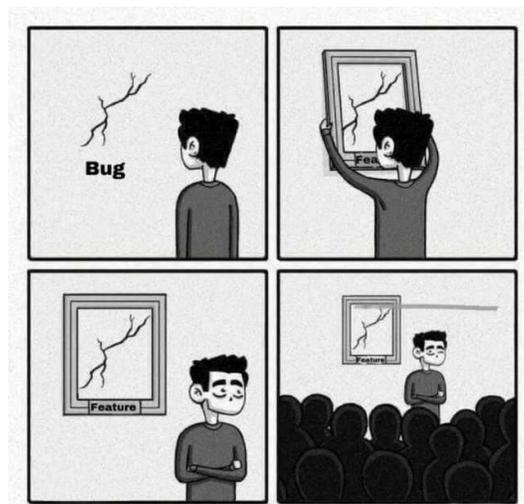

Figure 35 Meme about the role of mistakes in the architectural process

They also play a crucial role in the phase of development as they allow one to visualize and consequently make choices.

In later phases instead, they could become an instrument to persuade and convince the client about the validity of the design proposal, like a miniature version of the completed building.

Different goals correspond to different scales, techniques, and materials. The first study models need less precision, and their goal is to create a general picture, therefore they will have a small scale. On the opposite when dealing with development, the scale could increase until reaching the 1:1 scale, or more.

In the same way, while a study model must be flexible, simple, fast to assemble, and cheap, a final model must be extremely precise, and realistic therefore slower to assemble and more expensive.

It is essential to keep in mind that, besides the apparent closeness to reality, models are still the result of a reduction and abstraction process that exponentially grows with the change of scale. They therefore are a distortion of reality and that must be taken into consideration.

Both Frei Otto and Renzo Piano expressed their strong attachment to physical models as design tools, highlighting the crucial role that they play in the design process. They will therefore be analysed and compared to BIG.

Frei Otto
Frei Otto (1925-2005), a pioneer of modern, lightweight, tent-like structures, made extensive use of physical models as a design tool.

As the architect was designing complex structures way before the introduction of digital modeling, physical models were the main instrument to define volumes and shapes with an efficient structure.

Soap film models, hanging chain models, tensile fabric models, inflatable forms, or cable nets, were all materials used to explore the space. Throughout a process of iteration, models can become overly complex analytical tools, and each model technique could help to analyze different structural options: the soap film helps to define minimal surface for tensile membranes, and the hanging chain is used to size the catenary form for compressive arch and shell structures, and so on (Goldsmith, 2016)

Frei Otto was not only using models to verify the stability and aesthetic of his proposal, but he was also to define the architecture's shape according to natural laws (like gravity or tension). He believed that architects are "much more like midwife rather than God the creator (Goldsmith, 2016)." Therefore, models are not shape-making but form-finding instruments. For example, the soap membrane was used to define the shape of a conoid with a tensile structure of zero. The line of the structures was then projected on a surface using a wire grid.

This shape definition methodology has drastically changed in the last decades due to the development of digital instruments. In this scenario, architects have become computer programmers who define parameters, but still, models can play and significant role in the design process because, as Frei Otto has demonstrated, models can be, not only efficient communication tools but also instruments to develop and find ideas.
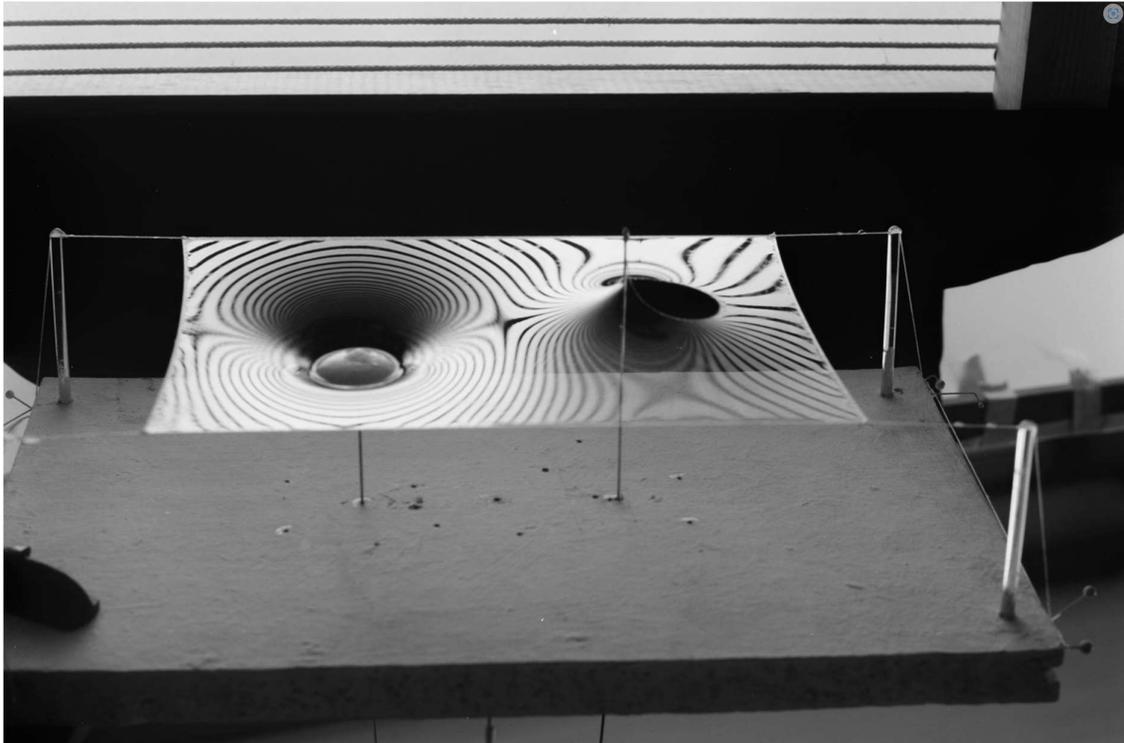
Figure 36 Frei Otto's soap film model, image from saai (Archive and Civil Engineering, Karlsruhe Institute for Technology)

Renzo piano

The Italian architect Renzo Piano has well understood the importance of physical models as an instrument to experiment and develop projects. For him, the most crucial aspect of this tool is that it allows him to pass from a virtual image to a tangible illustration of an idea.

Models have been central for Renzo Piano since the beginning of his practice as suggested by the name of his studio: "Renzo Piano Building Workshop" (RPBW).

At RPBW, model-making is considered an integral component of the architectural process, and most of the models are built in-house, in contrast to many other businesses that contract models mainly for display purposes. Although architects can create basic studies in foam or cardboard, the agency uses its six full-time expert model-makers in its specialized facilities in Paris and Genoa for challenging assignments.

As published on their website, in the studio mainly two types of models are realized: study models and presentation models. The firsts are used in the initial stages of the project, and they are considered 3-D sketches that help to visualize and materialize ideas, to then verify if any modification is needed. The process of verification is much more efficient when realized with the model as it is impossible to cheat or hide. Initially, the models are used to understand the connection between the building and its surroundings. Afterward, they help to understand the unique quality and connections within the volume itself. Naturally, the scale of the model follows the analysis process passing from smaller scales to a 1:1 scale.

Examining closely, for every project a large number of study models are created. Nearly 6,000 models are included in the database of the firm, and over 4,000 are kept in the Renzo Piano Foundation archives. The number of models per project varies based on the size of the intervention, the design's complexity, and each person's working style. Over 165 models were needed for certain projects, such as the Kimbell Art Museum in Texas; 112 models were recorded for the Shard; over 150 models were needed for the Whitney; and even the comparatively little "Pathé Foundation" in Paris had ninety-six pieces documented. Communication and comprehension between model makers and architects are essential parts of the RPBW process. This intense relationship is what Piano calls the "ping-pong game" (RPBW Architects, s.d.): a back-and-forth of sketches and models that will ultimately lead to the final design.

Once the final design has been decided, models become a valuable tool to present the design idea to clients and the public. In this case, models can become intricate and sophisticated artworks. Some of the best work realized by the company has been displayed in shows honoring RPBW's output in cities such as New York, Shanghai, Paris, Athens, and, most recently, London's Royal Academy.

Regarding the choice of material, wood, and Plexiglas are the main materials used by the company. The first is used with the intent of obtaining a warmer finish. Plexiglass instead allows to obtain fast results thanks to the use of laser-cutting. 3-D printing could be necessary for organic shapes, whereas simpler, geometric models work well when constructed of wood and are simpler to assemble by hand.

In Piano's workshop the process of project development follows the same procedure in both Paris and Genoa: when a model is needed, whoever is free jumps in. It could be an assistant, intern, or the architect itself, which means that everyone could experience the process of model creation which is so important to develop innovative ideas and see things from different points of view.

Piano also highlights the importance of the development of technology as the introduction of laser cut machines and 3D printers allowed to keep model production at a great level both in terms of quality and quantity, in-house.
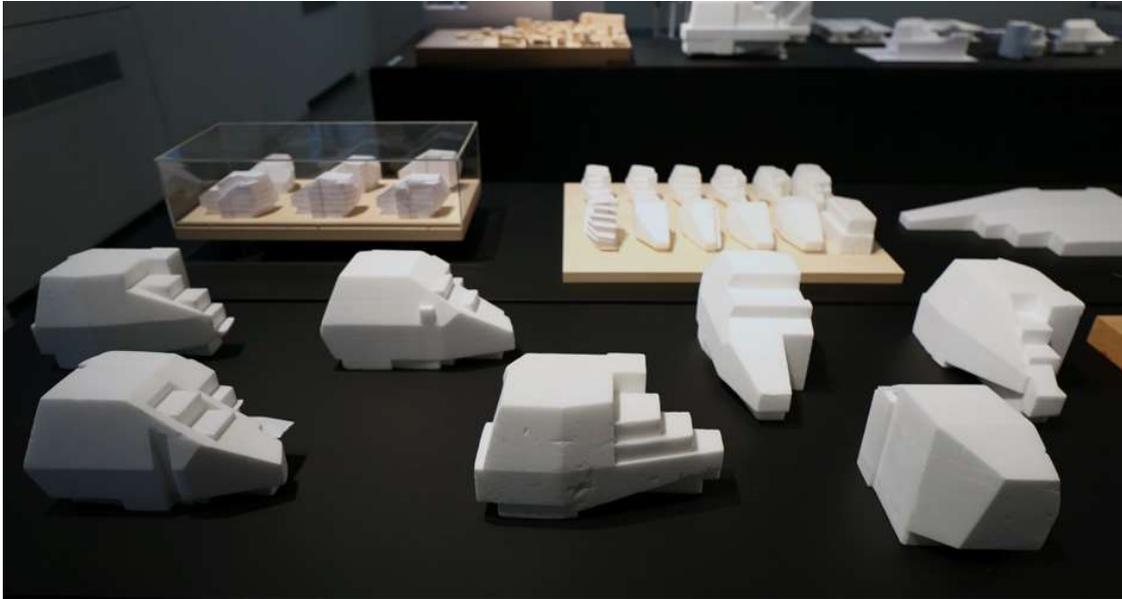
Figure 37 Renzo Piano's Whitney Museum project exhibition presented at Casabella Laboratorio, Milan. (images by Designboom)

Kengo Kuma

Kengo Kuma, a visionary Japanese architect renowned for his innovative approach to design, places a profound emphasis on the philosophical exploration of materials within architecture. His philosophy revolves around the belief that materials possess inherent narratives and atmospheric qualities, challenging architects to engage with them in unconventional ways.

In an interview with Palimpsesto, Kengo Kuma shed light on his design process, revealing a departure from traditional methods of sketching in favor of a more collaborative and iterative approach centered around physical models.

When asked about his methods and whether they begin with sketches, models, or conversations with the staff, Kuma explained his preference for initiating projects with discussions rather than sketches, as he believes this generation tool may limit the creativity of his team. Instead, he opts for a dialogue-driven approach where each staff member presents a model, fostering specificity and productivity in their conversations.

This method ensures that ideas are thoroughly explored and refined through the tactile experience of interacting with physical models. Kuma's willingness to modify and manipulate models during discussions underscores their significance as dynamic tools for iteration and refinement, ultimately leading to the development of design solutions that best embody his vision and philosophy regarding materials and architecture (Palimpsesto, 2013).

In the same interview, Kengo Kuma further elucidates his design philosophy and methodology, emphasizing the importance of tactile engagement and hands-on exploration in architectural education and practice. As an esteemed architect and

educator, Kuma encourages architecture students to embrace the use of "Hands," a directive that mirrors his approach to design. This simple yet profound statement underscores the significance of physical interaction with materials and models in the creative process. Kuma believes that this hands-on approach fosters a deeper understanding of architectural concepts and allows individuals to trace the origins and evolution of ideas.

For Kuma, the process always begins with a site model, providing a tangible platform for physically manipulating materials and experimenting with spatial arrangements. This tactile engagement serves as a vital pathway for Kuma to immerse himself in the project, gaining invaluable insights and inspiration that inform the design process.

In Kuma's design process, physical models play a pivotal role as tools for studying materiality and developing the project to be able to achieve what he terms as "materials structure" (Kuma, 2004). As exemplified in his book "Kengo Kuma: Selected Works," Kuma's reliance on mock-ups and physical models is evident in his quest to experiment and learn about materials firsthand. For instance, he describes rushing to the client's quarry to create a mock-up, where he discovered the limitations of a particular stone bar (Bognar, 2005). This anecdote underscores Kuma's hands-on approach to material exploration, where models serve as instruments for shaping the project's outcome.

Another explicative quote from the same book highlights Kuma's use of mock-ups in the early stages of design, where he experimented with various forms ranging from cylinders to glass boxes before arriving at a groundbreaking idea for an observatory atop Mount Kiro in Oshima. These quotes underscore the relevant role of physical models in Kuma's design process, serving as vehicles for experimentation, verification, and the generation of innovative ideas.

Through the iterative process of model-making, Kuma not only harnesses the potential of materials to create architecture that transcends conventional boundaries, inviting users to experience spaces imbued with a narrative richness and sensory delight but also places the material at the forefront of his architectural production.

Models serve as a crucial tool for Kuma, allowing him to delve into the expressive qualities of materials, understand their potential, and explore the limits to which they can be pushed in his designs.

Figure 38 Space study models for the Manila's Museum of Indigenous Images by Designboom.

BIG

Bjarke Ingels employs a robust sculptural approach to architecture, seamlessly integrating an extensive use of physical models throughout the design process. The significance of this tool is underscored by the substantial collection of models housed within the office, each subject to review and employed as a wellspring of inspiration for the development of innovative designs.

Within each studio, a capacious model shop is provided, equipped with the requisite materials and tools at the disposal of the employees. Further proof of the value placed on this tool is the appointment of a model shop manager, a professional tasked not only with maintaining the model space but also assisting in identifying optimal solutions for design challenges. Additionally, the manager plays a pivotal role in maximizing the utility of the instruments, experimenting with novel materials and techniques, and contributing to the ongoing evolution of the design process.

Similarly to RPBW, the models produced by the firm belong to two categories: study models, which allow to development of ideas and compare different options; and final models, which will be presented to the clients or the competition jury.

Study models are usually produced during the first weeks of the design challenge. These are quickly assembled using foam blocks or polyester sheets to show the general massing of the proposal.

At this stage physical models are essential to comprehend the validity of the design proposal as they allow a three-dimensional experience and to understand the relationship with the context, which is for BIG an essential focus of the design scope. This process of confrontation and analysis happens during discussions and meetings, where models are used to increase the clarity and the quality of the conversation.

Methods and materials chosen by the firm are optimal as they are fast to assemble and extremely cheap. A possible flow of the materials, compared for example to clay, is its rigidity and inability to be manipulated.

Another instrument that is often used is the 3D printer, which is fast and cheap but, most importantly, can create complex shapes that would be exceedingly difficult to obtain from a flat plank of material, nonetheless, it can achieve a level of precision that is not comparable to any other method. For this reason, the 3D printer is often used for the final model as well.

The final models in BIG are not realistic. Their aim is not to create a miniature of the project, but to express the project ideas, especially focusing on the general massing and the relationship with the context. Usually, they are made of polyester or plexiglass sheets with different thicknesses, either in white or transparent colors. With its models, the company wants to impress the client creating a "WOW" effect. For this purpose, a typical strategy is to install a set of LED lights to switch on in front of the client creating a magical moment.

Besides the enormous investments that the company is making in this tool, the way it is exploited presents some criticalities. The most evident aspect is that the model shop is a place for "interns," while architects tend to avoid doing the manual part. Therefore, whoever oversees experimenting with the project is doing it only with the 3D Software, and whoever is experiencing the materiality is not involved in the design. In this sense, the role of the model is reduced to a mere confrontation of massing, and the experimentation with space and material is lost in the hierarchy of the company.

In conclusion, two distinct approaches to modeling in architecture emerge: the first revolves around models as tools for experimentation and experiential learning, a methodology exemplified by Frei Otto and Kengo Kuma. Otto utilized this approach to make physical simulations and understand the limits of the structure (tasks that now are relatively easily solved by laptops); while Kuma employed physical mock-ups to grasp material properties and limitations, informing his design process.

Conversely, Renzo Piano and BIG employ models primarily as three-dimensional representations of ideas. This approach serves as a means of visualizing and verifying design concepts, enabling architects to make critical considerations and proceed confidently in the design process based on the model's validity.

For BIG, this practice is a consequence of their sculptural approach to architecture, prioritizing massing and volume over materials, which are perceived as secondary elements, akin to an external membrane. While materials still play a role in setting the mood and ambiance for users, the emphasis lies on the resulting feeling rather than the specific means by which it is achieved. Consequently, whether warmth is conveyed through wood or warm-toned concrete becomes less significant compared to the overall experiential outcome.

Figure 39 Series of study model (Bjarke Ingels Group, 2009)

PERSPECTIVE VIEW

Similarly to drawings, perspective views play an essential role and are therefore employed in every design studio. Their significance stems from their ability to integrate geometric information from ground plans, elevations, and sections into a vivid three-dimensional image. Governed by precise rules accessible to all, this tool introduces a critical innovation by representing spatial situations with all elements related within a uniform three-dimensional system.

Each design tool, dictated by its inherent functionality, accentuates certain aspects while potentially neglecting others. While a drawing asks for scale and geometry, a perspective requires an individual observer and reflects the three-dimensional effect of a design. The viewer is rewarded for this by the impression of being included in the picture space, the sense that he is standing on the same ground as the scenery depicted. Perspective, like no other medium, establishes a direct link between the space depicted and the viewer's body.

Its dual function, with theoretical-mathematical image construction on the one hand and a practical-artistic depiction of spatial contexts on the other, makes it possible to achieve powerful realism as well as completely illusory portrayals.

Perspective's relationship with the image is determined by three factors: first by the choice of the viewer's position (center of projection), then by the direction in which the viewer is looking, which defines the position of the vanishing point, and finally by the choice of the distance point, which fixes the distances between center of projection, picture plane and the object depicted. All three operations are not immediately comprehensible to the viewer of the completed picture but vastly influence the way it is perceived.

Perspective was subject to many attacks by classical Modernism in the first half of the 20th century. Rejected as a tool of humanism and absolutism, decried as subjective and irrational, it was (and is) sometimes forbidden even by architects. The De Stijl and Bauhaus architects preferred axonometry and isometry, which seemed more objective, as they change only the angles in the solids depicted, without any perspective distortion of length (Gänshirt, 2021).

Digitalization has made the perspectives considerably easier to create. Many different viewing angles can be tried out rapidly using digital 3D models. Designers are no longer confined to a fixed viewpoint; eye level, focal length, viewing point, and viewing angle can now be moved freely and changed with ease. Elaborate renderings achieve the quality of photorealistic simulations and can represent any surface structure and any light source with all their shadows and reflections. In this way, digitalization has completely changed our habitual way of looking at things within only a few years. Hand-drawn perspectives have become perfect-looking simulations, and often also combinations of photomontages and simulations that no longer look "made," no longer seem like the result of an artistic effort but intend to be as natural and convincing as photographs, from which, in well-executed cases, they are retrospectively scarcely distinguishable.

The role that perspective has acquired throughout the years goes beyond its role in representation: it becomes a catalyst for idea generation. By manipulating viewpoints and experimenting with the observer's position, architects can explore fresh concepts and unconventional spatial arrangements. The dynamic nature of perspective encourages a fluid thought process, sparking creativity and innovation in the architectural design journey.

In the same way, they play a crucial role in the development and verification phase. Professionals can use perspective views to scrutinize the spatial relationships, proportions, and aesthetic qualities of their designs. This tool allows for a dynamic dialogue between the conceived ideas and their visual representation, enabling architects to refine and validate their concepts. Through the lens of perspective, designers can assess the coherence of their ideas, ensuring that the envisioned spatial experiences align with their original intentions.

Nonetheless, the immersive quality of perspective provides viewers with a tangible sense of being within the envisioned space, fostering a deeper connection to the architectural narrative, and making the perspective view a perfect communication tool. Their efficiency is enhanced by the fact that perspective transcends the technicalities of design, allowing architecture to be comprehended and appreciated on both intellectual and emotional levels.

To sum up, in the initial stage of the architectural process diagrams offer a platform for designers to explore and generate innovative ideas by emphasizing key relationships and abstracting complex elements. Through this exploratory phase, architects can push the boundaries of conventional thinking, allowing for the emergence of innovative concepts that may form the foundation of the entire design.

In the context of perspective as the focal tool, a comparative analysis of how different architects employ it may not be deemed necessary. Given the ubiquity of it as a widely adopted and established tool in architectural design, its application transcends individual stylistic preferences.

DIAGRAMS
Diagrams are essential tools that help with thinking, problem-solving, and communication in the design disciplines (Do & Gross, 2001).

The difference between a drawing and a diagram is that the second uses geometric elements to represent specific features or elements of the project simplifying and abstracting them to express ideas immediately and clearly. Some of the most common diagrams in the architecture field are the conceptual diagram, where the main concepts of the project are expressed; the bubble diagram, where circles of different sizes can represent the relationship between elements of the proposal; structural diagrams, where a simplification of the structure is represented to show its functioning; circulation diagrams, to show people's movement in the space; analytical diagram, which helps to understand the context of the proposal and the interaction between the two; and as many diagram typology as the ideas that the architect aim to express.

Therefore, the power of this tool lies in the fact that not only does it efficiently express geometric elements, but also allows to fully comprehend abstract elements such as forces, flows, privacy, movements, perceptions, or behavior. To express these concepts diagrams, need to go beyond the typical representations of structural elements, openings, facades, plans, and so on, with the introduction of new symbols such as arrows, colors, lines, or icons to help clarify specific characteristics of the design proposal. In other words, diagrams are made of symbols and explore concepts. They explain and demonstrate the correct functioning of the design, clarifying the relationship between different elements and explaining how things work.

An essential characteristic of diagrams is that they omit details, and do not aim to realistically represent things. Thanks to the process of abstraction things become

extremely clear and easy to understand. This clarity helps to see things, comprehend them, and then adequately respond.

Diagrams serve as powerful tools in the architectural design process, particularly in the initial stages, when they drastically enhance the process of ideation. They offer a platform for designers to explore and generate ideas by emphasizing key relationships and abstracting complex elements. Through this exploratory phase, architects can push the boundaries of conventional thinking, allowing for the emergence of innovative concepts that may form the foundation of the entire design.

As the design progresses, diagrams become invaluable in the development and verification of ideas. Their ability to express not only geometric elements but also abstract concepts like forces flows, and behaviors allows architects to thoroughly comprehend the intricacies of their proposals. This iterative process of refinement ensures that the chosen design solution aligns with the initial vision while addressing functional requirements.

In the latest phases instead, diagrams transcend their role as ideation and development tools, becoming highly effective communication instruments. With the capacity to succinctly convey complex relationships and design principles, diagrams facilitate clear and compelling communication between architects and stakeholders. They distill intricate details into visually comprehensible forms, aiding in the transmission of design intent, rationale, and functionality to diverse audiences, including clients, collaborators, and decision-makers (Edwards, 1979).

The relevance of diagrams in the design process is so high that according to Peter Rowe, designing is a process of transforming and merging diagrams "trying to take a structural diagram, a functional diagram, and a circulation diagram" and "combining them" (Rowe, 1987) .

Thanks to the evolution of digital instruments architects can now produce architecture of any form. Diagrams are used to justify and give meaning to the proposed massing. These two needs are conveyed in a new current called "Diagramism" (Wacht, 2015). Architects that belong to this group use the most impacting strengths and constraints of the brief to create a diagrammatic storytelling that shows how issues are tackled and exploited resulting in an inevitable three-dimensional result that is sold as the best possible solution.

Diagrams are essential tools for many companies around the world. Among them, MVRDV and BIG are two of the most relevant and will next be analyzed.

MVRDV
MVRDV is one of the leading firms in the movement of Diagramism. Their aim when using diagrams is to condense concepts into a coherent flow that explains the genesis of an architectural design. These sketches explain the studio's methodology and aid in

illuminating the company's rational path toward a design solution guided by contextual and programmatic factors.

The design result is the outcome of a usually simple and direct concept that is expressed via a diagram to present to the public. Not only diagrams are used to communicate ideas, but it is also to define the design itself, to develop it, and to finally verify its validity. Diagrams as communicative tools and shapes definer fully overlap.

BIG
BIG emerges as a prominent advocate within the architectural movement of Diagramism, and its impactful ideas often result in projects that become iconic representations of the firm's design philosophy. The dedication to simpler, yet profoundly meaningful forms is evident on BIG's website, where each project's most compelling idea is distilled into an iconic representation.
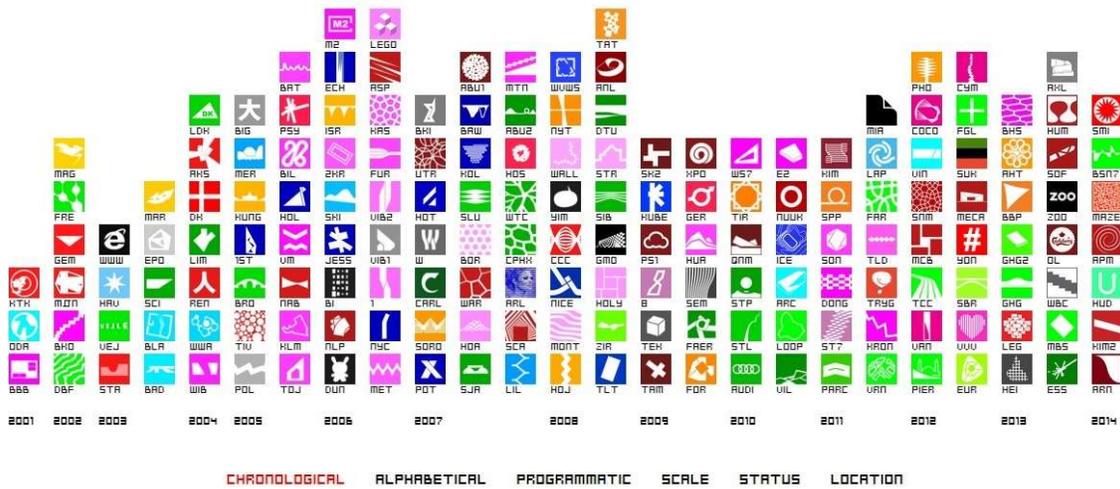

Figure 40 BIG's old website (Wacht, 2015)

The firm, known for its strong ideas, places diagrams at the core of its design process. Far beyond being mere illustrative tools, diagrams in the realm of BIG serve a multifaceted role: they are instrumental in the development, justification, verification, and communication of the entire design.

In the initial phases of project development, BIG uses diagrams as dynamic tools for experimentation and innovation. Concepts are born and refined through the abstraction of arrows, connections, or deliberate movements. This exploratory stage allows the project to find its purpose and strength, setting the groundwork for a design that resonates with the intended vision.

As the project progresses, diagrams continue to play a pivotal role. They are employed to concurrently study various aspects of the project, ranging from contextual

considerations to environmental impacts, sustainability features, and circulation patterns. Each design element is subjected to simplification and representation in diagrammatic form, facilitating a comprehensive understanding of the intricate layers involved in the architectural creation.

The culmination of this intricate process occurs when all diagrams align coherently and satisfactorily. At this juncture, diagrams transition from being tools of exploration to efficient communication instruments. Their immediacy and playfulness prove invaluable in capturing public interest and elucidating complex design issues for clients. The ability of diagrams to distill complex concepts into visually comprehensible forms positions them as indispensable assets in the architect's toolkit.

The distinctive strength of diagrams lies in their power of abstraction, allowing architects at BIG to isolate distinct challenges and address them methodically, without falling into the trap of oversimplification. This approach transforms what may seem impossible into tangible, well-informed solutions. Bjarke Ingels himself emphasizes the pivotal role of diagrams in making informed decisions, reinforcing the idea that, within the BIG design ethos, diagrams are not just illustrative aids but critical instruments shaping the inevitable outcome of the final form (Hobson, 2014).
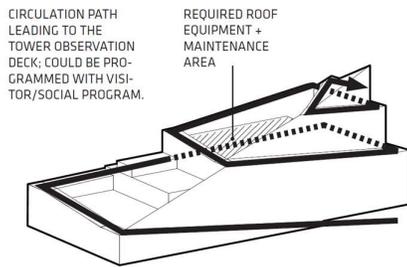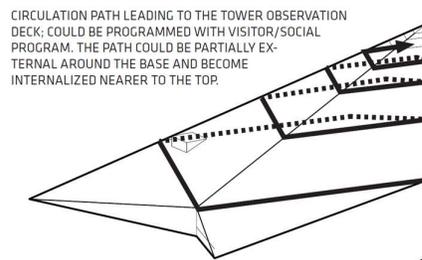

Figure 41 BIG's study diagram of the CopenHill design concept (BIG's private database)
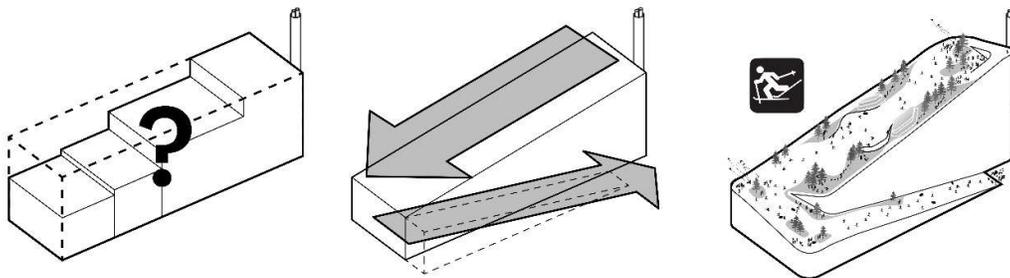

Figure 42 BIG's final diagram of the CopenHill design concept (Bjarke Ingels Group, n.d.)

SOFTWARES

The beginnings of Computer-aided design (CAD) can be traced to the year 1957 when Doctor Patrick J. Hanratty developed PRONTO, the first commercial numerical-control programming system (Popkonstantinović, 2019).

The advent of computer programs has completely revolutionized how architects work, allowing professionals to achieve goals that were imaginable before. Nonetheless, the software is the base of almost every other design tool: for making a model, a digital twin is often required, diagrams are produced with the help of 2d and 3d tools and the same for perspective views.

The key role that programs play in the process of design is to drastically increase the level of complexity managed by the architect (CHOUGUI, 2001). Due to this, they have become so essential that in the current practice, it would seem impossible to produce any kind of project without them.

At the beginning of the process of digitalization, software primarily mirrored manual architectural processes. Yet, with the evolution of these tools, their capacities have experienced a remarkable surge. Presently, computers serve as instruments that not only replicate human abilities but also substantially enhance the complexity and sophistication of the tasks undertaken.

Programs play a crucial role in every stage of the project development. In the initial stages of the project, computers allow to establish other ways of materializing inner ideas allowing to experiment with unique and innovative ideas, eliminating the problem related to the physical world, such as materiality and physical laws. This opportunity represents a great liberation, and some help to speed up the process. One inevitable consequence is the loss of the sensual quality and directness of the material, both delicate factors.

Again, the phase of development can be implemented thanks to the use of programs. One essential potential of the tool in this phase is the possibility of making simulations. Therefore, understanding the consequence of present choices on the design. This allows to deal with complex issues such as sustainability and offers a new point of view. Architects can foresee problems that would have been impossible to predict just a few years ago. Among the several simulations that can be done, there are fire response, acoustic, aerodynamic flows, lighting, and energy consumption. This potential allows developing the project with a control that has never reached this level before, allowing to make the most thoughtful choices, consequently increasing the quality of the design proposal, and most importantly implementing the project in the most sustainable way, reducing emissions, energy consumption, and general environmental impact during the construction phase but also when the structure will be in use, and at the end of life.

In this scenario, it is important to limit the risk of overreliance on software, which could potentially limit creativity and innovation as architects may be constrained by the capabilities of the tools.

Architectural design software helps with the automation of repetitive tasks, reducing the potential for human error, and saving time on design changes. This capability leads to a faster, more efficient design process, freeing up architects to focus on more strategic and creative aspects of their work.

The introduction of the right software can help to implement the communication aspects related to architectural production. It is for example possible to create cloud-based solutions that allow multiple users to access and edit a project simultaneously from anywhere in the world, leading to real-time collaboration. Again, the efficiency of the design and decision-making processes is optimized, saving time and resources while reducing the likelihood of misunderstandings and miscommunications (Fidanci, 2023).

The possibility of sharing information in real-time encourages a more integrative design process, improving the quality of the design result. On the opposite, traditional methods often require separate drawings for different building components and systems, which can lead to coordination issues.

This comprehensive approach is perfectly applied when the methodology of Building Information Modeling (BIM) is applied. BIM is not merely a tool but a process that enables the creation and management of digital representations of a building's physical and functional characteristics. This approach allows architects to predict performance, understand behavior, and make informed design decisions, thus leading to better outcomes for their projects.

Programs have become so relevant and influential in the architectural practice that they have defined new ways to deal with architecture. Some examples are the so-called "revitism," "scriptism," or "subdivisionism" methodologies, which can be grouped under the name of "parametricism." This is not an architectural movement but a computational concept (Wacht, 2015): a series of instruments and tools that allow to create an intelligent form. In this context shape, massing, apertures, and every aspect of architectural design exist as it responds to a specific parameter and need.

Choosing the optimal approach for each situation is crucial as it will have an impact on every aspect of the design result.

Architectural design software has dramatically transformed the way architects work, providing tools and capabilities that augment their creativity, efficiency, and effectiveness. By unlocking the benefits of this tool, professionals can maximize their potential and deliver high-quality, sustainable, and innovative designs that respond to

the needs of the modern world. As we move further into the digital age, the use of such tools will only become more essential for the architectural profession.

AI

The technological revolution has transformed how human beings live, and the changes do not seem to stop. One of the most innovative and currently discussed technologies, is Artificial Intelligence also known as AI.

Artificial Intelligence is a broad field of technology able to develop problems with the autonomous use of logic, self-awareness, comprehension, reasoning, problem-solving, and creativity (Selkut, 2019).

In the field of architecture, AI is used for six main scopes: performance optimization, form finding, spatial programming, restoration, and design tool development. This means that the design process can be faster, especially in the initial stages when several options must be taken into consideration, drastically implementing the quality of the job and the possibility of architects exploiting their time at best.

Among the numerous available resources, Midjourney is one of the most known. For this reason, the analysis of this tool will provide great insight into the role that AI plays in the design process.

This "independent research lab" (midjourney, s.d.) is a generative AI, which means that it can produce images from natural language descriptions, commonly named "prompts." The function is remarkably like other available platforms such as OpenAI's DALL-E and Stability AI's Stable Diffusion. (Jaruga-Rozdolska, 2022)

The process of creation allows not only to obtain four different images thanks to the definition of the prompt but also to create further variants based on them. If none of the options is satisfactory, it is possible to obtain new options by inserting the same prompt. It is impossible to obtain twice the same result, as the program works with random inputs. Nonetheless, the more users and images are produced, the more the script evolves, improving every time its results.

This allows architects to easily experiment with new shapes, materials, and ideas. It can help to see problems from a distinct perspective and develop solutions that no one thought about before.

This technology, like any other kind of AI, can be considered a double-edged sword depending on how it is used. If, on one hand, given the predictability of architectural processes, they can help to optimize budget, physical and human resources, speed up construction timeline, and achieve faster scalability of companies' commercial operations; on the other, not every decision on an architectural project's timeline is predictable or efficient. Aesthetics, context, market trends, socio-cultural characteristics, marketing campaigns, historical linkage, public opinion, and stakeholders' interests

(namely, clients, developers, architects, and managers) have always been part of the equation.

As long as humans are the ones who make the final decision, AI will be subordinated to ordinary decisions. AI technologies will not replace humans; rather, they will enhance individuals who can use them (Valencia, 2023). The future of architecture lies at the intersection of technological innovation and human intent.

In general, architectural firms are starting to explore these technologies but, while image generator programs are exploited worldwide, especially in larger studios, other kinds of AI are not commonly used. More likely both the market and the technologies still need to be developed, but without any doubt, in a few years, artificial intelligence will become essential in the architectural disciplines.

Zaha Hadid Architects seems to be one of the leading studios in the application of these new tools. Their habits will be compared with the ones of BIG.

Zaha Hadid Architects

Zaha Hadid Architects (ZHA) is an internationally acclaimed architectural firm known for its innovative and avant-garde designs. Founded by the renowned Iraqi-British architect Zaha Hadid, the studio has earned a reputation for pushing the boundaries of architecture with its distinctive and futuristic approach.

ZHA's modernity is not only found in its design aesthetic but also in the approaches and methodologies through which it develops its design. First of all, the company is a pioneer of parametric design as a consequence of its early application of programs such as Grasshopper. Nonetheless, they are investing great energy and resources to introduce AI in their design process.

The most used artificial intelligences used in the firm, are image generation software such as DALL- E2, and Midjourney. According to Patrik Schumacher, one of the principal architects of the studio, this tool results in being extremely powerful in the initial stages of the project when a substantial number of options are produced. Only 10-15 % of the outputs are then modeled in 3D so that their actual functionality is verified (Barker, 2023).

The tool is therefore used to find new ideas and inspiration. It is considered as a "method of producing ideas."
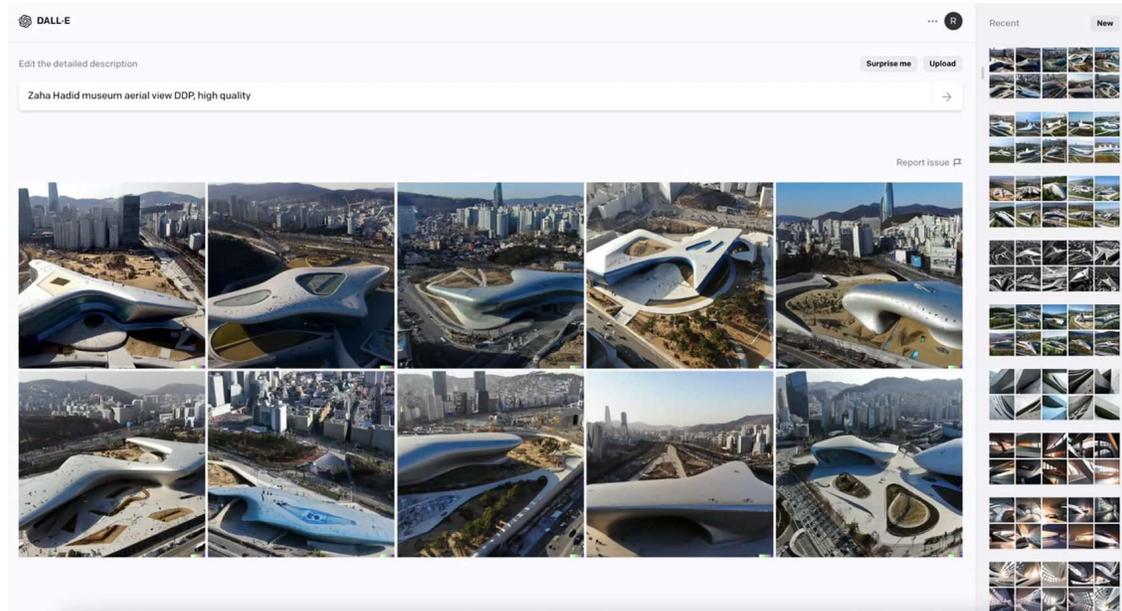
Figure 43 Collection of imaginary building images created using DALL-E 2, Midjourney, and Stable Diffusion , (Barker, 2023)

BIG

As in many other studios of this magnitude, BIG tries to make use of the modern technologies available on the market, AI included. At the state of the art, the only artificial intelligence that is used is the one for generating images. The main software used is Midjourney, which, as said, is an image generator engine. The program is sometimes exploited to experiment and find inspiration at the beginning of the design process, but rarely the results are taken into consideration as an actual option. The resulting images are used only for internal meetings and presentations, and they are never shown to the clients.

While having access to this tool allows the whole company to start to become confident with this new generation tool., the use that it is currently at BIG is more similar to a game rather than architectural experimentation and research.
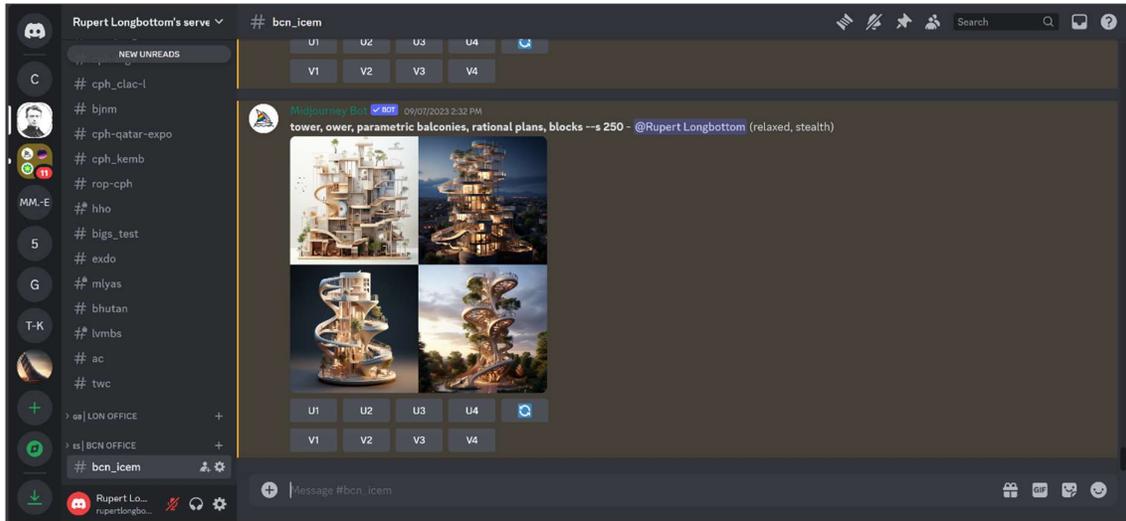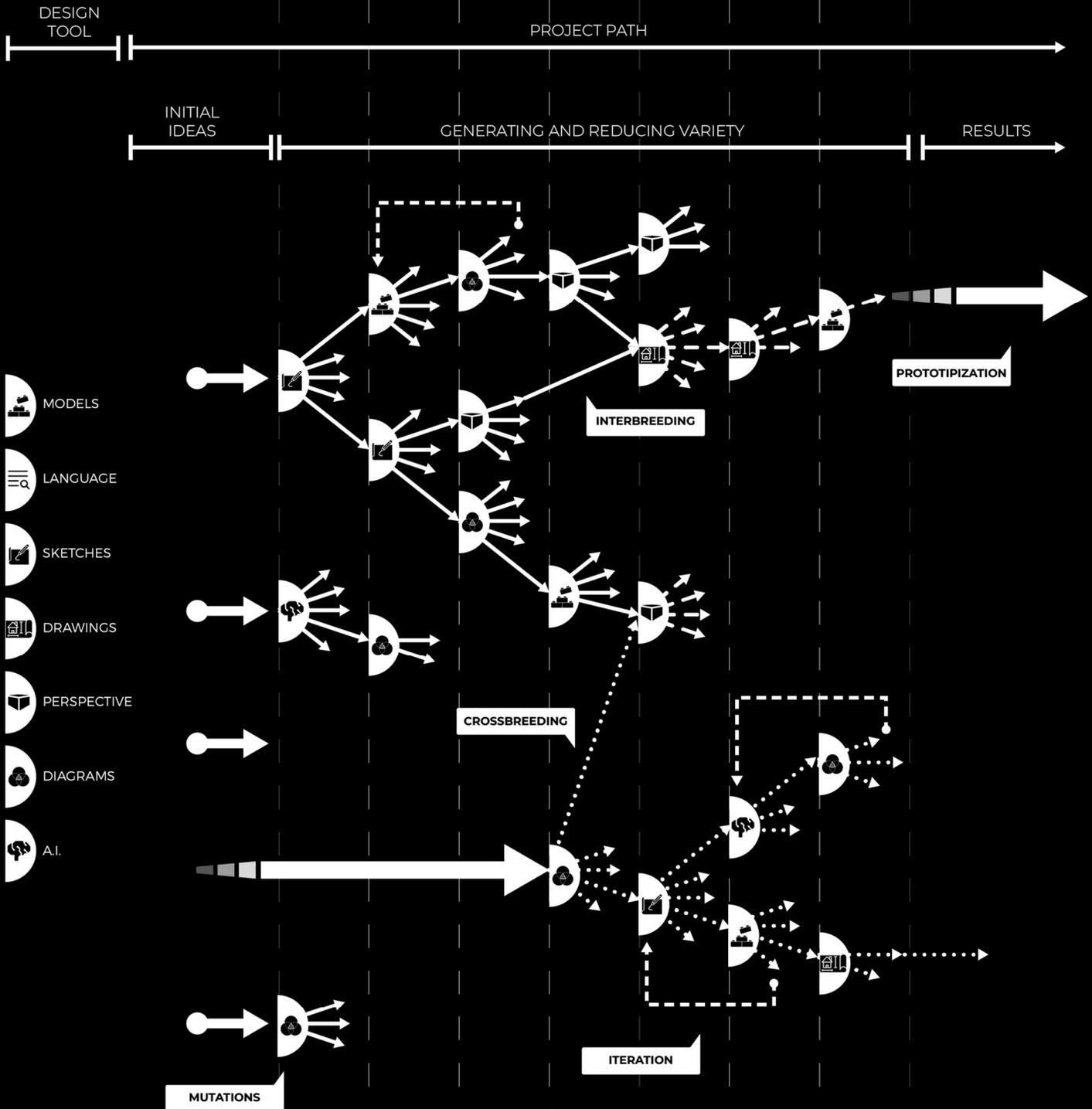
Figure 44 Collection of imaginary building images created using Midjourney, in BIG (BIG private database)

TAKEAWAYS

Prescribing a singular and absolute path for architects is an unattainable task. However, it is feasible to delineate a general approach, distinctive to each architectural studio. Ingele has used Rittel's model, and his concept of project trajectory defined by increments and reductions of variation, as a foundational framework. Nonetheless, the model has been implemented incorporating additional layers of complexity, including crossbreeding and interbreeding, iterations and reiterations, and prototyping.

An in-depth exploration of the tools employed has facilitated a comprehensive definition of the studio's approach. Notably, language emerges as the least utilized tool, with diagrams and models assuming pivotal roles, leading to a strong tridimentional approch. This distinctive characterisic has propelled BIG into becoming one of the most influential architectural studios globally, with Bjarke Ingel emerging as a leading figure in the field.

DESIGN TOOL

PROJECT PATH

INITIAL IDEAS

GENERATING AND REDUCING VARIETY

RESULTS

MODELS

LANGUAGE

SKETCHES

DRAWINGS

PERSPECTIVE

DIAGRAMS

A.I.

PROTOTIPIZATION

INTERBREEDING

CROSSBREEDING

ITERATION

MUTATIONS

V. FACING REALITY

The theoretical groundwork laid thus far must now confront the reality of practical application. An analysis of real-world cases becomes paramount in assessing the extent to which a company's values and methodologies translate into everyday office practices.

This chapter draws upon data collected through the author's direct involvement in a curricular internship at the BIG Barcelona studio. The selected project was meticulously tracked by the author from the inception of the competition call, providing an immersive understanding of the entire design process. To maintain confidentiality, names and direct references to the project will be redacted, as its details are not publicly available.

It is crucial to acknowledge that while this case study offers valuable insights, it does not encapsulate the entirety of BIG's project processes. Instead, it represents only one of many possible iterations that projects may undergo in real-world scenarios. The application of methodologies and values is contingent upon various factors such as the specific project, team dynamics, and the overall office environment.

BIG Barcelona presents a unique opportunity for studying the evolution of ideas, given its focus on competitions and concepts. However, it's important to note that subsequent project phases are seldom developed within the Barcelona office. Therefore, while this case study provides a window into the design process at BIG Barcelona, it should be understood within the broader context of the firm's diverse project portfolio and global operations.

Having grasped the theories put forth by Bjarke Ingels concerning the architectural process, it is now essential to evaluate their practical application to understand how the general scheme previously explained is applied in the real world.

The objective will be pursued through a detailed analysis of a real case study. The process of comparison between theory and reality allows to verify the validity of Ingels methodologies, therefore understanding what is real and what is part of the architect's narrative. Nonetheless, it offers the opportunity to see how the theory is applied and adapted to real case scenarios.

The chosen project has been developed by a team of around five people. Among the participants, the most expert architect covered the role of project leader (PL). The latter is therefore the person responsible for the results of the team: he assigns daily tasks, decides what people should focus on, and finally tries to set up the best possible presentation to show to the partner. The role of the partner in the design process result is crucial. He is the one deciding whether the design is working and proceeding in the right direction or not. The team is then flanked by a project manager (PM), in charge of the more practical aspects of the project such as maintaining communication with the clients, regulatory aspects, or economic evaluations. He is not directly involved in the architectural aspects of the project.

The project path is usually subdivided by weekly milestones. At the end of the 5 working days, the team must deliver an "update". This is a presentation in which the team shows what they have done during the week so that the partner is kept informed of the design evolution. Nonetheless, the presentation is sent to all the partners of BIG, not only the one who is currently following the project, increasing the possibility of contamination, and multiplying the amount of feedback received.

Besides this virtual exchange of comments and considerations, a weekly in-person meeting with the partner is usually set up. Each reunion is meant to be a small charette of ideas and a way to verify the proposed options. This moment of the week is the most crucial as it triggers design development. During each meeting, different tools can be used to increase innovative thoughts. Therefore, the week is mainly exploited to generate variation, while the weekly meeting is both a moment of variation generation and reduction.

The time at the disposal of the team is organized so that, each week has a specific objective, starting from setting the base of the project with general research and analysis to developing as many options as possible, to finally freeze one proposal and develop the necessary material for the competition/client.
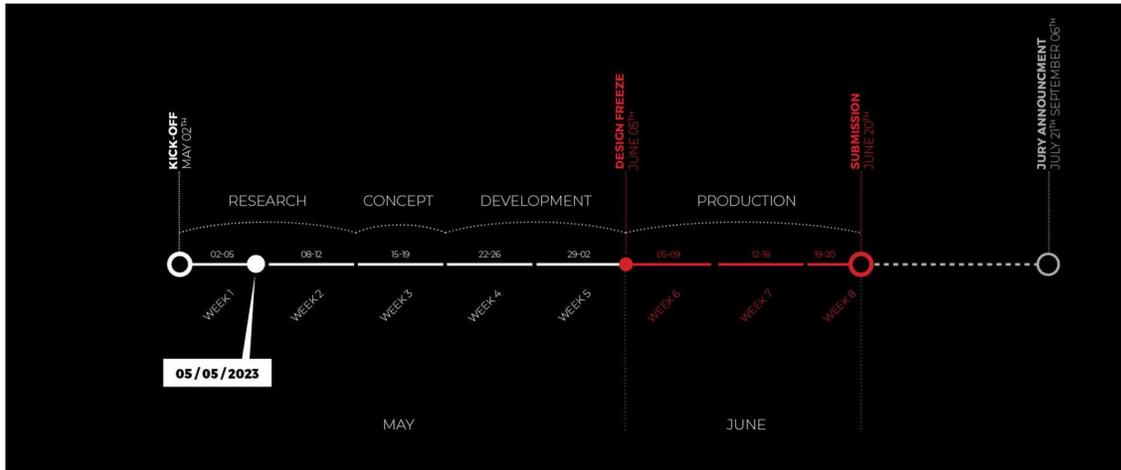
Figure 45 Study case timeline, (BIG private database)

The chosen case study is a competition for a residential tower to develop in eight weeks.

To understand the project's path an analysis of the several updates' content will be conducted, therefore retracing the evolution of the different options explored, together with the tools with which they have been analyzed and developed.

The design path could be analyzed at many different scales, especially considering that every decision in the design process is based on the process of creating different options and choosing the optimal one. For this reason, each update, or even each option could be further represented as a unique evolutionary diagram. For the sake of this research, the weekly scale was deemed sufficient.

WEEKLY UPDATES
As explained, each week the team is requested to send an update to show the work that has been developed in that time. An analysis of the content of the update will provide a macroscale representation of the project evolution, allowing to understand how different proposals interacted and where the ideas came from. Nonetheless, it gives a chance to observe the main tools that have been exploited to analyze and develop the design.

The numerous updates could be summarized as follows:

The first week of the competition is dedicated to research. This means that the brief must be studied together with the characteristics of the project location. The initial part of the update therefore explains the relevant competition facts, such as the project typology, the total square meter requested, the maximum height, and in general the client's ambitions.
Nonetheless, the competitors' strengths and weaknesses have been defined.
Follows a brief historical analysis of the project location, enriched by the most characteristics values, and identity features.

After this overview, the presentation delves into the specific plot, starting from the urban context, transportation, evolution of the site, and green areas. A great number of pictures of the existing condition allow to visualize the plot and the surrounding environment. The analysis of the climate condition is introduced to better deal with sustainability.
Last, the plot dimension and general constraints related to the challenge are translated into a diagram to have a first visualization of the possible volume of the proposal.

In the next update, an analysis of the existing residential typology in the city is introduced to try to understand from history what is the best strategy for a residential use tower in a specific location. This initial approach is also useful for developing structures that belong to the context.

The residential structures equipped with courtyards and "case di ringhiera", are the two main historical typologies that emerged. Nonetheless, newly built residential towers such as Bosco Verticale or Torre Solaria are analyzed to understand what is considered appealing nowadays. Further analysis of the plot is developed, for example, introducing information about the neighborhoods or close relevant buildings.

Being a tower, it has been possible to develop some initial layouts to understand how to optimize it, given the square meters per floor requested by the brief.

A first set of five options is brought to the table and developed through diagrams, perspective views, and a first set of planimetries which allowed to understand if the design could work. Three out of the five proposed options are the result of prototipization processes the inspiration comes from already developed projects of BIG. Initially, the prototypes are only placed in the plot. Through further mutation processes, they will be developed and adapted in relation to the context.
None of the proposals has been influenced by historical and context research until now.

Thanks to a first round of mutation each option has created two different schemes, reaching a total of eleven proposals.

This evolution is introduced to start adapting the options to the specific location. The historical research is reflected in the proposal of a tower with an internal court. In this case, it is possible to also see a connection with the project of New York 57 by BIG. Another option is influenced by the project Scala Tower, again by BIG.

Diagrams, views, and drawings are the most used tool at this point as they allow to give a complete overview of the project functioning modifying the proposal to better satisfy the three points of view at the same time.

Nonetheless, the most successful options have been reproduced on a scale of 1:500 with a physical model.

Figure 46 Models realized for the analysed project competition, picture by the author.

Update 3

Some of the options are further developed and processes of interbreeding with other BIG projects start appearing. More in detail, the court-scape option interacts with the mountain scheme creating a pixelated version of the same massing.

A new idea is introduced at this step. Other schemes are further mutated to create new versions of themselves, particularly focusing on the efficiency of the plans. Another round of physical models is realized to help the conversation during meetings and therefore fasten the process of design development.

Update 4

This week an important step toward the final result has been made. Further mutations are introduced, together with new crossbreeding processes.

Four new prototypes are introduced. Similarly to what happened in the first update, the new proposals are only inserted in the context without adapting them to the unique conditions of the plot. These options will greatly influence the outcome.

Each proposal is studied with the same tool: diagrams to show the general ideas, perspectives to understand the massing and its interaction with the surroundings, and plans to see how the volume could work.

Update 5

At this point of the process, the remaining options are upgraded through interbreeding with existing projects by BIG.

For all the options plans and sections have been studied in more detail especially focusing on the optimization of the cores.

One crucial crossbreeding interaction happens between one of the latest introduced prototypes and one of the ideas that has been introduced in the third update, resulting in a hybrid version of the two that will become extremely successful.

Update 6

Only five options have been considered worth developing. To the selected massing several typologies of facades have been applied to understand how they would look. Facades are always inspired by other projects in the office.

To study these results realistic perspective views are the most used tool as they allow to understand how the massing will be perceived.

A matrix to compare all the options is introduced allowing to easily understand the pros and cons of each proposal. Consequently, the team can better select the proposals that are worth developing.

Update 7

The comparison allowed to define the preferred option which is further developed to better respond to the specific condition of the plot. Further studies are developed using diagrams. For example, the consequences of the introduction of the building on the public space on the ground floor, or how softscape and hardscape interact.

The aforementioned option, which is the result of the crossbreeding of two proposals, has been selected as the most successful design. The final massing is the result of studies in planimetry, sections, and renders. Several facade typologies are applied to the final massing. The process of façade elaboration is repeated until reaching a satisfying result.

In this case, the historical study influenced the material of the façade. Perspective views are the main tool to understand how materials work with each other and with the context. This choice is part of the strategy of response that is part of the company manifesto.

The final design is the result of numerous iterations which allowed through a process of trial and error to define the most efficient layout in terms of volume, relationship with the context, façade, core optimization, and layout functionality.

PROJECT PATH

In accordance with the theory, the final design is the result of a series of mutation, interbreeding, prototipization, and iteration processes.

All the strategies are exploited and contributed toward the development of the final design. Among them, mutations, interbreeding, and prototipization seem to be the ones that most influenced the design process.

For what concerns mutations, this is the simpler and more intuitive strategy to apply, therefore, to evaluate the different possibilities for its position, and therefore choose the best one. Different trials can sometimes lead to a new option which could be developed independently creating a new branch in the tree scheme.

The extended use of interbreeding is more related to the company's tendency to be autoreferential. Therefore, to find new ideas or inspiration the most common resources used are the past projects developed by BIG. This situation is the consequence of several factors. First, the company's production has a very strong identity and character, therefore, by using BIG's project as a reference, the design will almost necessarily reflect these characteristics.

During the interviews, especially questioning people who had previous experience in other offices, it emerged that most architectural firms use this approach, due to the positive outputs of its application. Therefore, the innovation brought by Ingels is the one of using this approach openly. This honesty characterizes greatly Ingels as an archistar.

A further reason that pushes architects to be autoreferential is the fact that consulting and obtaining material for projects developed by BIG results in being extremely immediate thanks to a common platform where all the materials are uploaded. This allows to directly find presentations, renders, InDesign files, rhino files, scripts, materials, and everything that has been used to develop the project. As a result, employees can open the 3D model of any project and "copy–paste" what is needed in the new file, from whole massing to blocks, or textures. Obtaining the same data from another platform

would be impossible. The application of interbreeding has a great impact on the speed with which the project is developed.

For the same reasons, also prototipization contributes toward fastening the design development and allows to guarantee the maintenance of the company identities and values.

It is always vital to not overuse both interbreeding and prototipization to avoid flatness and repetitiveness of the studio production and ensure a strong relationship between the proposal and the context.

In the specific case, the application of the aforementioned approaches was also a consequence of the very short period that the team had at their disposal. Nonetheless, given the rationality and efficiency that is requested in a tower, it could be convenient to apply the already studied design to start the process with more information and some aspects of the proposal already solved (such as layout optimization). Later, through mutation and iteration processes the proposal can efficiently adapt to the specific conditions and develop its unicity.

While the multitude of ideas generated within the short time at the disposal of the architects provides an opportunity to explore various scenarios and gain insights into spatial dynamics, it also presents challenges.

Limited time can lead to inefficiencies, as architects are compelled to juggle multiple tasks simultaneously, thereby diminishing the available time for developing each proposal. Consequently, there's a risk of superficial work and compromised outcomes, as the rush may hinder the thorough exploration and refinement necessary for achieving satisfactory results.

It could be concluded that BIG's strategy of design, which implies the production of as many options as possible, could be very successful, but the amount of work that the architects can handle has a physical limit and therefore, a delicate balance between "too little" and "too many" must be achieved. The project leader and the associate together have the responsibility of finding a good balance.

GENERATION TOOLS
Many different tools have been exploited during the design process. The considerations made in the relative chapter have been confirmed seeing diagrams, drawings, and perspectives as the most used instruments.

Diagrams, drawings, and perspectives not only have been used extensively, but their potential has been exploited at best by using all of them in parallel. When diagrams, drawings, and perspective views are represented in the same sheet, it is possible to control the massing's aesthetic, its interaction with the context, the functionality of the plans, and the impact of the cores, all at once. Nonetheless, when changing one variable,

for example in the plan, the consequences of this choice on the other aspects of the project are immediately understood.

For what concerns physical models, they have been used extensively. According to the theory, the important aspect of the model is not only the final product but the process of manipulating materials and experiencing the three-dimensionality of the massing. In this case, all the realized models have been built by the author in the role of the intern.

During the realization of the models, there hasn't been any kind of experimentation. The models were merely three-dimensional representations of the proposal which were produced by the architect in charge of the design concept. Therefore, the potential of this tool as a moment of experimentation and experience is lost. Besides this, models have been essential to understanding the relationship between the proposed massing and the surroundings and the impact that the former would have on the nearby areas, therefore stimulating meaningful conversations and developing the final massing.

The already mentioned flows of the firm's approach to design tools have emerged. Language, AI, Sketches, and programs, haven't been exploited at their maximum potential throughout the process.

Language has been reduced to its minimum following the "passive" strategy of the firm, avoiding a situation in which architects get trapped in one point of view. Nonetheless, the potential to actively trigger new perspectives is lost.

AI hasn't been used at all. This is likely because the company mainly uses image generators among the available AI tools. Nonetheless, the results obtained with this category are usually un-rational, out of the box, and surprising. Given the little time at disposal and the extreme rationality with which the tower must be developed, the tool has not been taken into consideration.

For what concerns programs, the basic software and tools exploited to develop all the other tools have been exploited. Rhinoceros, Illustrator, and InDesign results being the essential kit for architects in BIG.

While, when considering software as a tool to make simulations, it has emerged their complete absence.

The fact these tools haven't been exploited at all, says a lot about the relevance of sustainability in the initial stages of the project development. While it could be argued this aspect will be further developed in the next project's phases, the absence of early consideration reduces the effectiveness of the sustainability strategy, that will be introduced later, and more importantly, raises doubts about the company's commitment to this principle, as highlighted during the analysis of the company manifesto.

If sustainability, as declared, is the foundation of BIG's production, then it should be developed and considered since the beginning of the processes with the final objective of maximizing the integration of sustainability strategies in the building.

By integrating sustainable principles at the outset, architects can effectively optimize resource efficiency, minimize environmental degradation, and reduce the carbon footprint of buildings. Moreover, early consideration of sustainability aspects allows for innovative design solutions that seamlessly integrate ecological features with functional and aesthetic requirements. The earlier these considerations are factored in, the cheaper, more effective, and more sustainable the result will be, emphasizing the importance of early integration of sustainability into architectural projects.

COHERENCE WITH MANIFESTO
The last factor to evaluate is the coherence of the result of the design process with the manifesto of the company. As previously explained, the capability of the company to produce consistent projects gives validity to the manifesto itself, giving sense to the whole architectural production of the company.

The principles of response, reincarnation, productization, and biophilia represent the foundation of the company's manifesto. For the analyzed case, most of the value seems to be absent or extremely weak.

Response
The idea of response can be retraced in the project path but did not influence the project development deeply.

To evaluate this aspect of the project it must be observed whether the proposal responds to the specific culture, landscape, climate, and city of the location where it will be built. Only if this condition is respected it is possible to speak about responsive design.

As mentioned, the goal of this approach is not to duplicate what already exists but rather to adjust to it, fostering a smooth continuation of the current condition.

For what concerns the analyzed study case, the only two aspects that have been taken into consideration are the typical housing typology of the area and the material choice for the façade.

" Casa a corte", or courtyard house, is the typical residential structure present in the area. In the second update, one of the options has been adapted following this tradition. The proposal has been further developed through a prototipization process. The result has then been excluded due to the low efficiency of the circulation and the core, together with the great impact that such a footprint would have on the surrounding public space and buildings, whose views would have been greatly obtruded.

The second moment in which the principle of response has been introduced is during the late phases when different facades have been applied to the options that have been

reached so far. To respect the city palette and traditions, mainly local stone has been taken into consideration to clad the façade and has been presented to the client.

Reincarnation

According to the manifesto, reincarnation is another relevant value that must be taken into consideration while developing any project. Flexibility and adaptability are the resulting characteristics of a design that have been developed to pursue the reincarnation concept. This strategy allows to keep the structure relevant in terms of its functionality and purpose, to finally develop a space that can outlive its materials.

Thematic or issues related to reincarnation have never been discussed in the eight weeks of the development of the project and, consequently, have not influenced in any way the design. The structure has been thought to fulfil at best the client's need to sell apartments as soon as possible, with the highest return on investment rate. This means creating attractive apartments, possibly double exposed and with a private terrace, at the lowest possible construction cost.

As the client is interested in his earnings, and the fact that the company's goal is to sell their design, topics regarding the future of the structure and how it can adapt to future needs are not considered valuable.

Although BIG did not consider the prospect of a future change in the building's use, as it did not align with its interests, the investors had a different perspective. The project brief stipulated that all underground floors must maintain a minimum height of three meters. While the basement floor could theoretically be lower to save on materials and excavation costs, the client opted to invest more in the construction phase with the hope that this floor could eventually be repurposed. This decision was made with the ultimate goal of maximizing profits, as this space could potentially be converted into garages for resale.

Productization

Productization corresponds to "thinking" of architecture as modular, prefabricated, and efficient sets of elements that can be assembled in infinite combinations, ensuring adaptability, variation, and personalization in each architectural design.

This principle has been kept in mind while developing the planimetry of the tower but with insufficient results.

The team's goal was to produce a reduced set of floor plans, creating a reduced set of modules to stack one on top of the other, consequently ensuring efficiency and still variation on the façade. The valuable intention of the design has not been developed properly, therefore an excessive amount of floor typologies were created, consequently reducing the positive output of the application of the strategy.

Again, the final aim of selling the project idea to the client has prevailed on sustainability aspects.

Biophilia

Biophilia seems to be the only strong manifesto concept included in the design proposal.

Decreasing the urban heat island effect, improving biodiversity, optimizing air quality, optimizing thermal comfort, and enabling urban farming for food production are only a few of the direct and indirect positive outcomes that the application of this strategy can trigger, directly contributing to the objectives outlined in the 17 Sustainable Development Goals (SDGs).

In the proposed solution greenery has been included with the introduction of spacious lush private balconies. Not only in the design have been proposed low-rise bushes and plans, but also small trees. These have been thoughtfully distributed close in correspondence with the structure to reduce the impact that the weight of the tree would have on the structure, nonetheless, the façade presents sufficient height to allow the growth of tall greenery.

Economic interest and sustainability in this sense work complementary toward to same objective. While greenery is contributing toward sustainability, the investor will have more valuable apartments to sell.

However, it is also important to consider the several drawbacks of this strategy. Among them, emerges the increased structural load, potential waterproofing issues, ongoing maintenance requirements, higher initial costs, limited applicability based on structural and climatic factors, fire risk, design challenges, variability in energy efficiency benefits, and potential impact on local biodiversity. Especially considering that introducing biophilia without the integration of parallel sustainable strategies may lead to accusations of greenwashing. This occurs when operations are portrayed as more environmentally friendly than they are, potentially undermining credibility and trust. Such accusations can have major consequences on the integrity and credibility of the company, damaging its reputation and relationships with stakeholders.

While this example represents one of the infinite possible scenarios of their application, some general conclusions can be drawn.

The company seems to stay true to its theories when it comes to project path development. Naturally, depending on the specific case and condition some strategies will be exploited more than others to obtain the best possible result.

For what concerns the use of design tools, the criticality that has emerged in the dedicated chapter has been confirmed, proving that the company has strong preferences and habits. The fact that some tools are more used than others will nonetheless affect the production of the company creating a precise style and identity associated with BIG.
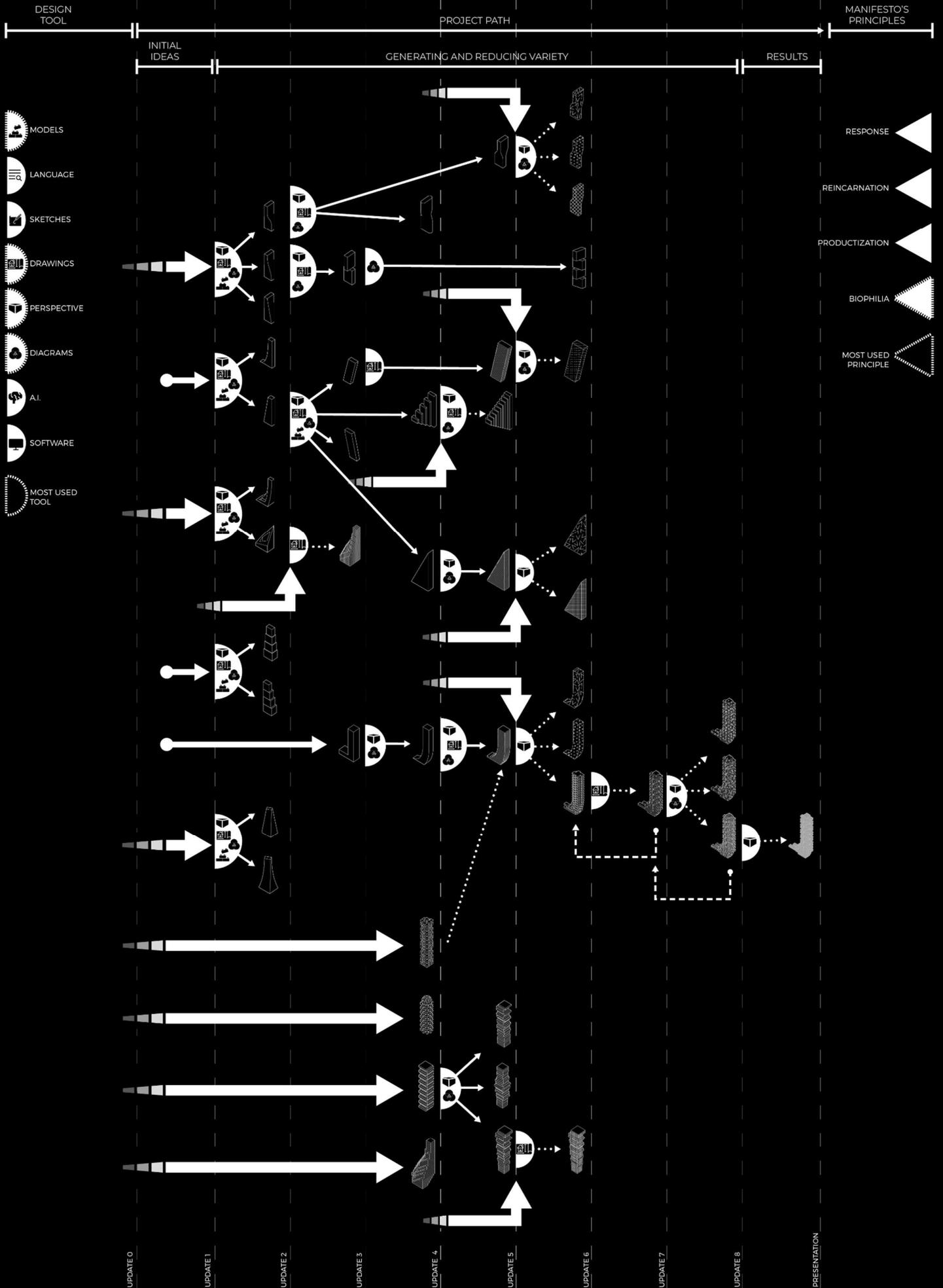
The consistency with the manifesto has emerged as a delicate point of the project development.

According to the paragraph "BIG's manifesto", it seems that the final products of BIG, are usually a strong expression of a maximum of two of the most meaningful BIG principles, and the same happens in the study case. This situation is critical because, if a project only pursues one goal at a time, the functioning of the manifesto as a complete vision of the project is lost.

In this case, the only strong value seems to be the one of biophilia. This proves a lack of attention and effort by the company to fulfill coherence.

This issue could be caused by several factors, such as the need for the company to be economically competitive and to produce attractive spaces and structures, but also that fact international companies must put together an army of people, some of whom may have not read, or better, analyzed them in depth the publication of BIG, and therefore could be not aware of the explicit goals that the firm has set for itself.

TAKEAWAYS

DESIGN TOOL   PROJECT PATH   MANIFESTO'S PRINCIPLES

INITIAL IDEAS   GENERATING AND REDUCING VARIETY   RESULTS

MODELS

LANGUAGE

SKETCHES

DRAWINGS

PERSPECTIVE

DIAGRAMS

A.I.

SOFTWARE

MOST USED TOOL

RESPONSE

REINCARNATION

PRODUCTIZATION

BIOPHILIA

MOST USED PRINCIPLE

UPDATE 0   UPDATE 1   UPDATE 2   UPDATE 3   UPDATE 4   UPDATE 5   UPDATE 6   UPDATE 7   UPDATE 8   PRESENTATION

VI.   ADAPTATION STRATEGIES

In the concluding chapter, an evaluation of the strategies that the company is putting into place to ensure its capability to evolve and to adapt to new needs of society is developed.

Environment related issues and the fast implementation of technology resulted being the topic more relevant in the company. These investments help the company to respond to present needs but also increase its capability to respond to future needs.

Most data used to develop in this chapter has been constructed based on two distinct questionnaires. The first was tailored for the management and operations team in conjunction with the partners, while the other was designed for the employees. This dual approach enables a comprehensive understanding of the company from diverse perspectives, shedding light on its strategies, their implementation, and the resultant impact on employees and their perception of the company's goals and objectives.

BIG's firm belief in life as a dynamic entity, subject to change over time, drives its commitment to evolution. This means consistently aligning with societal needs and tackling new challenges head-on with fresh, innovative approaches. To do so, the firm itself must undergo a process of evolution, consciously avoiding getting stuck in old habits and familiar territories.

This chapter delves into the strategies that BIG in general and BIG Barcellona are putting into action in order the keep the pace, or even better to anticipate, the needs of society, ensuring the company's evolution.

Two pivot areas of interest are sustainability and technology implementation. Investments in these sectors can have a major impact on the company's production and on the capability of professionals to deal with new challenges.

SUSTAINABILITY

As already mentioned, the construction sector exerts a profound impact on the environment across various stages of its lifecycle. Beginning with land consumption, construction projects often entail the conversion of natural landscapes into built environments, leading to habitat loss and fragmentation. This process disrupts ecosystems, diminishes biodiversity, and threatens the survival of plant and animal species. Moreover, the construction industry heavily relies on the exploitation of natural resources, including minerals like sand, gravel, and limestone, as well as timber and water. The extraction and processing of these resources contribute to environmental degradation, such as deforestation, soil erosion, and depletion of freshwater sources.

Energy consumption is another significant environmental concern associated with the construction sector. From the energy-intensive manufacturing of construction materials to the operation of buildings during their lifespan, construction activities contribute to substantial greenhouse gas emissions and energy consumption.

Furthermore, the demolition of buildings at the end of their lifecycle results in additional energy consumption and waste generation, further exacerbating environmental impacts. Overall, the construction sector's footprint on the environment underscores the urgent need for sustainable practices and policies to mitigate its adverse effects and promote ecological stewardship.

Recognizing the urgency of the situation, many governments are implementing measures aimed at increasing the sustainability of the sector and minimizing its environmental footprint. These regulations may include mandates for sustainable building practices, such as the use of environmentally friendly materials, energy-efficient design standards, requirements for waste management and recycling during construction and demolition, of the use of green certification. Additionally, governments may offer incentives or subsidies for developers and builders who adopt sustainable practices, such as tax breaks for energy-efficient buildings or grants for green building

projects. By implementing these regulations and incentives, governments are working to promote a more sustainable construction sector and mitigate its impact on the environment for the benefit of current and future generations.

From an ethical standpoint, prioritizing sustainability aligns with corporate social responsibility principles, demonstrating a commitment to environmental stewardship and societal well-being. By reducing their environmental footprint, companies contribute to mitigating climate change.

Companies that position themselves as sustainability leaders gain a competitive edge in the marketplace. By differentiating themselves through environmentally responsible practices, they appeal to environmentally conscious consumers, investors, and partners, enhancing brand reputation and market positioning. Additionally, being ahead of regulatory mandates allows companies to avoid potential compliance risks and associated penalties, while also capitalizing on early-mover advantages in emerging green markets.

According to the declaration published in "Yes is more", BIG seems to have anticipated the global urge to implement sustainability and now needs to keep pace with the development of new technologies and the current standards of sustainability.

The company is investing in this sector and looking from a new perspective at what they have done in the past, trying not to repeat the same mistake. Too often formalism has surpassed the environmental needs.

The sustainability department that was created years ago is currently passing through a moment of deep revolution with a worldwide reorganization. A new manager has been installed and is slowly moving to obtain a more efficient workflow, spread knowledge, and exploit at best the potential of such an influential company.

The company's strategy to reach sustainability works at two levels, one is on a global scale, and the other is related to the different studios around the world.

At the global level, BIG is spending time and resources to develop tools to facilitate the application of green principles.

One of the most efficient tools developed in-house is a Life Cycle Assessment (LCA). Like any other LCA tool, it helps to assess the overall environmental performance of a product or process and identify opportunities for improvement to minimize its environmental footprint. The potential of an in-house tool is the compatibility with the company workflow and favoring the introduction of the instrument into daily practice.

Another instrument that the company provides to its employees is a large set of grasshopper scripts which can help to quickly produce light, irradiation, shadow, views analysis, and many others. Each script is organized to maximize its usability to also

encourage people who are not familiar with the tools to experiment with it. For the same reason, each script is enriched with an instruction booklet.

Yet, the Department of Sustainability is understaffed and doesn't have the budget nor the time to properly support the enormous number of projects that are developed in BIG at the same time. Therefore, the strategy on a larger scale differs between each studio. In this sense, the way sustainability is developed in different countries is tightly related to the governmental regulation strictness and the market requests.

This situation is mainly caused by the never-ending battle between ethics and economic return, especially given the fact that this sustainability is not directly producing income and it is very difficult to quantify the indirect impact that they have on the rest of the company.

In this sense, it is evident how powerful the intentions of the governments are and how they can fasten the application of sustainable practices.

For example, in Europe, governments have been at the forefront of recognizing and addressing the environmental impact of the construction sector. With initiatives like the European Green Deal and the Circular Economy Action Plan, the European Union (EU) has set ambitious goals for reducing greenhouse gas emissions, promoting resource efficiency, and fostering sustainable development across all sectors, including construction.

In response to these imperatives, EU member states have been implementing regulations and policies aimed at enhancing the sustainability of the construction sector. For instance, the EU's Energy Performance of Buildings Directive (EPBD) mandates energy-efficient design standards for new buildings and renovations, aiming to reduce energy consumption and greenhouse gas emissions associated with building operations. Similarly, the EU's Waste Framework Directive sets requirements for waste management and recycling, encouraging the reuse of construction materials and minimizing waste generation during construction and demolition activities.

Moreover, the EU's Sustainable Finance Taxonomy establishes criteria for defining environmentally sustainable economic activities, including construction projects. This taxonomy provides guidance for investors, developers, and policymakers to identify and support sustainable construction initiatives, thereby driving investment toward projects that align with environmental objectives (European Commission, n.d.). In this environment not only, has sustainability become mandatory, but it is seen as an attractive investment.

Therefore, given the different levels of importance with which sustainability is perceived around the globe, BIG is focusing its effort on studios which, due to governmental and market pressure have a greater urge.

Consequently, offices, such as the one of BIG Copenhagen which mainly develops projects around Europe, are forced to produce extremely sustainable projects, or they would have lost a great share of the market.

In the case of BIG Barcellona, the topic has emerged as being underdeveloped.

The first cause of this situation is the fact the company is still in its initial years of production, but most importantly is related to the market where the studio is developing the majority of its projects: Saudi Arabia and the United Arab Emirates. These areas are currently experiencing great growth in the construction sector, with their market projected to grow from USD 70.33 billion in 2024 to USD 91.36 billion by 2029 for the former (Mondor Intelligence, 2023), and from USD 41 billion in 2024 to USD 50.40 billion by 2029 for the latter (Mordor Intelligence, 2023). Another characteristic of this, besides its fast development, is the low levels of sensibility, awareness, and legislation related to the environment. In this market, sustainability is not perceived as an attractive investment.

As a consequence, BIG Barcellona's production doesn't need necessarily to focus on this aspect to obtain investors' interest and to win competition and is currently taking time and exploiting this possibility to focus on other aspects of the project that are more valued by the investors, while waiting for adequate foundings.

In general, it has emerged a diffuse awareness of the low capability of BIG Barcelona to pursue sustainability values and their application in everyday practice (Employees, 2024). Nonetheless, the company realizes that this situation needs to change and that BIG has a responsibility toward society. Therefore, the firm should put sustainability first, regardless of the fact that it is requested by the client or not. Environmental strategies should be integrated into BIG's production of architecture and should be sold as an economically appealing solution, bringing positive outcomes both to the investor and the community.

In the case of BIG Barcelona, given the reduced budget at its disposal and the low immediate necessity of the implementation of sustainable projects, the dedicated department is setting the base for fastening the future implementation of sustainability, triggering the process from down to top, therefore with the direct involvement of employees and testing their willingness to learn and to question their production.

The first tactic put into action in this studio is to spread knowledge. To do so, several lectures covering different aspects related to sustainability such as LCA, Operational Emissions, and so on, are being held in person. Educating people about sustainability will speed up the integration of such strategies in the company in the years to come. Nonetheless, it will also help to eliminate the common belief that the initial stages of design are not as critical as later phases (Schematic Design - SD, and Design Development - DD). This prevalent perspective stems from the notion that most final

decisions are made in the later stages, while the primary aim of the concept phase is to provide a broad overview of how the project might evolve to succeed in competitions.

While it's accurate that during SD and DD, the project undergoes thorough development, necessitating architects to make critical decisions regarding technologies and materials, which are integral to achieving sustainability, introducing meaningful considerations earlier can enhance the efficacy of sustainability strategies. For instance, early decisions such as the massing or the orientation of a facade, can significantly impact energy consumption. Once a massing design is finalized, it becomes challenging to modify it in subsequent project phases, potentially compromising the structure's sustainability level.

An approach that has been experimented with in Copenhagen with great success is having mandatory LCA analysis from the initial stages of design. This allows having a more realistic proposal, but most of all to develop the architect's sensibility toward this topic, allowing in the future to make responsible decisions without the need of this tool. BIG Barcelona will introduce the same rule soon.

Nonetheless, during interviews, greater emphasis is consistently placed on professionals who demonstrate an interest in sustainability, particularly those who have already acquired expertise in this field. Recruiting individuals with such backgrounds catalyze the adoption of sustainable practices. As they apply their knowledge to project development, they also educate their colleagues.

TECHNOLOGY

It is evident that sustainability and technology are tightly connected, and it is almost impossible to separate the two aspects. The introduction of new tools and the implementation of an efficient script will help the company to increase its capability to produce sustainable designs. It wouldn't have been possible to realize the LCA tool or all the other scripts to do climate analysis if it wasn't for the parallel company interest in this department.

In general, investments in this field can yield numerous positive effects. Firstly, it enhances efficiency by streamlining design processes and increasing productivity. Secondly, it fosters improved design capabilities, allowing architects to explore innovative solutions and push the boundaries of creativity. Technology facilitates seamless collaboration among team members, consultants, and clients, promoting a more integrated approach to project development. It can lead to long-term cost savings by reducing errors and optimizing resource utilization. Lastly, investing in technology ensures adaptability to change, as studios remain agile and responsive to evolving industry trends and challenges.

BIG's technology department works as an international community that is constantly sharing information and opinions about new instruments or new ways to use already-

known tools. The communication channel of the department is always busy, and every employee can participate in the conversation and get updated with the latest news.

Besides this virtual community, each studio is provided with a proportionate number of employees who spend time developing support material to fasten and ease the life of the architects, and who focus on researching and learning new tools, to later share their knowledge with the rest of the company.

Also in this case, finding a direct way to measure the impact of this investment is very difficult, but still, the company believes in the relevance of this service and the necessity of being a leader in innovation application.

The technology department is focusing its attention, especially on developing scripts to stream the workflow of the company, therefore preparing a set of tools that will fasten the production, for example with scripts that given a line, can automatically generate 3D stairs compliant to regulation, or randomly selecting blocks to scale and rotate them to create variation, or again all the already mentioned instruments to evaluate sustainability.

Secondly, professionals are channeling their energy toward artificial intelligence. The research is mainly on image generator tools such as Midjourney, LookX, Magnific, and similar. The experts create small presentations where methodologies and the potential of the tools are explained to the rest of the company. AI potential is not yet fully exploited by the employees, who showed a general interest but a lack of real application in their everyday practice (Employees, 2024).

Other educational activities are guaranteed with in-person short lectures and with a shared platform where several tutorials are available. These pills of knowledge about tools and software are taught by other BIG employees, allowing to directly understand workflows, and approaches used within the company.

As these online lectures, named "BIG schools", are not sufficient to learn new software from scratch, in the next months, BIG Barcelona plans to introduce further full courses of different software.

The choice of the company to invest in departments that will not directly produce an earning is crucial and has multiple indirect consequences inside the company, although difficult to measure. In the case of BIG, both sustainability and technology could affect positively the design process helping the process of design development, for example, they could be exploited as a strategy to increase variety, finally helping to obtain the best possible proposal.

Nonetheless, technology will help to fasten the workflow. The method of BIG, which implies the development of a great number of options, is successful but could extremely become time-consuming. Introducing new tools in the project development phases
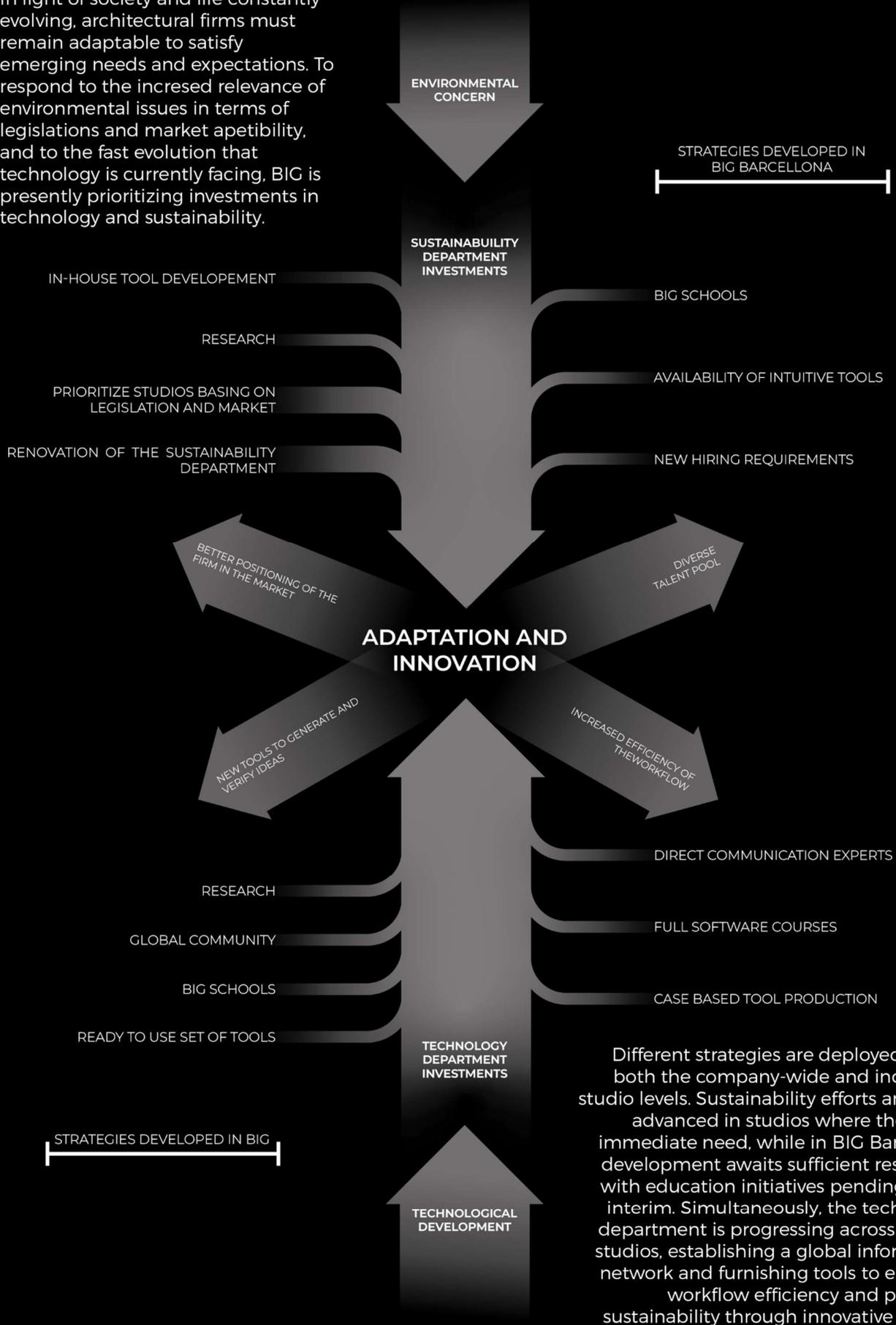
could speed up the whole process, finally allowing the employees to focus on what is more important and again, have better results.

Offering employees the possibility to freely develop their knowledge will help to create a talented pool of employees and a variegated asset of human capital. Fostering innovation and a culture of continuous learning and improvement.

These investments allow the company to respond to present needs, and to be ready to respond to what the world will need in the next years.

TAKEAWAYS

In light of society and life constantly evolving, architectural firms must remain adaptable to satisfy emerging needs and expectations. To respond to the incresed relevance of environmental issues in terms of legislations and market apetibility, and to the fast evolution that technology is currently facing, BIG is presently prioritizing investments in technology and sustainability.

ENVIRONMENTAL CONCERN

STRATEGIES DEVELOPED IN BIG BARCELLONA

SUSTAINABUILITY DEPARTMENT INVESTMENTS

IN-HOUSE TOOL DEVELOPEMENT

RESEARCH

PRIORITIZE STUDIOS BASING ON LEGISLATION AND MARKET

RENOVATION OF THE SUSTAINABILITY DEPARTMENT

BIG SCHOOLS

AVAILABILITY OF INTUITIVE TOOLS

NEW HIRING REQUIREMENTS

BETTER POSITIONING OF THE FIRM IN THE MARKET

DIVERSE TALENT POOL

ADAPTATION AND INNOVATION

NEW TOOLS TO GENERATE AND VERIFY IDEAS

INCREASED EFFICIENCY OF THEWORKFLOW

DIRECT COMMUNICATION EXPERTS

RESEARCH

GLOBAL COMMUNITY

FULL SOFTWARE COURSES

BIG SCHOOLS

READY TO USE SET OF TOOLS

CASE BASED TOOL PRODUCTION

TECHNOLOGY DEPARTMENT INVESTMENTS

STRATEGIES DEVELOPED IN BIG

TECHNOLOGICAL DEVELOPMENT

Different strategies are deployed across both the company-wide and individual studio levels. Sustainability efforts are more advanced in studios where there's an immediate need, while in BIG Barcelona, development awaits sufficient resources, with education initiatives pending in the interim. Simultaneously, the technology department is progressing across various studios, establishing a global information network and furnishing tools to enhance workflow efficiency and promote sustainability through innovative means.

VII. CONCLUSIONS

In conclusion, the culmination of this research journey illuminates the profound insights gleaned from delving into the design process in BIG and BIG Barcellona. Through rigorous investigation and analysis, this study has shed light on the company organization, its manifesto, the role of Bjarke Ingels as a starchitect, the way the design process works in the company and how the different tools are exploited, and finally the strategies applied to ensure the continuous evolution of the company.

The FAST GROWTH of the company in terms of size and relevance has been constantly sustained by successful architectural design. In 13 years, the company passed from a group of few people to a task force of 700 employees.

Different projects have marked the initial years of the company's production. Among the most influential results, is the VM HOUSE in 2005, which was the starting project of the company, but also the MOUNTAIN DWELLINGS in 2008, the 8 House in 2010, and Surperkilen in 2011. The success of these projects has been crucial to acquiring and maintaining international visibility fastening the growth process of the company.

The IMMEDIATE SUCCESS of the company allowed the company to expand around the globe quickly. In this scenario has also been opened the studio of Barcellona, which followed the same curve of growth passing from 4 people in 2019 to almost 70 people in 2023. The enlargement of the studio also had an impact on the INCREASED STRUCTURAL COMPLEXITY of the studio which passed from an informal organization to a hierarchical and well-defined structure.

A further crucial moment for the company's production has been the publication of its first book: "Yes is More". This written production is extremely relevant for the firm because it serves as its manifesto, in which the values and intentions of the architectural studio have been explained. Manifestos in architecture act as agreements between architects and society, aiming to establish universal propositions, which are supported by projects as evidence. Design proposals, therefore, form the basis upon which the manifesto's validity rests, rather than being mere products of its intentions.

The main goal of the company production is achieving "HEDONISTIC SUSTAINABILITY", which corresponds to a vision of architecture as a coexistence of the principles of sustainability and the pursuit of joy and pleasure. Nonetheless, in further publication, the concept of sustainability is further investigated. Further investigations allowed to better define what Ingels means with sustainability. The ideas of RESPONSE (adapting to the existing), REINCARNATION (ensuring the versatility of the structure to permit a possible second life), PRODUCTIZATION (production of modular elements that can adapt to different situations), and BIOPHILIA (introduction of vegetation in the built environment), are the pillars on which BIG intend to build their sustainable architecture.

While all the principles are extremely valuable and effective in terms of sustainability, some of them are more difficult to pursue due to the reduced economic return that they create, and therefore the little interest that investors will have on the topic. The most problematic strategy is the one or reincarnation, as it does not directly produce income, and therefore is not perceived as an attractive investment. Another controversial concept is the one of biophilia. The most delicate aspect of the application of this strategy lies in the fact that, if not properly implemented, it can be perceived as a greenwashing marketing strategy, with a great impact on the firm credibility.

The difficulty of creating an economically attractive structure while pursuing these values is reflected in the little coherence that the production of the company and its manifesto has and that has been proved through a methodological analysis of the project of BIG.

While most of the projects are related to one or two values of the manifesto, it is very unlikely to find a design proposal developed on all four pillars. Therefore, the efficacy of the overall intention is lost. Nonetheless, being projects the basis of the manifesto validity, the fact that BIG is not capable of respecting his promises toward society is extremely impacting on the firm's credibility.

The first chapter led to defining a company that revolves not only around the creation of exceptional architecture but also around the personality of its founder, Bjarke Ingels. In this scenario Ingels transcends the role of architect becoming a star, an icon, and an idol; he entered the world of the starchitect.

Literature showed that the three main requirements to become a starchitect, have been identified and then verified Comparing Ingels' career and life to those of past masters such as Rem Koolhaas, Frank Owen Gehry, and Frank Lloyd Wright.

As for any other successful professional, TALENT result being the first characteristic that brings together starchitects. This implies the capability of the architect to solve problems and produce high-quality architecture. But this is not enough the enter the restricted group.

This quality must result in a moment of great mediatic exposition: an EPIPHANY. For Koolhaas this culmination corresponds to the publication of Delirious New York, the construction of Santa Monica House for Gehry, and of Winslow House for Wright. In the case of Ingels, the Mountain Dwelling has been a crucial moment of exposition.

But again, having a moment of fame is not enough. Architects become examples to look up to, idols, and stars, only if they can maintain their EXPOSITION and stay at the center of attention for a long period. At this point, it is evident how different architects, depending on the time they lived in, the tools they had at their disposal, and their unique temperament, achieved this goal by exploiting different strategies and tools.

Koolhaas for example, quietly gained recognition, through the publication of books, delivering lectures, and through the exposition related to award-winning. He demonstrated a tendency to avoid interviews when possible and did not appear often at public events. On the opposite more eccentric characters like Write were strongly exploiting his image as a tool to construct fame, which was largely built on scandals and gossip.

Ingels has proved to respond to all the requirements to become a starchitect. Undeniable talented and charismatic, Ingels has maintained the fame acquired with his early projects with the PUBLICATION of books, delivering LECTURES AND INTERVIEWS, working in collaboration with famous BRANDS, and participating in FILMS and famous conferences like TEDx Talk, nonetheless winning numerous AWARDS. The application of all these strategies allowed Ingels to go beyond the little field of architecture, becoming a known figure among the whole population. Another defining characteristic of Ingels is his denial of the vision of architects as "misunderstood geniuses" (Bjarke Ingels Group, 2009). On the opposite, he built a strong PUBLIC IMAGE that relies on the ideas of being approachable, and relatable, nonetheless, with a friendly and down-to-earth demeanor, which communicates that he is accessible to the public, clients, and fellow professionals.

Having understood the relevance of BIG worldwide, the constituent values of architectural production, and the role of Ingels, the focus shifts on the tools and methodologies applied during the company design development, therefore understanding the general approach of the company and which strategies are put into place to trigger the mind of the architect to produce new and innovative design.

The detailed analysis of the firm's publications, Ingels's interviews, and direct experience in the office allowed to define BIG's methodologies and strategies and to understand which are the foundations of its theories.

BIG's project path result is a complex approach where Rittel's multi-step scheme, McLuhan's spiral thinking, Darwin's evolutionary theories, and Mendel's genetic laws merge.

Therefore, in accordance with RITTEL, BIG's design process set its foundation on processes of incrementation and reduction of variety. This process can be represented through Darwin's evolution tree where all options are developed through a process of mutation obtaining a great number of proposals. As for natural selection, only the most successful options will continue to be developed, while the weak ideas will be abandoned.

But, while the natural process of evolution follows only one direction due to the impossibility of escaping time laws, during the evolution of design architects have to possibility to take a step back, and rethink an option to improve it, keeping in mind what has been discovered in the meantime with a process of reiteration. This idea is

based on MCLUCHAN's representation of the artist's thought, which is moving back and forth in a circle in the X-Y plane, apparently without moving closer to the result, but is moving in the Z direction, which is the dimension one time. This emphasizes the iterative and multidimensional nature of the design process, where architects can revisit, refine, and evolve ideas over time, ultimately leading to improved outcomes.

The third level of complexity is introduced with the application of MENDEL's genetic laws in the architectural scenario. This translates into processes of crossbreeding and interbreeding, therefore putting together options of the same family or of different families to obtain a better proposal.

To fasten the project development BIG also introduces the idea of prototipization. the underlying principle suggests that robust design ideas possess the flexibility to adapt to their surroundings throughout the process. Consequently, it becomes feasible to create prototypes capable of versatile utilization, as they demonstrate an inherent capacity to adjust to diverse contexts and circumstances.

Having clear the design process of the company, it becomes imperative to delve into the generation tools exploited by architects to trigger this process and verify the validity of their design. The choice of the tools will nonetheless have a great impact on the company's results.

Among them, the most used generation tools are language, sketches, drawings, physical models, perspective views, diagrams, software, and Artificial Intelligence.

Bjarke Ingels doesn't view LANGUAGE as a generative tool in the design process; neither written nor oral communication is actively employed to develop ideas or assess architectural validity. However, language subtly influences the production at BIG. The company's habit of minimizing written text to essentials, termed a "passive approach," prevents architectural perspectives from becoming rigid. This approach is evident in the initial briefing process, where written text is condensed into graphical information to allow architects freedom in experimentation. Internally, communication also emphasizes minimal text, fostering varied interpretations among team members.

Yet, when disseminating innovative ideas, language strategies are actively utilized. Neologisms, portmanteaus, and metaphors are integrated into design concepts, such as "hedonistic sustainability" and "court-scraper," facilitating quick comprehension of the innovative company's approaches by the public. Despite the company's acknowledgment of language's power, it remains largely absent from the design process, foregoing the potential for abstraction and reformulation.

Also, SKETCHES result in being an underused generation tool in the company. The most relevant aspect of sketches is not the drawing itself, but the process of realization, the act, and the experience of drawing, which allow architects to process and develop ideas. The immediacy and impreciseness of sketches are fundamental features of

sketches and what makes them a great tool to foster new ideas and develop concepts. Frank Gehry and Bernard Tschumi are two of the numerous great fans of this instrument. Also, in this case, BIG undermines the potential of the instrument. Given the strong sculptural approach of the company, three-dimensional tools are preferred from the initial stages of the project.

DRAWINGS have emerged as indispensable for project development, serving as meticulous 2D representations of projects, drawings play a critical role in verifying functionality and communicating designs to stakeholders. Their geometric precision enables the evaluation of proportions and functionality, making them indispensable for architects. Despite their perceived completeness, drawings undergo abstraction and reduction, akin to the process of translating concepts into written or oral language. This simplification facilitates the organization and verification of ideas, particularly during the detailed development phase of a project. Moreover, drawings act as a universal language, transcending verbal, and cultural barriers, and serving as precise means of conveying complex architectural ideas. Some possible drawbacks of this tool could be impreciseness, oversimplification, and unfaithfulness when translating 2d drawings to 3d representations. Therefore, drawings have emerged as a universal tool exploited by all studios.

PHYSICAL MODELS serve various purposes throughout the design process, depending on the stage and objectives. In the initial phases, they aid in understanding context, experimenting with massing, and grasping proposal structures. Models, unlike computer simulations, ignite imagination and often lead to new ideas through errors and unexpected viewpoints. They also assist in visualization and decision-making during development phases. Later, models serve as persuasive tools for clients, offering a miniature preview of the final design. Different goals correspond to different scales, techniques, and materials; study models prioritize a general overview with flexibility and affordability, while final models prioritize precision and realism at a larger scale. However, despite their apparent realism, models are still abstractions of reality, subject to distortion with scale changes, a factor crucial to consider in the design process. Similarly to sketches, models are relevant not only for the result but for the process of model creation itself. In this delicate phase, architects can feel the materiality, experiment with shape, and encounter (also by accident) new solutions.

Given the robust sculptural approach of the company, models are extensively used tools throughout the design process of BIG. A great number of models are realized and used to visualize the proposal three-dimensionally, understand the relationship with the context, and have a more informed discussion about the proposal.

Despite significant investments in modeling, there are critical issues with how the tool is utilized. The model shop primarily relies on interns, while architects often avoid manual work. Consequently, experimentation with projects occurs solely through 3D software, with little involvement from those exploring materiality. This hierarchy

diminishes the model's role in massing comparison, neglecting crucial experimentation with space and material.

PERSPECTIVE VIEWS are indispensable tools in every design studio, offering vivid three-dimensional images that integrate geometric information from ground plans, elevations, and sections. While drawings emphasize scale and geometry, perspectives require an observer and reflect the three-dimensional effect of a design, providing viewers with a sense of immersion and connection to the architectural narrative. Despite criticism from classical Modernism, perspectives have evolved with digitalization, allowing for rapid experimentation and photorealistic simulations. Their dynamic nature encourages creativity and innovation in idea generation, while also facilitating development and verification phases by scrutinizing spatial relationships and aesthetic qualities. Ultimately, perspectives serve as powerful communication tools, transcending technicalities to engage viewers intellectually and emotionally. In summary, perspectives play a crucial role in architectural design, fostering innovation, facilitating development, and enhancing communication, making them indispensable in the design process. BIG as every other design studio greatly exploits this tool to control the project development.

In the case of BIG, the most characterizing instruments are the one of the diagrams and physical model, also due to the strong sculptural approach of the firm. Both tools allow the architect to experiment, see new opportunities, and develop the best design possible.

DIAGRAMS strongly characterize the firm's production, consequently, its style has also been defined as "Diagramism". For what concerns sketches and language's potential, it is not exploited at best. The firsts are only used as a three-dimensional representation of the options, but not as a moment of design experimentation; Language is mainly used to efficiently communicate and make presentations but is only passively used as a generation tool, consequently reducing its potential to narrow and broaden perspectives.

SOFTWARE and drawings are essential tools that every firm needs to develop the project. While the former has become essential to manage the new level of complexity that is expected in an architectural project, the latter guarantees efficient communication between the different parties involved in the process thanks to its role as a common language.

Despite its actual use being mainly image generation, the role of AI in the architectural process will slowly become more relevant.

The initial study has led to a deep understanding of the incredible success of BIG and its founder Bjarke Ingels, which has not been derived by randomness but comes from the perfect combination of luck, talent, and methodologies.

The following chapter functions as a verification moment where the theory thoroughly analyzed until now, faces the difficulties, and the inconveniences of reality.

From the perspective of the PROJECT PATH, it has been confirmed that the final design is the result of a series of mutation, crossbreeding, interbreeding, prototipization, and iteration processes. Mutations are extensively used due to the simplicity and intuitiveness of the process. Crossbreeding and prototipization instead are exploited to fasten the design process while keeping a strong identity. These last two must be used within a certain limit to avoid becoming flat and repetitive and ensure a strong connection between the proposal and its context.

BIG's approach of generating numerous design options within a short timeframe offers opportunities for exploring diverse scenarios and understanding spatial dynamics. However, this strategy also poses challenges, as limited time can lead to inefficiencies and superficial work. Architects must balance the quantity of design options with the need for thorough exploration and refinement to ensure satisfactory outcomes. Achieving this balance requires careful management by project leaders and associates.

For what concerns the use of GENERATION TOOLS the criticality that has been previously identified has been confirmed.

Diagrams, drawings, and perspectives are extensively utilized in parallel, allowing for comprehensive control over various aspects of the design simultaneously. However, the potential for experimentation and experience with physical models has been underutilized, as they are solely used as representations without exploration. The firm's approach to utilizing language, AI, sketches, and programs also falls short of their maximum potential. Language is minimized to avoid trapping architects in specific viewpoints, while AI remains unused due to time constraints and the rationality required for the project. Basic software like Rhinoceros, Illustrator, and InDesign are utilized, but simulation software is absent. The lack of utilization of sustainability tools in the initial stages of project development raises concerns about the firm's commitment to sustainability principles. While sustainability aspects may be addressed in later project phases, the absence of early consideration diminishes the effectiveness of the sustainability strategy and casts doubt on the company's dedication to this principle, as highlighted in the company manifesto analysis.

The final step is evaluating the coherence of the final proposal with the company's MANIFESTO which is based on four key principles: response, reincarnation, productization, and biophilia.

The principle of response, which involves adapting the design to specific cultural, landscape, and climatic conditions, is partially addressed in the project by considering

local housing typologies and materials for the facade. However, deeper integration with the surroundings is limited.

Reincarnation, emphasizing flexibility and adaptability in design to ensure longevity, is not adequately considered in the project. The focus is primarily on meeting immediate client needs and maximizing profits, overlooking long-term adaptability.

Productization, aiming for modular and efficient architectural elements, is pursued to some extent but results in excessive floor typologies, reducing efficiency. Economic interests often supersede sustainability considerations in decision-making.

Biophilia stands out as a strong concept in the design, with the incorporation of greenery contributing to sustainability objectives. However, potential drawbacks such as increased structural load and maintenance requirements need to be addressed to avoid accusations of greenwashing.

Overall, while some aspects of the company's manifesto are evident in the project, coherence with all principles is lacking. Economic competitiveness and the complexity of international projects may contribute to this inconsistency, highlighting the need for greater awareness and alignment with the company's stated goals.

The criticalities and potential of the methodologies or BIG have been thoroughly investigated, with the final understanding that while some choices are part of the company identity, others show a lack of diligence and interest by the company. Whilst non-exploited tools will slow down the process of design development and reduce the possibility of exploring different solutions, the most critical point remains the lack of coherence with the company manifesto. As said the capability of materializing values in their architectural proposal is essential to give validity to what is declared and promised to the public. If this coherence is not pursued, the manifesto becomes an empty declaration of intent, seriously affecting the studio's reputation.

Given the issues that have emerged and BIG's commitment to evolution is driven by its belief in life as a dynamic entity, prompting the firm to continuously align with societal needs and embrace fresh, innovative approaches, it is relevant to understand where the company is focusing to become more efficient and respond to the changing needs of society.

The construction industry has significant environmental impacts, including habitat loss, resource exploitation, and energy consumption. Governments are implementing regulations and incentives to promote sustainability in construction, aligning with corporate social responsibility principles. BIG recognizes the importance of SUSTAINABILITY and invests in tools and strategies to integrate green principles into its projects. However, the reduced budget at the disposal of the department forces the company to focus its efforts on the base of regulations and market demands. Therefore, while some offices prioritize sustainability due to regulations, others, like BIG

Barcelona, are taking time due to the low urge for the introduction of green policies. In the meantime, the company is indirectly facing the issue through the implementation of KNOWLEDGE dissemination changing the RECRUITING REQUIREMENTS giving more relevance to professionals with sustainability backgrounds.
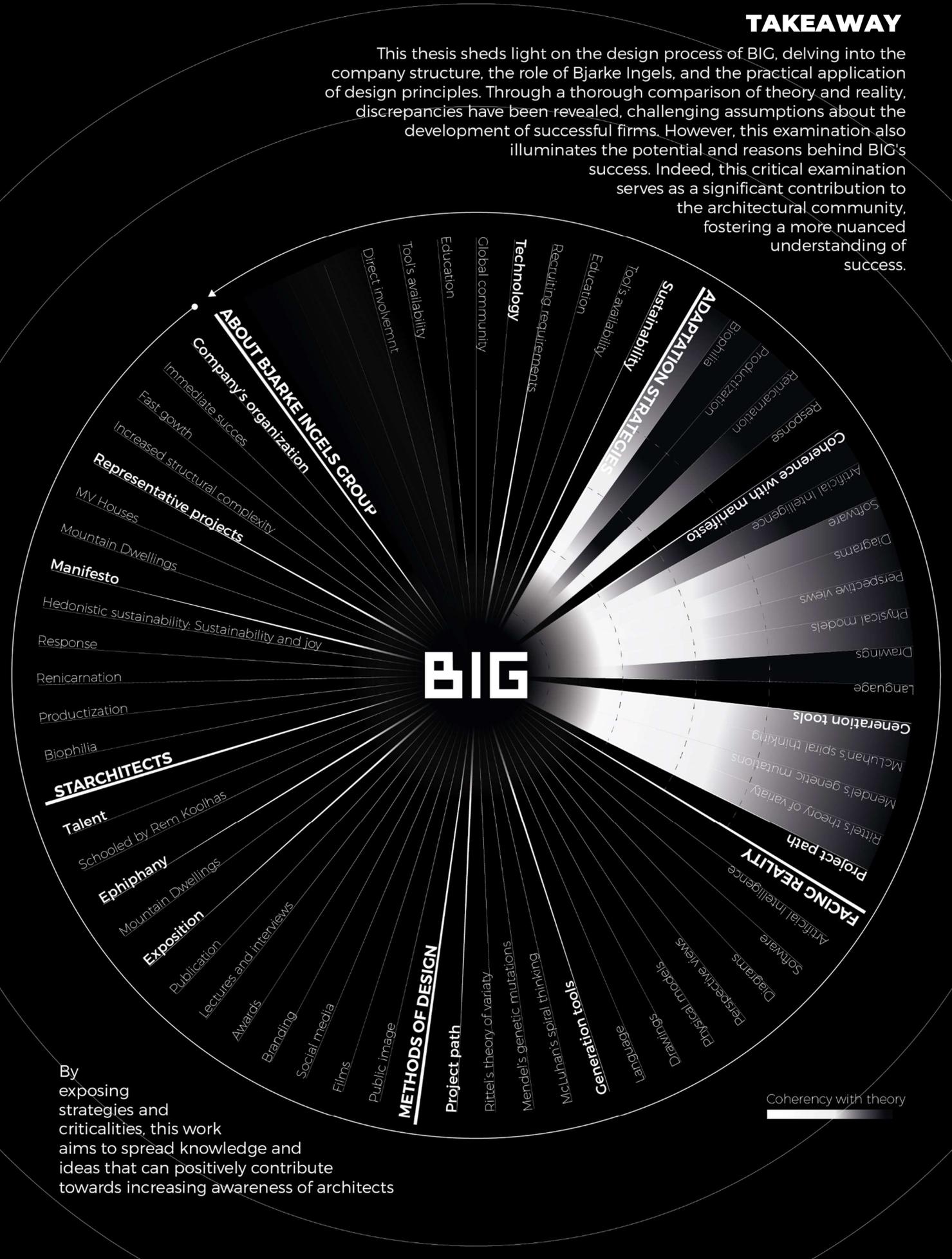
Sustainability is also tightly connected with the other principle focus of the BIG: technology. With the development of different tools and continuous research of the latest software in the market, the company is trying to increase its capability of producing sustainable designs.

Besides the aspects related to sustainability, the technology department is structured as a GLOBAL COMMUNITY with representatives in each studio. The communication and exchange of opinions, and research results are constant. Nonetheless, professionals are constantly spreading KNOWLEDGE among employees through lectures, presentations, and DIRECT INVOLVEMENT. Nonetheless, an online platform full of short tutorials produced in-house is provided. On top of this, BIG Barcellona will soon provide its employees with free access to full software courses.

BIG's strategic investment in both sustainability and technology underscores its commitment to remaining at the forefront of innovation in the architecture and construction industry. By intertwining sustainable practices with cutting-edge technological advancements, BIG not only enhances efficiency and productivity but also fosters a culture of innovation and adaptation. This proactive approach ensures that BIG remains agile and responsive to emerging societal needs while also positioning itself as a leader in sustainable design and technological innovation. As technology evolves at an unprecedented pace, companies like BIG must continue to invest in these areas to not only meet current demands but also anticipate and shape future trends.

This thesis sheds light on the design process of BIG, delving into the company structure, the role of Bjarke Ingels, and the practical application of design principles. Through a thorough comparison of theory and reality, discrepancies have been revealed, challenging assumptions about the development of successful firms. However, this examination also illuminates the potential and reasons behind BIG's success. Indeed, this critical examination serves as a significant contribution to the architectural community, fostering a more nuanced understanding of success.

BIG

ABOUT BJARKE INGELS GROUP
Company's organization
Immediate succes
Fast gowth
Increased structural complexity

Representative projects
MV Houses
Mountain Dwellings

Manifesto
Hedonistic sustainability: Sustainability and joy
Response
Renicarnation
Productization
Biophilia

STARCHITECTS
Talent
Schooled by Rem Koolhas

Ephiphany
Mountain Dwellings

Exposition
Publication
Lectures and interviews
Awards
Branding
Social media
Films
Public image

METHODS OF DESIGN
Project path
Rittel's theory of variaty
Mendel's genetic mutations
McLuhan's spiral thinking

Generation tools
Language
Drawings
Physical models
Perspective views
Diagrams
Software
Artificial intelligence

ADAPTATION STRATEGIES
Sustainability
Tool's availability
Education
Recruiting requirements
Technology
Global community
Education
Tool's availability
Direct involvemnt

Biophilia
Productization
Renicarnation
Response

Coherence with manifesto
Artificial Intelligence
Software
Diagrams
Perspective views
Physical models
Drawings
Language

Generation tools
McLuhan's spiral thinking
Mendel's genetic mutations
Rittel's theory of variaty

Project path

FACING REALITY
Artificial Intelligence
Software
Diagrams
Perspective views
Physical models
Drawings
Language

Coherency with theory

By exposing strategies and criticalities, this work aims to spread knowledge and ideas that can positively contribute towards increasing awareness of architects

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