LEGO Architecture Studio - create your own architecture
CREATE YOUR OWN
ARCHITECTURE
Introduction

Welcome Page 4

Architecture and Creative Play Page 8

The LEGO® Brick in Architecture Studies Page 14

Introducing Builds and Creative Sessions Page 20

The Architects

REX Architecture:
Getting Inspired Page 29

Hands-On Exploration: Scale Page 70

REX Architecture Workshop Page 74

Sou Fujimoto Architects:
Researching and Sketching Page 81

Hands-On Exploration: Space and Section Page 102

Explorations within Projects of Sou Fujimoto Page 106
From the time the very first two LEGO® bricks were put together over 60 years ago, kids all over the world have been building houses, fire stations, and imaginary buildings with wings and wheels. One brick at a time, each brick inspires you to continue building, inviting you to find the next brick that will shape what you otherwise only imagined, and it goes on and on until you say, “This is it!”
Have you ever wondered how the buildings that surround us were created, why they were built, where the ideas regarding their function or aesthetics came from, or questioned the journey that led a group of people to make the decisions that resulted in a building becoming what it is? Design is not a coincidence or a formula; it is a result of human reflection and vision in response to a specific challenge.

Together with six architectural practices from around the world, we invite you on a journey into the world of architecture, the world surrounding us, our homes, our schools, offices, and public buildings. Everywhere we look, architecture has made its mark and will continue to shape the world around us in the future. You will see the steps of the design process and learn about the thoughts that go into a final building design. You will come to understand that there is not just one way to design a building: there is a red thread that goes through all of the architects' work, from the first brief to a final presentation.
The LEGO brick is the perfect tool for exploring the ideas of architecture, using your hands and your imagination together. So this is more than a book: it is an invitation to a hands-on experience that will allow you to explore the ideas and principles of architecture with the LEGO brick. Get a feeling for the built environment by building it yourself—and then share your ideas with the world.

Maybe one day an aspiring young architect will look at your building and think, "I wonder why it was designed to work like this?" or "Why did the builder choose these materials?"

We hope that through this book you will be inspired and enlightened and that you will share your experience with us, so we can make it even better.
Frank Gehry—the Pritzker prize—winning architect behind the Guggenheim Museum in Bilbao, Disney Hall in Los Angeles, and the Manhattan skyscraper, 8 Spruce Street—laments the loss of “creative play” in the architecture profession. As a child, growing up in Toronto, Canada, Gehry was encouraged by his grandmother to build miniature cities and imaginary houses out of off-cuts of wood salvaged from his grandfather’s hardware store. It was the happy memories of these play sessions that inspired him to take architecture classes. Gehry defines “creative play” as “letting one’s intuition express itself, but in a knowledgeable, not haphazard way” and this playful spirit is an integral part of his working practice, which involves modeling with coloured wooden building blocks, not unlike outsized LEGO® bricks, that allow him to experiment with space, scale, and volume.

Plato advised that future architects should play at building houses as children, and, indeed, most architects learned the laws of gravity, physics, engineering, and omnipotence playing with construction kits. LEGO bricks and Erector and Meccano sets allow children—and adults—to create an infinite range of structures that explore form and test the limits of stability. Construction sets, which have a long history, were originally conceived in the eighteenth century as “philosophical toys”: they were intended not only to amuse but to serve an important educational purpose. In so doing, they played a crucial part in shaping the modern world.
“Construction sets played a crucial part in shaping the modern world.”
“These toys were the building blocks of modernism.”
It is no coincidence that Frank Lloyd Wright, Le Corbusier, and Buckminster Fuller were all taught in kindergarten the school system that introduced building blocks into educational play. These simple forms reveal the first traces of modernism—the start of a relationship between architecture and creative children’s games that continues to this day. In *Inventing Kindergarten* (1997), the New York sculptor and architect Norman Brosterman argues that the pedagogical tools used in the second half of the nineteenth century might be interpreted as having laid the ground for geometric abstraction in art and architecture. Brosterman convincingly shows that the 20 “play gifts,” or architectural toys, used by the German educator Friedrich Froebel to teach children an appreciation of abstract patterns were the building blocks of modernism.

Frank Lloyd Wright, Le Corbusier, Buckminster Fuller, and many other members of the architectural avant-garde went to kindergarten schools and played with Froebel’s geometric toys. They sat at special gridded desks where they experimented with knitted balls, building blocks, colored sticks, rings, mosaic tiles, and a rudimentary construction set made from toothpicks with dried peas for the joins. Froebel drew plans for educational tools that implicitly foreshadowed the actual buildings that Wright, Mies van der Rohe, Adolf Loos, and Le Corbusier would design when they grew up.

[Construction sets from the collection of author Douglas Coupland. Image courtesy of Douglas Coupland]
In his autobiography, Wright, who went to a kindergarten school outside Boston, and whose mother trained as a kindergarten teacher, acknowledged the profound influence this education had on him. He was taught not to copy nature but to appreciate the basic forms hidden behind appearances. “For several years I sat at the little kindergarten table,” Wright wrote. “The smooth cardboard triangles and maple-wood blocks were most important. All are in my fingers to this day. . . . I soon became susceptible to constructive pattern evolving in everything I saw. I learned to ‘see’ this way and when I did, I did not care to draw casual incidentals to Nature. I wanted to design.” Wright wrote that these toys directly informed the organic abstractions and clean geometric lines found in his buildings and the regulating grids of their plans.

It is no surprise that these structures, with their careful balance of interpenetrating forms, lend themselves to being reimagined as architectural toys: you can now buy a kit that enables you to build his famous Fallingwater in LEGO pieces. ICON, the architecture magazine that I edit, asked several leading practices to take this set, or others from LEGO’s architecture series, and rebuild them in their own fashion: Foster and Partners fused Fallingwater with the Empire State Building to create a sustainable tower with a series of hanging gardens; FAT laid the pieces from the Wright model out as a city grid; ATMOS melted it in the oven in response to Wright’s suggestion that architecture would “bring out the nature of materials.” They showed that the fun of LEGO was that, deviating from the plan, you could make anything you liked—exactly the premise of the new Architecture Studio Set.
It is this spirit of playful curiosity and childish excitement that carries over into the most innovative buildings, which we celebrate here in this book. While some of the architects included in this volume, such as Moshe Safdie (with Habitat 67) and Winy Mass (in MVDRV's Oslo bank HQ), have experimented with LEGO models in their practices, most use other tools. But they all acknowledge the importance of what Gehry called "creative play" in the process of design, and celebrate LEGO, with its inherent abstraction and modularity, as a creative tool. In fact, many of the buildings by architects featured here—REX's Museum Plaza and Tham & Videgård's Humlegården Apartment—have been compared to LEGO, and the Dutch architect Herman Hertzberger has likened the current trend for pixelated towers, particularly in Asia, to structures made of LEGO bricks.

The childhood experiments with LEGO undertaken by the architects of these buildings, it seems, continue to leave their mark. LEGO is a way of thinking, as well as being good to think with, especially in the early stages of design. Santiago Calatrava, for example, who had a voluminous toy box as a child, still plays with architectural toys as he looks for inspiration for his bridges and skyscrapers. "My approach to design begins with the creation of toys and games," Calatrava has said, "that can give plastic expression to the principles of statics."
Dutch architect and city planner Winy Maas, who once worked for Rem Koolhaas, is one of the founding members of the Rotterdam architectural consortium MVRDV, established in 1993.

In 2012 MVRDV’s research arm, The Why Factory, in collaboration with Master’s-degree students at the Delft Institute of Technology and architectural studio KRADS, created a model of Europe with hundreds of LEGO® pieces. Porous City, an exhibition of 676 LEGO towers at a scale of 1:500, was exhibited at the 13th International Architecture Exhibition in Venice, which had the theme “Common Ground.”

When did you have the idea for the grand, experimental project with LEGO that you exhibited at the 13th Venice Biennale?
The idea came about in 2011 when I visited Reykjavik and met KRADS, a young architecture group based in Denmark and Iceland, some of whom had been working in our Rotterdam office. After the lecture I gave there, they led a workshop that used LEGO to explore form finding: at that moment I think the Pixel Towers project was born. We would use LEGO to create an exhibition showing a series of studies based on the brick’s modules. So we developed it immediately.

What was the brief you sent your students at the Faculty of Architecture of the Delft University of Technology when you began the tower series?
We started with a dichotomy—void and mass—and what followed was a series of studies exploring that. We began with a porous tower; we wanted to imagine how towers could be more open or more European, as we called it. We analyzed the traditional American tower, which seemed to be only about commercialism, and looked at other towers on the other side of the planet, in mainland China or India, where housing typologies were leading to simple extrusions, with the same floor plan everywhere.
The LEGO® Brick in Architecture Studies: The Pixel Tower projects with The Why Factory and Winy Maas
“We built a selection of the towers much bigger so that you could experience their scale.”

So, we could imagine that opening the towers up would be more ecological and social and would enrich the tower typologies. Maybe this would lead to a situation where towers might become more urbanistic and be used for more things, not only as an answer to density. In our first exercise, we started by simply asking students to make the towers more ecological or more social, and they came up with stairs, with landscapes, with grottoes that perform as improvements in the quality of collective spaces. They came up with a variety of sequences. It’s a very beautiful series, I think.
At the Venice Biennale you exhibited these as a gridded city of 676 miniature towers. What did you hope to learn from these iterations?

I noticed that MVRDV had been engaged in revisiting the tower typology for a long time. In the Mirador, a 22-story tower in Madrid, for example, we opened up the tower by having a big central void in the middle of it, transforming it into a large, open-air balcony with fantastic views. Or in the Celosia tower after it, also in Madrid, a city block divided into 30 apartment buildings arranged in a checkerboard pattern, we made gardens on every floor, opening up every apartment to the wind and light. We see a lot more hollow towers now, like Rem Koolhaas's CCTV in Beijing, and towers by the likes of Peter Eisenman. This seemed worthy of attention—it seemed like a subject or topic to explore.

At BODW (Business of Design Week) in Hong Kong you exhibited nine larger towers. What issues did you hope these might address?

We built a selection of the towers much bigger so that you could experience their scale. We added detail in these big towers and, not unimportantly, post-scripted them, to show the relationship between, say, the degree of porosity and the size of the tower, so that we could balance out these parameters. We hope to do further investigations on the relationships between porosity and the percentage of openness, and the sculptural, aesthetical, and functional effects this has.
Why is LEGO good as a design or sketching tool? Why is LEGO good to think with?
I know there are limitations, but in this case the pixelization inherent in LEGO helped—it was the proper material to explore these ideas with. And second, it's fast; if it's not working, you can kill it and rebuild it relatively fast. Third, people know the material because everyone has grown up with it; they like the towers because they are playful, they have an element of joy in them that makes even the most serious research more bearable—so the psychology behind it is very useful. This is perhaps why our research has spread over the Internet so much, which indicates the love people have of this kind of enterprise. Last, but not least, the constructions are very aesthetic: put a puppet next to them and the form suddenly becomes a building. LEGO allows you to fantasize: you see a building in it but it is not completely determined. There is a high degree of abstraction to it. My students love working with LEGO because you can build models very rapidly and do tests and it's relatively cheap when you compare it to 3D modeling, which is still very expensive.

Your project at Silodam, an apartment block in Amsterdam's dock area, was compared by the New York Times to “a child's giant LEGO construction.” Do you use LEGO models in your MVRDV's creative process?
We did use LEGO in the office when we worked on the DnB NOR building in Oslo, a 17-story bank headquarters on the Bjørvika waterfront that had this pixelization requirement that LEGO helped us to create. That project will be open early next year. But before then, no, I'd have to go back to my childhood. How could you avoid using LEGO as a child? In fact, initially my parents had another kind of building system, Bambino, the Italian toy, but my cousins had LEGO and I played with LEGO when I visited them there. This left its mark.
“The constructions are very aesthetic: put a puppet next to them and the form suddenly becomes a building.”
Throughout the book, we will demonstrate how you can explore the parameters and design process in architecture with the LEGO® brick, through hands-on exercises.

Every project starts with an architectural brief. The brief becomes the guide for the entire project and can evolve during the initial stages. A good brief can be very detailed, defining the program and material, or it can be very open, where architect helps to shape project requirements.

The creative journey starts with understanding and exploration. One can start developing ideas by setting two bricks together. A very simple structure could become a house or an environment around it.

From the pile of bricks to the concept and final project sketch, there could be different paths. The book will take you through the main stages of the architectural process: from defining your project, gathering inspiration, and exploration of the context, to researching and sketching, and developing your concept with your final presentation.

The idea presented here shows how just a few bricks can become a family house concept.

You will find additional examples created by architects and LEGO designers that will explain some of the important design parameters.

Create your own architecture.
Abstraction

How can we use various sources as inspiration in the design process?

A simple, and basic method of dealing with inspiration is doing the abstraction. Choose an image you find inspiring, like an object, a site, or maybe even a topic or a feeling you have. To abstract means to “draw away.”

Take important features from your source of inspiration and try to express them in LEGO® sketch-models. What are the elements that inspire you?

If you look at the mountain, you might find the silhouette of a mountain inspiring. Then start building the LEGO sketch-model by representing the silhouette in LEGO bricks—thus making your abstraction of a mountain landscape.
Let's start the exercise:
The first step is to choose the inspirational source. In our example we look at a bird.

1

Make a number of simple sketch-models with the LEGO bricks that express your inspiration.

2

Select one of the sketch-models and add more details to it. Or choose to combine two small sketch-models together.

3

Now, think of an architectural object—and rebuild your sketch-model. Is it a building, a design object, part of the city?
Imagine how your sketch-model turns into an architectural project. Imagine its function, the site, or other specific features.
REX ARCHITECTS: GETTING INSPIRED
REX was originally founded by Joshua Prince-Ramus and Rem Koolhaas as OMA New York, the Manhattan branch of Koolhaas’s Office for Metropolitan Architecture based in Rotterdam, the Netherlands. Prince-Ramus was the project architect for OMA’s iconic Seattle Public Library, praised by New York Times critic Herbert Muschamp as “the most exciting new building it has been my honor to review in more than 30 years of writing about architecture,” as well as the Guggenheim, Hermitage, and Las Vegas Museums. REX operates across many scales, consistently challenging and advancing building typologies, and believe that by proposing novel solutions architecture can socially engineer and change the way we do things for the better. They hope to show this in buildings such as the Wyly Theatre in Dallas Texas, which radically rethinks the traditional architecture of the stage, and Museum Plaza, a 62-story mixed-use development and art center in Louisville, Kentucky.
Investigating typology

REX is a practice that's very inspired by inventing, reinventing, challenging, and questioning typologies. From a process standpoint, that means we don't start with a blank piece of paper, or a walk, or an image of a bird lighting on a fence that inspires us to make a building that has moveable wings. There is much more perspiration than inspiration in the way we work. We dig into a particular problem with a client to understand what their issues are. The largest obstacle facing clients and architects is their failure to speak a common language. We spend time identifying the core questions they face, and establish shared positions from which we can collectively evaluate the architectural proposals that follow. We design collaborations, rather than dictate solutions.
Typology refers to building types: a theater, an opera house, an airport—an organization of built functions around which there is a whole host of conventional thinking. People presume there is a set way that they should be arranged and look. Our observation is that, sadly, many, many parts of any given type are not being refreshed and looked at anew by architects. However, libraries, museums, and exhibition halls should have completely changed because of a new demographic, a new technology, new ways in which people do research, or new kinds of energy or whatever, but they don’t. Human beings are incredibly prone to accepting poor conditions and in fact very often you can put a much more responsive solution in front of someone and, because it doesn’t look like what they know, they revile against it.
“We talk a lot in our practice about looking at a certain problem or situation with critical naïveté.”

Unprejudiced by convention or a preconceived aesthetic strategy, we return to root problems and doggedly explore them with a critical naïveté. We start by working very closely with our clients, by simply asking questions, by visiting other existing examples or precedents of what they’re asking us to design, by doing an in-depth analysis of what their programs are, by trying to get to the route of what turns them on and what scares them, what they would like to do but feel they can’t. We try to act like a really focused mirror; at times it feels like taking them through psychoanalysis. And very often we discover that there is a lack of fit between what a client says they want, versus what they need, which enables us to suggest new ways of doing things.

[All photos, courtesy of REX]
“If you really go back to first principles by investigating types, doing everything you can to avoid conventional reactions, you will arrive at something that is totally unexpected.”

If you really go back to first principles by investigating types, doing everything you can to avoid conventional reactions, you will arrive at something that is totally unexpected—a one-off response to a set of economic conditions, a client, a site, a budget, a moment in time—a novel conclusion that you simply could not have conceived as an inspiration. Novel may not be the right word: sometimes a conventional approach is the best. When you go back to first principles you will reaffirm what has been done before, but you do it with real conviction now because you know why you’re doing it. Sometimes we discover uncharted territory; sometimes we rediscover forgotten territory that has renewed usefulness; sometimes we reaffirm conventions with assured conviction. Through this process, we expose solutions that transcend those we could have initially or individually imagined, and aspire to produce designs so functionally specific that they offer profoundly unique aesthetic experiences.
For most contemporary architects, the agenda is formal. REX, however, is fundamentally driven to challenge and advance typology; we feel it’s time for architecture to do things again, not just represent things. Many people are not aware of the fact that architecture can actually change things: it can actually socially engineer and really transform the way a person does research (the Seattle Central Library); it can change the way that a person experiences suspension of disbelief in a theater (the Wyly Theatre in Dallas, Texas); it can really change how people collaborate in a design studio of a fashion house (the Vakko Fashion Center and Power Media Center in Istanbul, Turkey).

“We feel it’s time for architecture to do things again, not just represent things.”
**Brief:**
Design a Public Library in the heart of downtown Seattle. A library for the 21st century—an era dominated by many forms of media. The library shall include a variety of spaces for book storage, the public, librarians, meeting and reading rooms, and an auditorium.

In 1999, when we started the Seattle Central Library project, Seattle as a tech empire was exploding and there were a lot of very wealthy, educated people who were questioning why anyone would build a library at all. The Internet was booming, Amazon was booming, there was a lot of technology that was demanding that people rethink the role of libraries. Why spend $111 million for a physical building to put books in when others were investing billions in trying to make the book obsolete? And so, we asked the question: How can the building adapt to its new condition?

“**Their mission statement and building program didn’t jibe.”**
Analyzing the client's needs, we discovered that the library's social responsibilities were getting short shrift as opposed to the explosion of media—they believed their primary job was to provide access to information—but, when we were doing an analysis of the library's program, they had dedicated two-thirds of it to social responsibilities and only one-third to media. So that was an opportunity for us to point out that their mission statement and building program didn't jibe. Either their building program was radically wrong, or they'd changed but were unable to recognize it.
Central Library,

"If we were to push half of their mission out of the building, then it would be a poor building."

Many of the newly built libraries we visited were generic and uninspiring, rather than inviting. Because libraries didn't recognize they had two simultaneous responsibilities, the media areas were swallowing up and pushing the social areas out of these buildings, creating bland results. That would be fine if that was what our client wanted, but their own program suggested that was not true. If we were to push half of their mission out of the building, then it would be a poor building.

We also looked at the role of the physical library in the digital age, an age where information can be downloaded onto your handheld phone—and the information that is accessible is exploding. Our feeling was that the role of the library was to curate information, not just to provide access to information. Of course it had a value for the people who were on the wrong side of the digital divide and did not have access to that technology and were therefore becoming ever more disconnected. It also had a responsibility for the general public to be able to curate and to help them understand and navigate through the incredible abundance of information now available.
If you study a problem with critical naïveté you will come up with a solution that has not been seen before and is pretty radical and very exciting both in the way it performs but also architecturally. In terms of librarians being curators, we had to get them in the same place rather than being scattered all over the building in fiefdoms. What you need is a bunch of different librarians with different expertise helping you refine what you’re actually looking for. Our emphasis was that the single most valuable resource of the building was actually the staff, not the books, and we had to get the staff collected in an area where they could work on a patron collectively.

“If you study a problem with critical naïveté you will come up with a solution that has not been seen before.”
“We created this book spiral using technology familiar to most of us in the parking garage.”

To do that we had to make the book collection incredibly easy for a patron to self-navigate, so we also challenged the libraries on all their book categorizations. Why do we have these classification systems—Humanities, Literature, Non-Fiction—that obfuscate the search rather than facilitate it? So we agreed ultimately to arrange the library’s 1.5 million books in a linear, numbered ribbon. We took that ribbon and wrapped it up in a
spiral that covered the equivalent of four city blocks. We created this book spiral using technology familiar to most of us in the parking garage, a structure that we discovered can perfectly accommodate the expansion and reorganization of books. It also happens to be really cool from an experiential and navigational standpoint. You enter the books and you’re in a continuous loop. The elevators are marked with the call number you need, so when you press a button it takes you directly to that floor. It’s very straightforward. People also stumble across books that they weren’t looking for but find interesting. This building has seen checkouts increase by 250 percent.
“We showed that a lot of conventions aren’t rational, they’re just conventions.”
The Seattle Central Library has challenged the way librarians do things. It provides an architectural solution that rethinks the way libraries have functioned for hundreds of years. It solves the problem of how libraries should put their most important resource—the staff—front and center, rather than having to degrade them into being runners to help you find something. Most librarians have PhDs but spend 80 percent of their time helping you to find a book! We showed that a lot of conventions aren’t rational, they’re just conventions.
Museum Plaza,
Louisville, Kentucky
Brief:
Create a building complex that will host an office tower, a luxury condominium, a hotel, and a contemporary art museum. The complex should relate to downtown Louisville as well as the Ohio River, and sit in the 100-year floodplain of the river.
Illustrating the program with the LEGO bricks

Mixed-use building:

[LEGO® developed illustration]
In Museum Plaza we were addressing two typologies at the same time: one was the contemporary art institution, the other was the large mixed-use project. In terms of the contemporary art institution, our client, a husband-and-wife team of sharp collectors, very clearly articulated the problems of most contemporary museums. They said, "What we want is a space where contemporary artists aren’t mummified. Artists don’t want to be in a white box, they want to operate in the real world." In Brooklyn’s PS1, for example, the artist William Kentridge hangs his work in the staircase to avoid this problem. They wanted to create an institution in which everyday life interacted with the art. They also wanted to create a development concept where the other buildings, a for-profit development, would create an endowment for the 3,500-square-meter art center. Though they had enough money to build the institution outright, they realized that for its continued success it needed an endowment equal to that amount. It was a supersmart model.
The two typologies interestingly enough went hand in hand: from a development standpoint we had to come up with an idea that was still exciting visually but ensure that each component of the building was as cost-effective as possible, excluding the contemporary art institution. There were two hotels, two luxury condo towers, and an office block. So we had to come up with a way in which each one of those things was incredibly efficient, was relatively inexpensive to build, and perfect in terms of saleability or leaseability. And so what we did was work with a developer and the banks, asking them what was the easiest thing for them to finance, what floor plate was the best for them to lease, the perfect size of condo units for them to sell in the current market, and furthermore, the kinds of things that scared them about a 1.5 million-square-foot development.

“We had to come up with an idea that was still exciting visually but ensure that each component of the building was as cost-effective as possible.”

[All photos and illustrations, courtesy of REX]
“The end product looks like someone made a 1.5 million-square-foot building out of LEGO® bricks!”
We found that if we kept each one of the components of the building discrete, if we took each block independently and got a different bank to finance it, we could make each as efficient as possible. But when we aggregated the five blocks into the total form, it was like nothing anybody had ever seen before. But, because of our research and clear definition of programmes, we had total buy-in from the people who were going to finance the project. However, it resulted in something that was radically unusual and exciting. If I'd just sketched the final arrangement they would have looked at me and said, "You're out of your mind and you're fired." The end product looks like someone made a 1.5 million-square-foot building out of LEGO® bricks! It has unbelievable cantilevers and towers and things, and when people praise or criticize it they often talk about it looking like LEGO. Somebody described it as looking as if we'd put a Mies van der Rohe tower into a blender.
“It's a vision that is about maximizing performance.”

Museum Plaza, Louisville, Kentucky

Once we had the component parts, we could put them in many different configurations. The one that we picked was the one that we both thought performed the best but was also the one that was the most beautiful. It's an imposition of a vision but it's a vision that is about maximizing performance. Responding to the very unique conditions of the project constraints led to very unusual and interesting pieces of architecture, as opposed to mandating an individual aesthetic that you think should be imposed on the world. It would be very difficult to put our buildings in a line and say that they've been created by the same hand. There is a recurring attitude towards architectural challenges, rather than a recurring vocabulary used to solve them.
Brief:
Design a new theater for the Dallas Arts District Theater (ADT). The new theater should be flexible, adaptable, and easily reconfigurable, enabling the performers and directors to change the theater setting regularly to accommodate their artistic vision.

Wyly Theatre,
Dallas, Texas
“The traditional thinking is that the stage and the seating is set and the architect’s job is to put window dressing around it.”

**Wyly Theatre, Dallas, Texas**

The Wyly Theatre is also a good example of challenging a type. With theaters the traditional thinking is that the type itself, the stage and the seating, is set and the architect’s job is to put window dressing around it. But our client was a theater company that was operating outside of the big three cities—New York, Seattle, and Chicago—but was nevertheless attracting great talent. And, in time, we realized that, apart from having great patrons and leadership, they also had a horrible building, which was a huge advantage because they could do whatever they wanted to it. For a production of Anton Chekhov’s *Cherry Orchard*, for example, they dug a 30-foot hole with a digger right in the middle of the theater, so that they could create the well around which the play centers. If you proposed that anywhere else you’d be immediately fired!
So when they asked us to do a new edifice, we worried that a pristine building would kill the very thing that made this theater company important. So we asked the client if we could reappropriate the budget and put just a third of it to capital: architecture and finishes—and to trust us that we’d find an innovative way to still make it timeless and beautiful—and spend the rest on the infrastructure of the building so that it can literally transform constantly, so that you can do every single show in a different configuration at the push of a button. And in doing so we spent our energy, our intellectual capital, on thinking about things in theater that hadn’t been challenged for a hundred years: the relationship of the stage to the seating, the way the seating is organized, how it can move.

When we were doing tours around the world, we met with artistic directors in all the major theaters and almost every one told us: “You know who we hate the most? You, the architect. Why? Because you do so much with the architecture that, for the first ten minutes of my performance, I’m trying to get you out of the heads of my audience.” That’s a serious indictment! So we thought what we have to do as architects was to create a tool that allows the artistic director to control every moment of the theatrical experience.
“The building can transform to proscenium, thrust, or flat floor theater at the push of a button.”
Our solution was to invert the usual arrangement of the theater. We took the front of house and put it below house and the back of house and put it above house. In so doing we created a performance chamber whose infrastructure was above the entire space so that you could not only fly in scenography, you could fly in the seating, making the configurations of stage and audience easy to transform. It's literally a transformer, a robot — the building can transform to proscenium, thrust, or flat floor theater at the push of a button. We also created the façade out of acoustic glass (most people said you can't do this, but we showed them you can—as we pointed out, the control booths in theaters where the various technicians sit often have glass fronts). The entire perimeter of the chamber could be open, so the audience is sitting in the middle of the city, or blacked out. You could open the side, so you can drive a motorcycle in off the street for a production, or you can open the perimeter wall to have Greek theater, where everyone's sitting outside.
Working in close collaboration with a client is not to compromise.

I have a background in philosophy and when I studied we were taught the Socratic method, putting things to the test in rigorous debate. We use this a lot at the office where we literally beat the crap out of ideas. We put them on the table and the team attacks them to see what survives. And eventually some idea will get through and we will attack it again and again and what emerges out of the back end of this brutal process is incredibly strong and stripped to its core, and when it gets stripped to its core you start to see things that are actually radical. They make sense, you can convince people to build them, but they’re crazy when you first see them. The book spiral is a great example, the form of museum plaza another, but the reality is that we could justify that move to the point that the developer would build them. Inspiration is digging into an idea relentlessly until what comes out of the process is stripped bare but really powerful.

What I’m talking about has a lot to do with the process before putting pen to paper or finger to LEGO® bricks. It’s about thinking before acting. But one of the things that happens in our process very early on is that we start massing the program out and creating organizational diagrams out of blue foam that we paint so that we get a sense of the scale and the size of the different pieces. So that when we think about the organization and its massing as an object we already understand how the parts go together. We’ll make 10 models an hour for 20 days so we’ll end up with 200 models—they’ll be all over the place. We’ll try everything. And in time you start to see that certain models work better than others. You need to identify the best solutions and those which you have the most affinity for aesthetically. It is an iterative playing process that happens by making things.
"We literally beat the crap out of ideas."

by REX Architects
So I think if I was to use LEGO, I think I would use it less to say, "Now I’m going to make the building" but rather as a device that already has volume and color, so that it's easy to make chunk programs, to understand the different functions of the building—it seems that's something that LEGO could do very quickly and very effectively. LEGO might be used to make a three-dimensional Venn diagram of all the building's different functions. It might be used less as a "What is this going to look like?" tool and more a "How is this thing going to be organized and sit on the site?" tool. It can help you attack the problem. One thing I'm seeing that is increasingly causing me alarm is that many architects are now so myopically focused on the computer that they don't know how to design anymore, and I'm not a Luddite. There are certain things that a computer does incredibly well, but with models you can discover organizational systems much faster. You can see immediately—boom!—if something works.
In summary, at the core of what I would ask any student, is to have your agenda be about positively engineering human interaction, not just in thinking what your building will look like, because that is what I think architecture’s real value is. Not that I don’t think our buildings are beautiful. But instead of talking about form and function, as the modernists did, we talk about performance, which takes architecture out of the realm of being this weird struggle between one and the other. It's either wildly beautiful and totally dysfunctional or totally functional but boring. But why? Both are forms of performance.

If we do our jobs really well, a building should be both beautiful and functional.
Hands-On Exploration: LEGO® builds

Scale

1:1 is the default scale of the LEGO® brick. While only looking at a pile of bricks, the question of scale is merely a question of relations between bricks, the size of different combinations of bricks, and detailing of the build models: one model is taller than the other.

One brick could be a city block and the studs could be small buildings, or a combination of bricks could be a house. The scale of the brick is in the eye of the beholder. At the moment you start to relate the brick to the surroundings or an imaginary world, you define the scale of the objects. It is all a matter of scale and detail.
Relating to the real project, like the Yongsan International Business District "Project R6" in Seoul, Korea. The LEGO brick can represent a large volume (several stories of the building), or just a fraction of one level. Choosing a bigger scale with more detail makes it possible to show important elements of the building, like individual stories and the correct number of windows in them.
The exercise for you to explore Scale:

1. Make a sketch-model that has objects of different sizes in it. The scale of your sketch-model is perceived relative to the sizes of other things around it.

2. When adding more details and recognizable elements to the same sketch-model, it becomes more of an architectural object, clearly illustrating the scale.

   By adding a car, a person, or another point of reference, the model could become a building, and the small LEGO brick on the right could become a bench; or the model could be come a high-rise (like sketch 3 on the right side), while the small brick becomes a one-story building.
3

Imagine the function of the building and context of the site. By adding some visual elements, we can make it appear as large as possible.

Try to add context to your sketch-models that will make them appear to be in different scales.

See additional examples of **Scale** and **Modules** in the chapter "Defining Your Project" on page 111.
We asked the team at "REX" to give their interpretation of "scale" using the LEGO® bricks. It was a three-step exercise.
Make a number of LEGO sketches that express scale.

"You can assign the scale from the beginning. If it's a table, then it's a table-size scale."

"Scale, for me, is a process, like an evolving model."

"It's a scale-less thing until you add a recognizable thing to it, like a window."

"First, when I have something that I like, I can assign a scale to it."
Pass your model to another person and have them further build on the concept.

“I kept on adding modules, adding windows as a feature.”

“I took it from the table and built something much bigger—a tower.”

“I laid it down on the side and now it represents a different scale.”
Develop your model, thinking of an architectural expression. What do you imagine?

“I'm building it up and adding a context.”

“It's a new scale, a “stepping-style” like—could be an opera house or a cash register.”

“This is a mixed-use tower.”
“You can combine these pieces in different ways and they will represent different scales. This could be an entry to a subway or a bathtub.”

“There is a trend in current architecture fashion named “LEGO® architecture” because of its blocky and pixelated style.”

“It was fun to explore LEGO in an intuitive way, but it was less fun to build a special shape with the bricks.”
“LEGO’s limitation is that as a tool it could drive the design.”

“LEGO has a scale. But you can think of LEGO as a pixel and not necessarily as a scale.”

“Maybe one out of five times LEGO will be a good tool to use in order to solve a problem. So you don’t prescribe when and how LEGO should be used.”

“The limitation becomes the strength. LEGO is good in the process of discovering: for example, before you start cutting foam models and before the concept becomes very defined.”
SOU FUJIMOTO ARCHITECTS:

RESEARCHING AND SKETCHING
Sou Fujimoto Architects
In 2000, soon after graduating from the Department of Architecture at Tokyo University, Sou Fujimoto established his architectural practice: he was just 29. He describes his unique style as “primitive future,” a philosophy he outlined in 2008 in his book/manifesto of the same name. In his work Sou Fujimoto seeks to “return to a primordial, intuitive moment in the process of design, free of constraints and open to [future] possibilities.” His best-known projects, which question perceived ideas of domesticity, include House N in Oita City, three perforated cubes nested inside each other like Russian dolls; House O on a cliff top in Minami Boso (destroyed in the 2011 tsunami), a branching structure that jutted out over the Pacific; Tokyo Apartments, a series of four Monopoly-style houses stacked on top of each other; and House NA, which seems devoid of walls and looks like scaffolding. In 2012, Sou Fujimoto curated the Japanese pavilion at the Venice Biennale (with Toyo Ito, Kumiko Inui, and Akihisa Hirata), which explored the role of architects in the reconstruction of post-tsunami Japan, for which he was awarded a Golden Lion.
The forms of architecture are many and varied. The best way to understand the wonderful diversity of architectural shapes, and their significance, is to look back at the history of architecture from the perspective of form.

The most basic form is one we are all familiar with, the Egyptian pyramids. There are differing opinions as to whether they are best understood as architecture or monumental sculpture, but, in any case, they are built in a very easy-to-understand fashion. By piling stones one over the other in steps, a pyramid shape is naturally created; the staircases we use every day are basically an application of this terraced, pyramidal structure. The ancient Greeks, in contrast, used pillar-and-beam construction; beams are erected horizontally on posts to support roofs and ceilings. In the Parthenon, for example, many posts are used, with beams laid in between, to create a temple space within. The Romans, in turn, invented
arches and vaults. Structures such as the Pantheon in Rome and the Pont du Gard, an ancient Roman aqueduct near Remoulins in southern France, are constructed by placing bridging arches on top of walls to create circular-shaped vaulted spaces.

After the Romans, the history of architecture progressed through the Byzantine, Romanesque, Gothic, and Renaissance styles that flourished in ensuing eras. While each of these architectural fashions is marvelous in its own way, we can say that they are all based on a variety of combinations of the terraced structure, the pillar and beam, arches and vaults. However, around 100 years ago, architecture underwent a sea change. The arrival of new materials such as steel, reinforced concrete, and glass changed the forms possible in architecture. These new technologies were fused with new aesthetic sensibilities to give rise to a new movement called modern architecture. New forms, radically different from the aforementioned historical structures, were born.
“New technologies made it possible to have vast, open floors.”

First, it became possible to have vast, open floors. Le Corbusier, one of the pioneers of modern architecture, exploited this in his Villa Savoye (1929)—it has a feeling of lightness to it, as if the floors are floating. Frank Lloyd Wright, in Fallingwater, the house he built over a waterfall in rural Pennsylvania a decade later, demonstrated how floors could be layered in an acrobatic, misaligned way. This concept of stacking floors led to the technology for building skyscrapers that we see all over the world today.

At the same time, technological developments also allowed for the use of very slender walls. Mies van der Rohe’s Barcelona Pavilion, built for the 1929 International Exposition, is held up by thin, sharp walls in complete contrast to the thick walls required by the Romans. In the Guggenheim Museum in New York, built ten years later, reinforced concrete allowed van der Rohe to create new spatial experiences with curvaceous, spiraling shapes. Such experimentation continues today, facilitated by computers. Frank Gehry’s Guggenheim Museum (1997) in Bilbao, Spain, stands out for its creativity and novelty, and young architects such as MAD in China and BIG in Denmark are currently experimenting with shifting, organic forms that are adaptable to changes in scale in exciting ways.
Among my own works that explore ideas of form is a fantasy housing project that I named the Primitive Future House.

Here the entire structure has been built by stacking slabs of 35 cm square material to create a dwelling out of this topography. In final Wooden House I realized these ideas by stacking lumber like a giant game of Jenga. Everything is fashioned from these blocks alone, which become columns, beams, foundations, exterior walls, interior walls, ceilings, floorings, stairs, furnishings, and window frames. I envisaged the creation of a new spatiality: there are no separations of floor, wall, and ceiling here. The floor levels are relative and spatiality is perceived differently according to one’s position. People are distributed three-dimensionally in the space and, rather than being prescribed, inhabitants discover various functionalities in these convolutions. Such a structure could easily be built out of LEGO, couldn’t it?

I have designed other buildings that explore and question expected notions of form, including the Musashino Art University Library, which has a façade and interior walls that are composed solely out of timber bookshelves; House Before House, which looks like stacks of white, cube-shaped flower pots; House N, which creates a world of increasing privacy by nesting a series of cubes inside each other; and Tokyo Apartments, in which I stacked a series of forms that take the well-known house shape.

“Explore ideas of form.”
Many different kinds of spaces can be created by applying a variety of the previously noted architectural methods—terracing, post-and-beam construction, and the use of walls and arches. The difference between Roman spaces and Gothic spaces is the method of application of these techniques, which change the mood and function of those spaces. For instance, the ancient Greeks arranged a series of columns to create a temple, but the cloister in an abbey, which uses a similar arrangement of pillars, but has a vaulted loggia, has a completely different effect and function. A Gothic cathedral also uses pillars, but the tops of the pillars are connected using arches to create an atmospheric space of soaring height.

“Space is not a thing, but an experience.”
The various forms of modern and contemporary architecture we discussed also have their own characteristic spaces. A building with many flat floors creates a homogenous space, which spreads horizontally, stretching to the horizon; terraces of cascading water levels create a floating, flowing space. The Guggenheim in New York is a space that flows in a spiral around the central core of the building. The Guggenheim in Bilbao, with its free forms, is even more organic.

We can, therefore, use a variety of techniques to create a variety of spatial effects. Architects seek to create memorable experiences in the structures they create; they have to imagine how the people who use them will feel. Space has a deep relationship with the human body, and architects consider body measurements and human perceptions when creating spaces. The architectural project Final Wooden House that I designed is experimental architecture that is deeply connected to the relationship between the body and space. It is very important to create by conceptualizing that space not as a thing, but as an experience. I encourage you to bear this in mind when creating spaces with LEGO® bricks—imagine a miniature version of yourself going into your scaled-down constructions. How does that space feel? How do you move about inside it? What are the sequences of experiences that you'd have?
“Making architecture is about creating places of brilliant light.”
There is another important element that determines the nature of space, which you should bear in mind: **light**. Architectural spaces are the places where we live our lives; they are deeply connected to human experiences, and therefore the kind of light that fills these places is vital. When creating various spaces you have to consider not just the form of space, but also the light that will illuminate it and how it will be experienced.

You will see that the various architectural examples that we have seen so far all make abundant use of light. The window is the simplest method of allowing in light, and the stained glass used in cathedrals is a magnificent invention for lighting, creating brilliantly colourful spaces. In spaces such as the Pantheon, in Rome, drama is created in other ways—the gloom is broken by a single beam of light that falls into the darkness. The Guggenheim in Bilbao certainly has a unique form, but, when you experience the soft light within, you will understand what the architect intended to achieve with his use of space. Making architecture is about creating places of brilliant light. Light also creates shadows, which can then create new light by reflecting internally on the walls, ceilings, and floors.

**In House N, mentioned earlier, I created a nest of three boxes with many openings that were fitted one inside the other.** The light that shines in through each of the openings is reflected off the inside of the stack of boxes and overlaps and drops down like sunlight filtering through trees. The sunlight changes during the course of the day and the building is designed to reflect that, and its seasonal variations. It is very important to design the lighting in a building and its openings with an awareness of the constantly moving light. For example, in the morning and evening, the light shines in from opposite ends, and, while the afternoon sun is high, the morning and evening sun is low. In House N there are places when the sunlight comes through only at specific times, and the path of the light in the room keeps changing at every moment. The building does not move, but the movement of the light causes the expression of the building to constantly keep changing. That richness makes the building interesting.
When thinking about architecture, it is necessary to always consider **structure**. Failing to do so will mean that your constructions will collapse and will never be able to be built. The history of architecture is determined by the structural limitations of each period. The Grecian use of stone pillars and beams, for example, resulted in forms that were structurally determined by this method. Roman arches developed out of the desire to create larger spaces without posts; the method of applying arches rather than straight beams allowed for the creation of bigger spaces. In Gothic cathedrals, the problem of how to construct even grander, brighter, vaulted spaces by using stone necessitated much hard work but produced wondrous results. And more recent innovations in steel and concrete have led to the birth of new structural materials and structural shapes, and the beginnings of a new architectural experimentation.

You can intuitively understand structure with LEGO bricks. Build a simple structure with posts and beams, walls and roofs. If it collapses, then the basic structure was unsound. Then challenge the structure in regards to how many elements can be added or removed. If your addition makes the structure look likely to collapse, supporting posts will need to be added and roofs and walls thickened. Is there a method to support other parts that look unsafe if something is removed, or that are unsafe because something has been removed? **It might be acceptable to add thickness or hollow out a different place to achieve balance. By experimenting in such fashion, you will intuitively enjoy the principles of structure.**

In the world of architecture, buildings are beautiful if they have solid structure. Roman arches and the Eiffel Tower are beautiful because they have been designed with the universal principles of structure in mind. If these physical principles are beautiful, there is no doubt that buildings reflecting those principles will also be beautiful. Feel the beauty of the world by creating your own structures with LEGO bricks.
“You can intuitively understand structure with LEGO bricks.”
The space of architecture depends heavily on the impression and the experience you have when walking into and around a space. An important thing to remember when creating such effects is proportion. The impression created by a narrow hallway is different from the impression of a cube-shaped room. Similarly, a space that is vast, but with low headspace, gives an entirely different impression from a space that, though small, has a high ceiling. These are all variations on the same "white box," but one's experience changes according to its proportions.
When a window is added to a room, the proportions of that window also present a problem. Should it be a portrait window, a landscape window, or a square window? The proportions of a room, the proportions of its windows, and how they are arranged can change the impressions of a space in infinite ways. There is no “right” or “wrong” proportion. Historically speaking, beauty has a golden ratio. A quadrangle has a good balance when the length and width are at a ratio of about 1:1.618. Even today, that ratio can be observed in Grecian buildings and structures by Michelangelo or Le Corbusier. However, it is not necessarily desirable to achieve this ratio in all circumstances. The proportion you use should be suitable to the forms you want to create.
“House NA is a house consisting of a stack of square rooms with different proportions.”
Let us look at an example from one of my own works. House NA is built with thin pillars and floors, but if you take a careful look at the inside, you will see that it is a house consisting of a stack of square rooms with different proportions. Among these are a large room with a high ceiling; a space that, though small, has a very high ceiling; another, like a hiding place, that is small and where the ceiling is also low; and a sprawling place that also has a very high ceiling.

By combining these rooms of varying proportions, a variety of scenes unfold inside the house. And the relation between the proportions of adjoining rooms is also important. If you put a room with a low ceiling next to a room with a high ceiling, the contrast between them is conspicuous and makes both of them look better. You can see how proportion deeply affects life in this house, and how a combination of different proportions contributes to making the spaces enjoyable.
Space and Section

Section is an investigative tool to explore space. By cutting through a building or landscape, you can reveal space and also relations between spaces inside the building.

A house [LEGO® developed illustrations.] and a section of a house

Empty space encompassed by architectural mass is also called a void. In this instance, the voids are the rooms in the house.
Architects very often start designing "in negative": it is about designing a space where people live or work.

You can design spaces and how they relate to one another by perceiving the LEGO® bricks as empty space, in our case, the interior spaces of a house. We created a big single space on the ground floor and two smaller ones in the floor above.

If we were to split open the house, we would see the interior spaces inside it. The LEGO bricks in the middle represent the empty space inside the house: the rooms and other interior spaces. The roof terrace represents another form of space: even though it is outside, it still belongs to the house.
The exercise for you to explore Space and Section:

Make some sketch-models with the LEGO® bricks that represent different spaces in the structure.

Try to imagine how the different spaces make you feel. What elements of the space and structure evoke this feeling?

The cube structure on the right occupies the space but it can also contain a volume of space inside. You can explore different ways of defining space.

A volume of space doesn't have to be enclosed to be defined: four columns placed in the corners outline the cube.
Openings such as doors and windows in the building establish relationships between inside and outside spaces.

A tall, narrow, brightly lit space appears significant and imposing.

A tall space will feel even taller if you imagine that the building has a low entrance.

Space can evoke a multitude of feelings. Can you make a space that feels vibrant or mysterious, peaceful, safe, or maybe playful?
Space and Section
Exploration within projects of Sou Fujimoto

Sou Fujimoto House N
Location: Oita, Japan
Design Year: 2006-2007
Construction Year: 2007-2008

A home for two, plus a dog

The house itself consists of three shells nested inside one another. The outermost shell covers the entire premises, creating a covered, semi-indoor garden. The second shell encloses a limited space inside the covered outdoor space. The third shell creates a smaller interior space. Residents build their life inside this gradation of domain.

This is a presentation of an ultimate house in which everything from the origins of the world to a specific house is conceived together under a single method.
Sou Fujimoto
House N

This image shows the longitudinal section made by cutting through the longest axis of the building, where you can clearly see the three shells nested inside one another.

This image shows the transverse section, made by cutting at a right angle.
“One might say that an ideal architecture is an outdoor space that feels like the indoors and an indoor space that feels like the outdoors. In a nested structure, the inside is invariably the outside, and vice versa. My intention was to make an architecture that is not about space nor about form, but simply about expressing the riches of what is ‘between’ houses and streets.”
Looking at the house in plan: the 11 levels, or "cuts"

There are no separations of floor, wall, and ceiling here. A place that one thought was a floor becomes a chair, a ceiling, a wall from various positions. The floor levels are relative and spatiality is perceived differently according to one's position.

"Using LEGO® bricks to actually build something is the best way to understand proportion. Try a variety of combinations of lengths and widths and window proportions. Again, imagine what it is like to be inside those spaces and what impression those spaces might give you. Create a tiny space using LEGO bricks and imagine people experiencing various emotions inside. There is no doubt that the emotions generated by a particular space—happiness, feelings of grandeur, sanctity, excitement, tranquillity, and so on—change with the proportions; it is very exciting to explore these. As mentioned previously, there is no correct answer to proportion. That's what makes it so interesting. Discover your own amazing world of rich proportions."
SKIDMORE, OWINGS & MERRILL LLP:

DEFINING YOUR PROJECT
Skidmore, Owings & Merrill LLP (SOM) was founded in 1936 by Louis Skidmore and Nathaniel Owings. They were joined in 1939 by architect and engineer John Merrill. The firm was known for its distinctive glass-and-steel skyscrapers, such as the John Hancock Center and Sears Tower, which redefined Chicago’s skyline in the late 1960s and early 1970s. They went on to reimagine the American city with their buildings and to transform the international skyline. SOM, one of the largest international architectural firms, continues to engineer and design some of the world’s most towering structures, including the Burj Khalifa in Dubai, which at 828 meters is the tallest building ever built. The practice emphasizes teamwork over individual genius, promoting a corporate face, although SOM architects and engineers such as Fazlur Khan, Bruce Graham, Gordon Bunshaft, and Bill Baker have nevertheless become well known. SOM buildings under construction include 1 World Trade Center, which will replace the Twin Towers.

“Architecture is the masterly, correct, and magnificent play of masses brought together in light. Our eyes are made to see forms in light; light and shade reveal these forms; cubes, cones, spheres, cylinders, or pyramids are the great primary forms which light reveals to advantage; the image of these is distinct and tangible within us without ambiguity. It is for this reason that these are beautiful forms, the most beautiful forms.”

—Le Corbusier
Architecture is always a search for forms, but architects seldom begin with a blank sheet of paper. All architects find inspiration in different places. SOM’s late Design Partner Walter Netsch (1920-2008) claimed inspiration from other architects, including Le Corbusier, Alvar Aalto, and Walter Gropius, and from other buildings, notably the famed colored light of Paris’s Sainte-Chapelle. SOM Civil and Structural Engineering Partner William Baker, the engineer of Burj Khalifa (2010), the tallest building in the world, describes architecture as being “a story of a time and a place.” Structure, he says, “is the language.”

Most architectural projects start with a detailed list of project requirements, called a “program.” More and more, buildings have multiple uses such as offices, residences, retail, or entertainment uses that keep them occupied 24/7. These “mixed-use” projects—a project type that SOM has at the core of its practice—often force the architect to think hard about what’s possible in each unique project. While the program is usually rather strict, based on a developer’s economic projections for a project, the manner in which those elements are conceived and distributed can leave a lot of creative room for an architect’s mind to explore.
“Form ever follows function.”

Rethinking the program can offer opportunities for architectural inspiration and creativity. SOM's original design for Chicago's John Hancock Center called for two buildings—an office tower and an apartment building that would have been surrounded by a plaza that extended through an entire city block. But when a single-story club located on the corner of that block decided not to sell its land to the building's developer, Design Partner Bruce Graham (1925-2010) suggested placing the apartments above the office building in a single tower. Not only did this create what was then the tallest building in Chicago (and the tallest in the world outside of New York City), but the differing needs of each use helped define the form.

As Louis Sullivan famously said, "Form ever follows function." Offices need large floors; apartments need smaller ones. By tapering the shape of the 100-story John Hancock Center, Graham and SOM Structural Engineering Partner Fazlur Khan accommodated these different requirements by placing offices on the lower floors and apartments on the upper floors. The form also had the advantage of stability—the shape not unlike the tallest structures of the ancient world, the pyramids.
But at 1127 feet tall, the 100-story John Hancock Center is more than twice the height of the tallest pyramid. The building used the most advanced steel frame structural techniques—developed within SOM's offices under the direction of Khan—and called the “trussed tube.” The name comes from how the structure is made—adding diagonal bracing (the truss) to the exterior ties its columns and beams together into a single structure that acts as a tube, creating a distinctive X-bracing façade. The building was the most efficient use of steel construction for a tall building when it was completed in 1969. Research led by Fazlur Khan and SOM developed the trussed -tube concept for steel structures, but its efficiency was limited to buildings of less than 110 stories in height—which necessitated the further development of other techniques for building taller.

The architect of the Hancock Center, Bruce Graham, wrote: “The Hancock Building is but a modulation of the grid. Its brutality is deliberate, but it is that dream of departure from the real world that engenders its gigantic quality and yet brings it back to earth and its master, the human spirit.”
"The building was the most efficient use of steel construction for a tall building when it was completed in 1969."
Programming is the essential first step in defining your project. Once you’ve defined your program, it’s time to figure out how to make it happen. Getting a handle on how you’re going to build means you have to understand a few things about your materials. One of the great things about LEGO® bricks is that they come in just a few sizes. "How," you may ask, "is that an advantage?" Because it gives you a set module to work with from the start that guides your explorations.
A module is defined by Merriam-Webster's dictionary as "the size of some one part taken as a unit of measure by which the proportions of an architectural composition are regulated." Architects use modules to help define their spaces, create a workable structure, and allow builders to construct their designs efficiently.

Architects usually choose building modules based on the structural material used in any particular project. A wood frame will generally require relatively small modules; concrete and steel framing allow larger ones. Traditionally, steel has been used for the largest modules—and the tallest buildings. But this has changed in recent years. SOM's development of the "buttressed core" system of building made today's tallest building in the world, the 828-meter-tall Burj Khalifa, achievable in concrete construction rather than the traditional steel. In the future, it's likely that many tall buildings (although probably not as tall as the Burj Khalifa) will actually be built of wood. That's a solution that SOM architects and structural engineers are exploring now.

"Modules allow builders to construct their designs efficiently."
Willis Tower, Chicago, Illinois (1973)

One of SOM’s best-known projects is the 110-story Willis (formerly Sears) Tower in Chicago. From its completion in 1973 until the Petronas Towers in Kuala Lumpur were finished in 1998, the 442-meter-tall skyscraper was the tallest in the world. In fact, it’s still the tallest building in North America. SOM’s designers—led by Bruce Graham and Fazlur Khan—devised an innovative structural system based on modules that they called the “bundled tube.” The building is actually designed like nine individual towers, each 75 feet square. By “bundling” them—essentially making a larger square of 3x3 modules laid out like a tic-tac-toe board (noughts and crosses)—each of the towers helps support the others.
“The building is actually designed like nine individual towers.”
“The nine tubes are essential to making Willis Tower stand up.”

Willis Tower
Chicago, Illinois (1973)
The nine tubes are essential to making Willis (formerly Sears) Tower stand up, but they also define the building's profile on Chicago's skyline. The base of the building is square—with all nine tubes forming the floors from the ground to the 50th floor. Two of the corner tubes end there and the seven remaining modules rise together to the 66th floor, where the opposite corners are terminated. This creates a cross-shaped plan up to the 90th floor, where three more tubes end and only two rise to the building's full height. Thus, nine simple—and identical—modules are configured to create an exciting and dynamic form that represented the most structurally efficient construction of its time.

The varied floor plans made possible with varying combinations of the same 75-foot by 75-foot module also met the specific office requirements that Sears gave to SOM's architects and engineers. The lower floors are enormous—225 feet by 225 feet—and provided for the large office spaces that the client desired at the time the building was planned, starting in 1969. The progressively smaller floors above gave other tenants a variety of options for floor sizes. But the basic structural module of 75 feet was unchanged from the building's base to the top that still rules Chicago's legendary skyline, demonstrating how modules are essential building blocks for any design, from the smallest LEGO® construction to some of the tallest buildings in the world.
A module alone is not enough to make an interesting design, nor the sole means to solve your program. Two SOM projects—one very recent and one more than half a century old—demonstrate how the idea of hierarchy helps give buildings designed on a module their architectural interest and solve different programs. The dictionary defines a hierarchy as “a graded or ranked series.” In the case of architecture, this often is a series of modules, which derive meaning from their relative size and different programmed uses.
“The idea of hierarchy helps give buildings designed on a module their architectural interest.”
The Inland Steel Building in Chicago's Loop was designed as office headquarters for a locally based steel manufacturer. Walter Netsch and Bruce Graham developed the initial scheme with a distinctive hierarchy by creating two volumes—an office tower and an attached service tower. The main portion is 19 stories tall and provides 60-foot-wide column-free office spaces. Structural support is provided by stainless steel-clad columns that are external to the offices—allowing for maximum flexibility and openness on each floor. All of the necessary service elements—elevators, fire stairs, bathrooms, and storage areas—are located in a 25-story tower that attaches to the office block near the southeast corner of the building. The service block has no windows and is clad entirely in stainless steel that literally expresses the Inland Steel Corporation's product in the brightest light.

At the Inland Steel Building, Netsch and Graham used hierarchy to clarify the program and create a beautiful building that still inspires Chicago's architects, residents, and visitors. Although the building's 331-foot (101-meters) height might seem modest today (SOM's Burj Khalifa is more than eight times taller), the building was the tallest built in Chicago's Loop in nearly 25 years. But developing a thoughtful hierarchy of parts can also help you build taller!

"The building was the tallest built in Chicago's Loop in nearly 25 years."
“The client felt that the architect’s first idea is often their best idea.”
The 162-story Burj Khalifa in Dubai, United Arab Emirates, is the tallest building in the world—at 2,720 feet (828 meters), it’s taller than the Willis (formerly Sears) Tower plus the John Hancock Center! The initial design was produced by SOM as part of an invited competition that was only two weeks long! Luckily, according to SOM’s Managing Partner, George Efstathiou, “The client felt that the architect’s first idea is often their best idea.”
The initial design was for a far shorter building—only 550 meters or so, recalls Efstathiou. That's still over 1,800 feet tall—and the design development was eventually to increase the height from the previous tallest building by 60 percent. This achievement required the development of a new, innovative structural concept that William Baker calls the “buttressed core.” It utilizes conventional construction techniques while combining a central core structure with a three-legged “tripod” arrangement of wings. “It is an inherently stable system in that each wing is buttressed by the other two,” Baker explains. This configuration has the same inherent stability of

“The design development was eventually to increase the height from the previous tallest building by 60 percent.”

[Burj Khalifa, buttressed core © SOM]
“Hierarchy allows you to develop standardized modules to meet different needs.”
The Burj’s hierarchy utilizes a 9-meter (29.5-foot) module as a key part of its organization. The overall size of the Burj Khalifa is enormous—and its program is quite complex, with offices on the lowest floors, almost 1,000 residences above, and a 297-room hotel as well. Not unlike the John Hancock Center, the larger floors at the base of the building have offices, while the smaller floors towards the top have apartments and hotel rooms. This division of larger and smaller spaces to match programmatic requirements is an example of effective hierarchy in a building’s design.

Hierarchy allows you to develop standardized modules to meet different needs—whether holding up the building or solving your program.
“IT’S LIKE orchestrating A SYMPHONY.”

“The Burj Khalifa involved between 110 and 120 people in-house at SOM and about 75 specialty consultants,” says George Efstatthiou. “It’s like orchestrating a symphony.” Setting your program, establishing a usable module, and developing hierarchies is just the beginning of the design and construction process. However, these three tools are essential to defining your project. Even though you may be designing on your own or with a small group of friends, LEGO® requires that you use the same techniques—orchestrating your own visions and bringing them to reality in three dimensions. The nature of your work should be limited only by your imagination and curiosity. SOM’s architects, engineers, and city planners have been rethinking and revitalizing places around the world for more than 75 years. Your LEGO project should demonstrate your ideas, your dreams, and your creativity. They can become part of the age-old conversation that represents the built environment.
“I have never seen architecture as entertainment any more than poetry, music, painting, or sculpture, but rather as an adventure into the unknown which can extend the human experience beyond the ordinary needs of survival, sanitation, and the other necessities.”

—Bruce Graham
Hands-On Exploration: LEGO® builds

Modules and Repetition

Modular systems are an integral part of architecture, from the early developing stages to construction of the actual building. An example of a modular system is the brick, be it the LEGO® brick or masonry.

By repeating the module of a brick you can create much larger structures based on one simple module or the combination of different modules. Even very complex structures are often constructed with a number of simple modules in a systematic repetition.
Imagine a module that represents a room with a window.

The simplest form of repetition is linear: in that way we create a three-room apartment.

The modules can be repeated in horizontal and vertical directions to create a facade consisting of 12 three-room apartments.

And we can introduce new elements with different intervals of repetition, adding balconies and different-size windows.
The exercise for you to explore Modules and Repetition:

1. Make a number of small sketch-models to represent your understanding of a module.

   Our module is a 2x4 brick with one added LEGO® brick on both sides. Our module now is five LEGO bricks high and has the same dimensions, whether we place it upright or on its side.

2. Take your module and build a structure with it. Every building/structure built by repeating the same module is modular.
3. Imagine that each module is a living space (unit). Elaborate on your model by adding details that represent the function of each unit.

4. You can combine the units (modules) in different ways in your building. Modular designs allow for flexible arrangement and a variety of uses.

Imagine how different modules of your building could be combined together.

You can establish the scale of the building by adding details with sketching.
Modules and Repetition
Exploration via LEGO® examples based on Willis (Sears) Tower, designed by SOM.

Willis (Sears) Tower

A basic module of the Willis (Sears) Tower can be abstracted in LEGO with a 1x1 plate.

One brick represents a square with dimensions of 75 feet by 75 feet, with a height of two stories.
The modules are stacked into nine tubes with a height of 25/33/45/55 LEGO plates (which corresponds to 50/66/90/110 stories).
The tubes are arranged into a rhythmic composition: the seven shorter tubes are wrapped around the two tallest ones, creating a form that is not only structurally efficient but also appealing.
We asked the SOM creative team to experiment with the LEGO® bricks, and to determine how they could be used in the creative process.

“I can see the brick could be used for quick, large-scale massing studies, translating the project from diagram to the form.”

“In the creative process, program and the client set the rules. Massing is visualization of the rules.”
“Regarding modularity: Sears Tower modules match the form, whereas the Hancock Center has a different system and modularity.”

“In the beginning, the scale of the brick could be intimidating. But then you think it could be a good experimentation tool. The white color is about the shape, and it provides simplicity.”
MAD ARCHITECTS: MAKING SPACE
MAD is led by Ma Yansong, an architect who trained with Peter Eisenman and Zaha Hadid. In 2005, the year after it was founded, the studio won the competition to design the Absolute Towers in Mississauga, near Toronto, Canada, a pair of twisting, curvaceous forms that have been nicknamed the "Marilyn Monroe Towers" by local citizens. It was the first major international competition won by a Chinese architect, a notable achievement for such a young practice. MAD has also completed a futuristic museum in Ordos, Inner Mongolia. Other projects include developments in Rome and Amsterdam, as well as two major cultural centers in Harbin, China.
making Space

Developing one's ideas usually means filling in the blanks, fleshing out the details, and adding more things until one's thoughts are fully realized. As an architect, with the task of creating spaces, the opposite is perhaps true. Architecture these days has evolved: you work with many people who attend to details and as an architect you are more like a director, focused on the bigger picture. Your main concern is how the end user will experience and feel in a space.

For me, the LEGO Architectural Studio Set is not about the beautiful details but a tool in helping you to create something that explores how space is perceived. It helps you to understand, to invent a space. In LEGO there are no rules except for the elements you have—you're only limited by the size of the bricks and with them you can express anything. You can reuse elements to continue to experiment and build something new.
“At MAD, we want to build on the Chinese or Asian tradition of architecture to create spaces that are less sterile and more evocative and socially engaged.”
Architecture is all too often bogged down in particulars. In the 1920s, modernist theorists methodically mapped human activity with the aim of making the use of space more efficient. These studies were institutionalized in books like that written by Walter Gropius’s student, Ernst Neufert, a pupil at the Bauhaus who went on to work with his mentor to build the school’s campus in Dessau. His seminal work, *Architects’ Data*, was first published in March 1936 and has been updated four times and translated into 18 languages. It is still the most widely used reference work by architects worldwide.

However, Neufert’s handbook represents a system of indexing that turns human behavior into essentially a set of numbers. Architecture becomes less about making spaces geared to humans and begins to look like computer code: systematic, easily copied, generic, and ever more sluggish. It is no accident that in 1930 Neufert went on to work for Hitler’s architect, Albert Speer, who commissioned him to work on the standardization of German industrial architecture. Humans are treated like objects, products inside of bigger products. At MAD, we want to build on the Chinese or Asian tradition of architecture to create spaces that are less sterile and more evocative and socially engaged.
Modernist ideals about mass housing, developed in Germany in the 1920 and 1930s, have not been imported into China with great success. Take, for example, one of Beijing's traditional Hutong neighborhoods and compare it to a modern development in one of the city's new developments. In the historic parts of Beijing one can walk from home to work, and the route takes you through urban and public areas of different scales. Each space in and of itself is not particularly noteworthy, but the complete walk, where one goes through a sequence of spaces, is. However, in so many of the city's new developments, this variety and interest is lost. One's apartment (eerily similar to a hotel room) connects to an elevator, which takes you to the basement, where you get into your car. Then you drive out of the building to join an inevitable traffic jam (sarcastically called rush-hour), and at the point of arrival you enter another parking garage, wait in line for the elevator, only to be dropped off in the enclosed space of your office.

“Standardized design and construction have created a ticking time bomb.”

In the 1950s this air-conditioned nightmare was a unique American phenomenon. Now it is global, maybe more Asian than American, even. What gets built in China is becoming increasingly similar, as developers—unconcerned with how people feel in and use a space—seek to maximize profit. Neufert's rigid system of standardized design and construction, combined with the many additional standards that are required of new buildings, has created a ticking time bomb inside the city that threatens to destroy our human spirits.
Absolute Towers

“The curvaceous, fluid design seems to engage people at a fundamental level.”

**Brief:**
Like other suburbs in North America, Mississauga is seeking a new identity. This was an opportunity to respond to the needs of an expanding city, to create a residential landmark that strives for more than simple efficiency and that provides residents with an emotional connection to their hometown.
With the Absolute Towers in Mississauga, Toronto, MAD hoped to make a stand against this homogenizing trend. Sculptural from afar, the Absolute Towers mark the busiest intersection in Mississauga and obey all of the rules of a typical North American high-rise; there is a central core, a straightforward and economic structure, and a glass façade with thermal breaks. However, unlike the other square-box buildings that are everywhere in that particular suburb of Toronto, the curvaceous, fluid design seems to engage people at a fundamental level. In an environment of generic boxes, the two towers have captured people’s imagination, as illustrated in a cartoon in the Toronto Star, which portrayed MAD’s swirling buildings dancing in front of an otherwise bland skyline. In contrast, the sharp-edged structures in the background show nothing; they have zero connection to any human feeling or expression.

All the apartments in the Absolute Towers have large balconies that offer beautiful views over the area from Lake Ontario to the skyline of Toronto. The floor plates are on a rotating plan, which allows residents to enjoy enough outdoor privacy but also provides lines of sight to other balconies above and below. The architecture is intended to encourage you to feel part of a community. The human spirit feels more connected to a building that not only offers seclusion, but also promotes human interaction. Before we accept a commission, we always ask how our design can reflect the city’s multiplicity of social functions and feel more like a walk in the park.
Looking at the Absolute Towers plans shows us that the buildings are designed by using quite a simple concept. The towers are designed with oval-shaped floors.

... which are stacked one upon the other.

Every story is then incrementally rotated to give the building a curved and twisted outline.

[TLEGO® developed Illustrations]
“Nature is not ordered and regimented, but incorporated.”
MAD Architects is very interested in applying similar ideas to China’s fast-developing urbanization so as to create a city architecture that is more in harmony with the country’s tradition of gardens, courtyard houses, artificial lakes, and parks. What can we learn from places like Beihei, the former palace garden in Beijing, now accessible as a public park? Upon entering the park, which is walled off with a 6-meter-high wall, the first thing you see is a big lake that doubled as a freshwater reservoir, as water in Beijing is scarce. Gently laid out around the corners of the site are hills and other subtle changes in height; in between there are palaces and temples, which themselves have smaller and more detailed gardens. This landscape is just as artificial as the meticulous, manicured Gardens of Versailles, yet the feeling and cadence of moving through it could not be more different. Nature is not ordered and regimented, but incorporated.

In the recent history of China, the call to architects and government to develop a more natural and distinct Chinese city ironically came from a scientist rather than architect. In the late 1980s, Qian Xuesen, the famous Chinese rocket scientist—who worked for Jet Propulsion Laboratories in America during WW II and, on his forced return to China during the Cold War, helped to reform China’s academic system—became increasingly concerned about how Chinese cities were developing and started discussions between the leading architects of his time, hoping to come up with a new, ideal direction.
On July 31, 1990, Qian Xuesen wrote to architect Wu Liangyong, proposing a landscape city that would embrace technology, art, and poetry. He named it the "Shan Shui city" (literally, mountain-water city) after a genre of Chinese landscape painting. Shan Shui brush-and-ink landscapes don’t offer an open window to nature for the viewer’s eye; dispensing with naturalism, they present instead the artist’s thoughts about nature. Qian Xuesen hoped to preserve the intrinsic quality and specificity of Chinese urban development, without creating a rigid system or style. Unfortunately, he was unsuccessful. Despite many letters, newspapers articles, meetings, and support from influential figures, the style of development today is no different from before.
Guiyang

“A quality that does not depend on functionality but on spirit.”

Brief:
The Master plan suggested a tall twin towers—like building for a shopping mall, offices and apartments in the middle of a large, very empty plaza. The site is located between a very busy street and the mountains, so we thought of making a park, where a series of artificial mountains could become the building. This gives people a better feeling when they walk around.
Influenced by Qian Xuesen's ideas, MAD Architects is conducting research about how to develop an architecture based on his proposals, and how that might be applied to the current scale and speed of construction in China. In the city of Guiyang, for example, MAD proposed a master plan for Huaxi City Centre and invited 11 young, international architects to create buildings for the site. The development basically consists of a series of high-rise residential towers, but, to make a more meaningful space, MAD suggested an arrangement not that different from Beihei Park. The site has a central water feature and, instead of artificial hills, the architecture frames the setting. The quality of this project is what MAD Architects tries to develop in every project: a quality that does not depend on functionality but on spirit.
There is no manual yet on how to design spirit. So to end: think of your childhood, about the places you played and learned in every day and visited during holidays. It was most likely not perfect in terms of function, nor was it beautiful. Yet you have fond memories of it and therefore it is luxurious on a spiritual level. It is this spirit that gives cities and buildings their soul and meaning. I hope that the users of the LEGO® Architecture Studio Set are inspired to play with the set to make a space that is connected to their own feelings, rather than to make something technical. A child’s mind is capable of imagining lots of different places and things, and we often lose this spirit of curiosity. To explore those ideas is very important.
“A child’s mind is capable of imagining lots of different places and things.”
Surface

A surface is any figure having only two dimensions, defining the boundary of a solid. The surfaces of the building are its skin, which encloses and shelters the spaces. The outer surfaces are the "envelope" of the building—it is the first part of a building we see; it is one of the key components that determines a building's expression.

A flat or level surface is a plane. Surfaces can be horizontal, vertical, or at an angle. But surfaces can also be curved, freeform, or complex. Here we show a single curved surface.
The solid envelope of this building is constructed with only one folded surface.
The exercises for you to explore Surface:

1. Make a number of sketch-models that represent various surfaces. Use as few bricks as possible.

   In our example we have chosen a flat surface to start with.

2. Use the surfaces in different ways. You can add texture or pattern to it, or raise and fold it (just like a piece of paper).

   In our example, we have added texture with grille plates and raised the back two rows, so it appears that the surface was stretched and bent. We have chosen to change flat, square LEGO bricks into smaller bricks to make the transformation appear smoother.
You can take a picture or scan your sketch-model into your digital device, and sketch the landscape around it. What does your building represent?

We imagine our model represents an office building placed next to a street with parking in front; the form of the building relates to the landscape around it.

The surfaces of the landscape can be a source of inspiration for architecture.
We asked MAD to give their interpretations of “surface,” expressed in a three-step exercise utilizing the LEGO® brick.
1. Build models that express the topic of surface. Try to use as few bricks as possible.

“I was trying to create a transparent and porous surface—something you can see through. It is a flexible surface that you can fold to create different kinds of space.”

“The idea was to have a curvy surface that evolves from a flat surface into a hill or a mountain.”
Rebuild your model while transforming it. The transformation of the model should aim at creating volume and space within the surface.

“The flexible surface already had space inside it. I tried to develop it into a volume with different spaces, while still keeping the concept of transparency and porosity. In this step the model lost some flexibility.”

“Like using digital tools for sketching, I am trying to push different control points up to make a lot of different shapes or volumes. In this way space is created in between the volumes.”
Now rebuild your model into an architectural expression. Is it a building, a city, or a design object? Imagine how your model turns into an architectural project.

“It’s a different scale now. I imagine the flexible surface to be in a loft space—where I create space for different kinds of living. You can use it to divide your space.”

“If you can, imagine a type of city where the tallest buildings are in the middle and the height decreases toward the edge. I thought about light and shadow and to provide good light conditions all over the structure.”
"When you start to experiment with LEGO®, you can start to think of the LEGO bricks as an architectural language."

"LEGO could be a good tool for spatial investigations."
“When you start with the brick—then you have to turn your brain off, and start to explore with your hands.”

“Where LEGO becomes interesting is where you can use it as a tool to alter the perception of things, or how it can make you reflect on things.”

“LEGO bricks have limitations, but that makes you rethink your structures.”

“Making structures with the bricks helps you understand how the structures work: how people will move inside of them. So it’s not so much about representing the exact design of the building with LEGO. The abstraction in LEGO makes it an analytical tool to understand the building.”
THAM & VIDEGÅRD ARKITEKTER: WORKING IN A CONTEXT
In 1999, Bolle Tham and Martin Videgård founded Tham & Videgård Arkitekter. The duo both grew up in Stockholm in families of architects and went to architecture school together at the Royal Institute of Technology in Stockholm. They are perhaps best known for their Tree Hotel, a dramatic mirrored glass box that is centered on the trunk of a tree in a remote part of Sweden, deep in the Arctic Circle, and the Kalmar Museum of Art, which won Sweden’s most prestigious architecture award, the Kasper Salin Prize. They are also known for their bold use of color, as displayed in the bright yellow kidney-shaped Tellus Nursery School, or the red mesh façade that covers their striking Moderna Museet in Malmö. Their buildings embrace global ideas, but are always shaped by the specificities of a particular site, so that their architecture seems firmly anchored in its local context.
Context and the operative elements of architecture

One factor that makes architectural work constantly interesting and inspiring is context. If you look closely enough at a project’s context—its physical, cultural, and ideological environment—you will find an inexhaustible source of inspiration for new solutions to any architectural program. In fact, one can argue that it is primarily the approach to context that determines whether an architectural project works both for its location and for its own time.
“The building blocks for architecture are not materials but spatial relationships.”

In coming up with a design, we usually start with a discussion of what we call the operative elements of architecture. All great works of architecture—the Mayan pyramids, Le Corbusier’s Villa Savoye, Andrea Palladio’s Villa Rotunda, Rem Koolhaas’s Rotterdam Kunsthalle—have strong cultural presence and offer distinct spatial experiences: their balance and precision transcend historical style (Antiquity, Gothic, Renaissance, Baroque, Modernism, Post-Modernism, etc.) The building blocks for architecture are not only materials—stone, brick, steel, or concrete—but also spatial relationships, light, movement, proportion, scale, structure. These concepts—the operative elements—are the architect’s primary tools. They are the building blocks that shape the actual experience, and the effect is consistent, regardless of time.

We live in a time when, through real and virtual travel, the world is getting smaller. Globalization provides people around the world with common references, presenting architects with new opportunities—a more open attitude toward different ideas—and challenges—the risk of neglecting context and of reproducing meaningless uniformity. However, a combination of an analysis of the physical and cultural context, and precision in the use of the operative elements of architecture, enables one to generate site-specific and distinct buildings, an architecture that is relevant and meaningful. It requires a certain clarity to achieve something that really works and makes a difference. Basically, it’s about separating architecture from style and instead starting from perception, physical impact, and lived experience.
When we begin a project, we always start by searching for the most direct solution to the brief: the actual task, what the client needs and desires, from a pragmatic perspective in relation to its multiple contexts. Such a solution can be formulated without regard to architectural form. It is only when the program is solved that the work on the architectural design, the architect's actual craftsmanship, begins. You develop the building's own logic and potential using the operative elements—space, movement, light, and construction. Intuition and pragmatism interact with a desire for strong expressiveness and architectural clarity, which often generates new, unexpected solutions. That is when it is determined if a good idea also becomes strong architecture.

“You develop the building’s own logic and potential using the operative elements—space, movement, light, and construction.”

“A desire for strong expressiveness and architectural clarity often generates new, unexpected solutions.”
Brief:
The idea of the client was to create a guest room among the trees on a forested site close to the Polar circle. It is an addition to the small hotel, Brittas Pensionat, located nearby in the village of Harads.
“A mirrored box reflects the wilderness.”

With the Tree Hotel, which is located near a tiny village in a very remote place north of the Arctic Circle, the brief was simple: a room for two among the trees that fulfilled the dream of a secluded hideout, away from civilization. When we started thinking about a solution, we began looking at two things. The first was the reason why people go up north to such remote places. They want to experience wild, pristine, uncultivated nature; they want to feel that they’re the first person who has passed through there. The second thing we looked at was how man deals with these harsh conditions. We tend to bring a lot of high-tech equipment, like skis and Gortex clothes, to help us deal with nature. It’s a paradox that, when we search for original and authentic experience, we take high-tech materials and advanced equipment.

In the Tree Hotel we wanted to mix those two things. The starting point of the mirror cube is the relationship between man and nature. Its character, both camouflaged-contextual and abstract-deviant, is inspired by an observation of how we approach the wilderness both as something enticing but also challenging.
Starting from these double contexts, physical and cultural, we started a search for a way to let architecture both stand out and disappear among the trees. We didn’t want to cultivate nature, which was the reason we chose a mirrored box that reflects the wilderness rather than impacts on it; the other was the high-tech nature of the building, which combines a welded, lightweight aluminium frame that fits around the tree trunk with mirrored glass that is joined with the same glue used when making airplanes. It is also laminated in an ultraviolet cover, which birds can see but we can’t, so they don’t collide with it.

We visited two or three possible sites, where we looked for the tree that might work best with our idea. We chose a point on the threshold of the forest, where you seem to leave civilization and enter wilderness. The Tree Hotel is hidden at the edge of the woods, so that you can’t really see it from the green fields beyond. The mirrored cube, fitted and centered halfway up a tree, is reflective in daytime, though when you’re inside you can see out, and the opposite at nighttime, when it starts to glow in the trees.

[The functions included providing a living space for two people, a double bed, a small bathroom, a living room, and a roof terrace. Access to the cabin is by a rope bridge connected to the next tree. Courtesy of Åke Eson Lindman, Lindman Photography]
Another example of how context can shape and constitute a fundamental inspiration for architecture is the new School of Architecture in Stockholm. The location is a courtyard in the core of the campus, directly adjacent to dark-red brick buildings from the 1910s. We were interested in the idea of a campus as a series of detached institutional buildings that interact—it's not an urban system, but more like buildings in a forest, like a mind map where you can connect certain buildings with others, which is what you'd like to happen in the life of the university. That's why we thought it important to underscore and express the possibility of free movement within the campus with our building.

The goal was to place the new school without reducing the number of communication channels open to it. So we decided not to take away a lot of the existing walkways and connections, and we tried to position the building on the site so as to create new opportunities to walk around and through it. This was important as a way to integrate and anchor the new building in the context of the campus.

“Architects will relate to the building whether or not they want to.”
The cultural context is important as well, because it's a school of architecture (where we both trained); architects will relate to the building whether or not they want to because they will train there for five or six years. One way to have gone would have been to expose the structure, to make the tectonics obvious so that the building is something they might learn from. But we decided instead to make a building that was interesting and complex in its use of spatiality, in how different spaces are intertwined with each other.
We realized that, since the site was not a block where you could create an ideal orthogonal order, we had to embrace its complicated, triangular shape. We turned it into a series of almost landscaped spaces. In a way this was a very deliberate choice, but it was also a product of a very specific situation. All the curved walls in the building create voids or mass, depending on whether the curve is convex or concave. It’s something to explore as an architecture student and hopefully not that easy to read—it takes a while to understand and get your bearings in relation to the building. We’re interested in movement and curiosity, and the curves achieve this, drawing you around the next corner.

“We’re interested in movement and curiosity, and the curves achieve this, drawing you around the next corner.”
Kalmar Museum of Art
(2004-2008)

**Brief:**

The Kalmar Museum of Art in Southeast Sweden was inaugurated in 2008. Set among the high trees in the main park of the renaissance town of Kalmar, it is built on part of the remains of the medieval city wall, next to a restaurant pavilion dating from the 1930s by Swedish modernist Sven Ivar Lind. Kalmar is a very flat town, with buildings that seem to hug the ground, and the museum takes a new stance that contrasts with the horizontal condition of this urban landscape, adding a new topography to the city. We intended the museum to contrast with its context so as to be a new focus point in the city.
The conceptual idea of this museum is a series of open platforms for art-related activities. It is also how the museum is constructed, with large spans for maximum flexibility on each level, so that not only light but also space can be transformed and adjusted to meet the specific needs of each exhibition. The four floors, each different from the others, are stacked on top of each other and create a vertical walk up into the greenery of the trees, offering a series of different spatial experiences, while presenting dramatic views of the environs: Kalmar Castle, the lake, and the city center. The verticality of this monolithic volume is ambitious. It’s a solid box, but the facade is done in a more crafted, fragile way in a low-cost material—plywood panels, punctuated by large glazed openings—to produce a building that is solid but also kind of fragile.

“The verticality of this monolithic volume is ambitious.”
The reason why the client decided to move from their duplex apartment in central Stockholm to this countryside location at lake Mälaren was because they wanted a garden rather than a house. Consequently, we proposed a house conceived as an integrated vertical addition to the garden, where indoor and outdoor spaces gradually blend and interact. The building could be defined as a void in the landscape where the vertical gardens define the perimeter of the living space. We describe the Garden House as a void in nature; it doesn’t refer to traditional building, it’s more like a cave. Here the vertical green walls define the volume, and inside you’re able to dwell.

The triangular footprint is the result of a steep slope that diagonally crosses the site. We realized that if we placed a square or rectangular building there it would have left poor and narrow garden spaces around itself. And, in this case, the garden was to be the project, and the house the spaces left in between. We positioned the triangular plan so as to eliminate a pure northern façade, which in this part of Sweden means that in summer the remaining three façades benefit from sun until 10 in the evening, making it possible to grow plants on all sides. Plants, seven different species, were encouraged to climb high up the oversized trellis that covers some of the windows, so that in time they will become hidden within the greenery. It’s a camouflaged building.

Brief:
The clients, a couple in their mid-60s, decided to move from their flat in the city to a house in order to satisfy their great interest in gardening. The house was therefore designed as a completely integrated part of the garden, where indoor and outdoor would interact closely.
"The triangular footprint is the result of a steep slope that diagonally crosses the site."
The context of this summerhouse was an island on the outskirts of the huge Stockholm archipelago, close to the Baltic Sea. Our starting point for this project was to provide a direct relationship with the dramatic, rugged landscape, and to create a simple platform that would offer several diverse readings of the relationship between architectural space and nature. There were special challenges in building in such a remote place: without any car connections, all materials had to be brought by boat from the mainland and then carried up to the site.

**Brief:**
The client requested a vacation house on a small island in the Stockholm archipelago. The remote location triggered a lightweight construction in wood, also inspired by local building traditions. The idea was to create a house that opens up to the sun and the views over the Baltic Sea, with a strong relation to the horizon.
“All materials had to be brought by boat from the mainland and then carried up to the site.”
As a response to this, the Archipelago House was conceived as a lightweight construction in wood and glass. The horizontal character of the black stained exterior relates to the verticality of the island’s tall pines, and mirrors views of the Baltic Sea. The geometry of the plan, essentially a parallelogram, is generated by the specifics of the site; the house sits on a flat surface between two rocky outcrops, and is oriented both to the south, so it catches the sun, and toward the sea views in the west. We chose a flat site between two bedrocks and we put the house on plinths so we didn't need to excavate or take anything away—we just added the house.

With smaller rooms placed behind, the three large social areas of the house open up to the terrace and provide an open platform, crisscrossed by sliding glass. The zigzag
layout also creates a series of outside spaces that are sheltered from the island’s strong winds. As a result of the large glass panes and the prevailing conditions of light, reflections, and mirrorlike effects, a quality is created where nature, space, and horizon all interact together. Wood was chosen throughout the design to provide simplicity of construction and to minimize difficulties with heavy transportation.

A horizontal screen diffuses sunlight and provides a variety of shadows, as well as giving the impression of a continuous space, blurring the boundary between inside and out. It is similar to the Tree Hotel in a sense. Here you find yourself between the forest and the sea; it's not a coincidence that we chose to place the building just behind the line of the forest so that from the sea it's kind of hard to find. We were impressed by the dark shadows with which it blends. The house is a celebration of the horizon and the qualities of the archipelago.
Brief:
This Art Nouveau apartment was very run-down, and the client wanted a complete refurbishment. Inspired by the autumn leaves from the park outside, an oversized colored parquet floor was used to establish a new spatial organization within the original plan.

Departing from the Swedish traditional use of colors and patterns, this apartment is inspired by its location next to the Humlegården, a public park in the middle of Stockholm. We took away some recent additions of small rooms and corridors to recreate a more open, fluid space. The long progression of rooms relates to the green oasis outside. Light and color change with the season and become very present in the interior spaces: in winter, gray and black; bright, with deep greens, in summer; to orange, red, and yellow in autumn.

“The long progression of rooms relates to the green oasis outside.”
With an interest in finding new ways to detail and produce architecture that combines contemporary industrial processes with the quality of crafted materials and details, we developed an oversized and multicoloured parquet: 10,000 pieces were dyed in eight or nine different shades. As a result, a spatial idea was defined where overlapping colors transform the apartment program and add a new, layered structure of spaces that are linked to each other across the original plan.

The vibrant spaces we created morph slowly from one color to the other in a palette that is very similar to the autumn leaves you find outside the window. These colors create spaces within spaces and link one room to another. The result looks like an apartment made out of LEGO®.
We believe interesting and strong architecture is always inspiring and the benefit of LEGO® is that it has a large amount of abstraction within the concept. We think that’s the reason why the LEGO concept is still so popular—you have to put in some of your own imagination when you play with LEGO. In your mind you have to create your own pictures of what you’re actually doing. And you have the opportunity to immediately react to what is being developed firsthand.
This abstraction offers architecture students working with LEGO a great opportunity. You’re forced to reduce an idea to its essence, which makes you make clear choices about whether, for example, a space should be narrow, wide, high, or low. If you want to make choices that really influence the person using the space, it’s about these fundamental and overruling decisions. These kinds of exercises allow you to explore the operative elements of architecture, to explore the way architecture influences your experience of space, which is really the toolbox of the architect.
Mass and Density

Mass is the physical volume or bulk of a solid body. Mass and space are the basic formal elements of architecture. Architects organize these elements into an ordered form through the process of composition. Some buildings emphasize their mass: they look solid or have a “heavy” expression, while some buildings depend more on space expression, making them seem light and airy.

Density is the distribution of mass per unit of space. In architectural understanding, the term density refers either to physical density—as concentration of physical buildings in a certain space, or perceived density—which is an individual perception of relations between the space and people.
Exploring the parameters with the LEGO bricks:
If you have two piles of bricks, each containing 20 bricks, you can build two sketch-models—one almost twice the size of the other.

The larger sketch-model will feature gaps in between the bricks and in an architectural understanding be less dense than the smaller sketch-model containing the same number of bricks.
The exercises for you to explore Mass and Density:

Imagine that every LEGO® corner brick represents a single-family house.

If you have to house 18 families, the houses can be arranged in different ways, presenting different densities.

18 LEGO corner bricks arranged as free-standing single-family houses on large lots.

18 LEGO corner bricks arranged as multi-family residential buildings (apartment buildings).
or as a high-rise

Note that each type has its advantages and disadvantages. One takes up more space, while others are denser but can provide larger open areas for rest, recreation, or other public use. For example, stand-alone houses take up the most space but provide more privacy. The high-rise allows for more public space around it.

You don't have to follow an established typology. Architecture is a constant search for new solutions. Conduct your own exploration.
Mass and Density

Hands-On Exploration with Architects Tham & Videgård

We asked architects Tham & Videgård to give their interpretations of the “mass and density” parameters using the LEGO bricks. The same three-step exercise resulted in the following examples:
Making a prototype that expresses **mass and density**.

“When you look at the pile of bricks, you don’t know where to start. You start exploring with your fingers. The exploration part in the process of architecture is very important.”
Adding context to the selected prototype.

“The exploration with the brick is not a linear process. It evolves while you are working on it.”
Developing the prototype into an architectural expression.

“It is the transformation and interpretation that is interesting. If you just look at it (the prototype) as LEGO, it is nothing else but LEGO and it becomes very abstract. It does not have to look like anything specific, but the interpretation is what makes the project, and not the fact that you had a great idea to begin with.”
“The time we have spent building has been very similar to the creative work we do, because you don’t know what you are building in the beginning. In this case the possibilities are endless. You get the ideas as you go, and it is very intuitive and creative.”

“The constraints of the brick, the mix of shapes, and the amount and the color are the conditions (limitations) on itself. The constraint is what creates a direction and makes you transform and develop your ideas.”
“The LEGO brick gives you three-dimensional expression of the idea.”

“The method (ref. hands-on exploration with the LEGO brick) is based on intuition. If you build together with others, it will be a dialog and reflection on what you do and what you see. This method could be used to create architecture and find solutions for actual challenges you face.”

“It is a good ‘vehicle’ to get new ideas as you go.”

“The point is not to think of LEGO as a model in a certain scale. LEGO is the scale. This is not a six-story building, it is six pieces of LEGO that you relate to the other LEGO bricks and look at light and shadows, mass, void, and density. It is interesting to jump between the scales. You are allowed to think and imagine that the same model could be a skyscraper or a kitchen.”
SAFDIE ARCHITECTS

MODEL MAKING AND THREE-DIMENSIONAL REPRESENTATION IN ARCHITECTURAL PRACTICE
Moshe Safdie is an Israeli-Canadian-American architect and urban planner. In 1953, at the age of 15, he immigrated to Canada from Israel. In his 20s, after an apprenticeship with Louis Kahn, Safdie's master's thesis at McGill University became a cult building: the pioneering, modular Habitat apartments for Expo '67 and the World's Fair held in Montreal. Now based in Boston, Safdie's work is known for its dramatic curves, strong geometric patterns, and green spaces. He has designed over 75 buildings and master plans around the world. These include numerous Canadian institutions—the National Gallery in Ottawa, the Montreal Museum of Fine Arts, and the Vancouver Public Library—as well as the Holocaust Museum in Jerusalem, the Khalsa Heritage Centre in India, and the Marina Bay Sands and ArtScience Museum in Singapore. In the United States, Safdie designed the Peabody Essex Museum in Salem, Massachusetts, and the Crystal Bridges Museum in Arkansas. In all his work, Safdie seeks to create meaningful, inclusive, and vital social spaces that enhance community and respond to cultural context. By breaking down scale, and creating buildings that are easily navigated and open to daylight and the outdoors, he hopes to bring a sense of humanity to the megastructure.
“For everyone, a garden.”

When I opened my architecture practice 50 years ago, we had no CAD, no 3D software; we had but sketches, drawings, labor-intensive perspectives, and model making. My first project, Habitat ’67, was a highly complex three-dimensional assembly of modular components. Basically, the concept was to rethink the apartment building from first principles—the slogan was, “For everyone, a garden.” Each prefabricated module was a house, with a garden created on the roof of the building below. In the conceptual design phase, dozens of clustering schemes were explored, as were both frame-supported and load-bearing structures. The original scheme included structures of 12, 20, and 25 stories in height. Clearly, given the complexity at hand, the only way to explore the options was through model making.
COMPONENTS

The workshop we established at the time, staffed by three model makers, was the beginning of a model-dependent practice that continues to this day, 50 years later. For this highly modular concept, the workshop produced thousands of components in wood, foam, and acrylic, which were painstakingly assembled into alternative schemes for comparison and presentation.
With the Habitat module being approximately a two-to-one rectangle, it dawned on me one day that we might have a convenient shortcut in assembling the alternative schemes out of LEGO® bricks. At the time, LEGO toys did not yet possess a wide variety of different pieces. Most kits consisted solely of single-square and double-square elements, which came in white, red, and blue. We only used the white bricks, sometimes buying mixed sets and throwing out all of the colored pieces.

As we began deploying the blocks, I found them to be an extremely convenient way to experiment with the clustering and massing arrangements the scheme explored. LEGO bricks continued to be used by our workshop right up until the final design emerged some months later. We created about ten models and practically cleared out the available stock in all the toy shops of Montreal. I’m not sure what happened to these models—it upsets me that I can’t even find a photograph of one of them in the archive.
“LEGO® bricks continued to be used by our workshop right up until the final design emerged some months later.”
“Habitat is, in its own way, a very organic project based on an orthogonal system.”

In the early seventies, as we explored alternative habitats in a variety of locations, the modular geometry became more complex: octahedral and tetrahedral models with various inclined facets were considered for Habitat New York. A split-level chamfered module was utilized for Habitat Puerto Rico, and an assemblage of rectangular boxes with domelike components was explored in Jerusalem. The LEGO bricks available at that time were unable to serve us, and we explored a variety of alternate means of fabricating these complex modules efficiently (by, for example, folding and gluing cardboard into three-dimensional forms), so that design studies and presentation models could ensue.
In the late 1960s, presenting architecture to clients involved making labor-intensive renderings, using watercolor, line drawings, or pastels. I would often construct line drawings and render freely over them with a water-soluble pastel. The American architect Paul Rudolph's (1918-1997) rendering at the time was a model of facility, beautifully rendered and a clear representation of the spatial qualities of his buildings. The character of renderings from the time varied greatly and was strongly associated with the architects who generated them—the soft charcoal sketches of Louis Kahn (1901-1974), the hard-line drawings and constructed perspectives of Rudolph. These were more personal than the ubiquitous computer renderings of today.
“In the late 1960s, presenting architecture to clients involved making labor-intensive renderings.”
“I develop embryonic ideas by doodling in my sketchbook.”

From my first days as an architectural student I have developed my ideas using models. Of course, I started my career before computers or CAD, so I would develop embryonic ideas by doodling in my sketchbook and very early in the process would move to models. I find there's a fluidity to the model; even when you're working on a large complex of buildings you can move things around, you can break and rearrange them, you can use a variety of materials depending on what you're exploring: wire mesh, which you can stretch around; cardboard; clay; LEGO bricks. Since we depended greatly on model-making to evolve our designs, these also became the primary tools for presenting designs to clients. It was at this time that we began exploring model photography as yet another medium for design representation.
Initially, we would photograph models either in sunlight, for its precise and clear shadows, or with an artificial light that simulated sunlight by having a single parallel source. These photographs seemed to be somewhat out of context, so with the help of a young photographer, Jerry Spearman, we began setting up the models in front of rear-projection screens, projecting actual views of the site, skies, and the like to achieve more photorealistic results. We would often further montage programmatic material and rephotograph the scenes.

“It appeared so realistic that people wondered whether the project had actually been realized.”

In the 1980s, when we were developing the design for Columbus Center in New York City, the photographer Steve Rosenthal further perfected this photomontage technique of program and background views to achieve totally realistic placement of the project within the New York City context. The photographs of Columbus Center in its New York setting appeared so realistic that people wondered whether the project had actually been realized (which it had not).
“IN TIME, WE BECAME MORE AMBITIOUS.”

In time, we became more ambitious and our model makers began exploring mechanisms by which we could light models from within, so that in our photography we could also achieve nighttime effects. This meant designing the models specifically toward that end; they needed to be hollow (i.e., spatial), and we had to find lighting devices that, at the smallest scales, could simulate the nighttime conditions of our buildings. A variety of lamp types, minilamps and—more recently—LED lights were deployed to achieve a variety of lighting conditions. Fusing devices and other clever inventions were evolved over time to help achieve these lifelike lighting effects. This, in combination with the projection of surrounding site conditions, moved our model photography further toward realistic representation of our projects under both daytime and nighttime conditions.

Today, much of the supplementary work to our model photography is achieved with Photoshop. Rather than project and photograph models with images around them, models are now photographed in a variety of lighting conditions and then uploaded into Photoshop to create numerous different effects, with trees, people, foreground and background scenery all added digitally.

Since my days as an architecture student, the freehand design sketch has been my primary tool for exploring a building’s organization, specific details, and special relationships. With the portability of the sketchbook, this method enables me to continue working in a variety of conditions, including during travel. These sketches are easily photographed or scanned and forwarded to the project team, then translated into both physical and digital models with which the ideas undergo further development.
Then came the new age of computer renderings and computer thinking. Computers were introduced very early in our practice. The first software, Draw Base, was applied in the 1980s to the design of both Columbus Center and the National Gallery of Canada in Ottawa. In time, new 3D design software such as Rhino, Maya, and Sketch-Up became potent tools for the design teams. These tools enabled the exploration of much more complex geometries, heretofore impossible to resolve.

At this point, computers are central to our exploration. As a working tool it’s extraordinary. It gives you a facility to explore geometries and how the pieces of a building might come together. Computer renderings are quite different—they basically paint a picture with new tools, and I find them a bit disconcerting because they’re too realistic at too early a stage of the game. They aspire to be the real thing and often are so infused with detail that they feel like the real thing—they show all kinds of things you haven’t really thought through properly yet. So they’re exposing and I get uneasy about them unlike I do about, say, a pastel sketch or model, which gives you the feel for something but doesn’t spell out everything.
“At this point, computers are central to our exploration.”
“Computers enabled the exploration of much more complex geometries.”

In computer renderings you can quickly achieve something that is graphically very exciting and presentable, but it doesn’t mean that it’ll make a good building or one that is even appropriate for the site. I can see architectural students and architects getting very seduced by this stuff and seducing others with it. But the ultimate test is reality and real buildings.

However, many of our recent projects, such as the Salt Lake City Main Public Library in Utah; Exploration Place in Wichita, Kansas; and Crystal Bridges Museum of American Art in Bentonville, Arkansas, would have been extremely difficult to realize without these tools. Today, the advent of 3D printing opens up new possibilities and efficiencies for the model shop to translate designs of complex geometries into physical models.

Nevertheless, the availability of 3D software, for both design exploration and renderings, has not lessened our dependency on physical models, neither for design development, nor for design presentation. Today, our model shop consists of a team of eight model makers, supported by laser cutters and 3D printers, and a fully equipped workshop.
On a project such as Marina Bay Sands Integrated Resort in Singapore, for example, we produced several hundred study models for each and every part of the building—hotels, theaters, theater lobby, and the ArtScience Museum. It was an extraordinary site, with a program totaling 10 million square feet, so it was like designing a miniature city. A skeletal structure started emerging in which I tried to marry the spectacular waterfront with a corridor—the spine of urban life. It evolved into a podium building, with three towers containing 3,000 hotel rooms, and a sky park on the 59th floor joining them and framing views of the ocean. It was designed in four months and once we got selected it hardly changed at all. However, we created probably over 150 models just for the ArtScience Museum alone—models of varying scales, large cardboard models of the entire building to explore the gallery spaces, and skeletal models to study its structure.
“It was like designing a miniature city.”
Computers

Paper models were supplemented with computer models, which allowed for detailed development of the truss forms.

In the development of detailed models of the ArtScience Museum at Marina Bay Sands, the form of the building developed as the rationalization of geometry and buildability advanced. The earliest form of a sphere was followed by a more detailed exploration of spheroid geometries.
“NIEMEYER was dreaming shapes that he didn’t have the tools to realize.”

Though I'm not sure computers are an especially useful tool for conceiving things, they are very effective in helping to realize complex buildings. The ArtScience Museum, for example, is made of a series of spheroid geometries of slightly varying radius, though the surface appears as one solid monolith made up of these individual panels welded into a single plane. I can't see how we would have worked out how to connect these to the latticed steel skeleton with traditional models or drawings, let alone transfer that information to a manufacturer. So, in parallel with those traditional methods, the design team developed models in Rhino, Maya, and CATIA, which were eventually translated into construction drawings and fabrication drawings for the manufacturer.

Computer modeling tools are very effective in achieving better coordination between the building systems and editing out conflicts between them at an early phase. If we look at the exuberant curvy forms of the Brazilian architect Oscar Niemeyer (1907-2012), in real life they're pretty crude; they're made of concrete and plaster and things don't meet—they're sloppy in the execution and craftsmanship partly because he was dreaming shapes that he didn't have the tools to realize. However, physical models are a better, more potent tool for testing ideas and avoiding conceptual design errors. I like it that I can stick my nose into them, break them, shift them. In our 50 years of practice, we continue to this day to engage in extensive physical model making, often undertaken at a large scale, as an indispensable part of our design process.
“I always advise students to be aware of where one’s ego is in the process of creating architecture.”

I think many of us had experience of designing with kits or building blocks as kids; they used to be made out of wood and had little arches and columns. I think LEGO® is similar but different to these because, unlike those traditional blocks that were dependent on simple gravity for stability, which really limited what you could explore, LEGO has a connective system built into it. This clipping device opens up a range of possibilities that you don’t have with a gravitational system, which is why the artist Sawaiya is able to create extraordinary complex forms well beyond the rectilinear, orthogonal geometry of the individual piece. And so it offers students a more fun and open-ended method to understand the link between the systemic conception of architecture and its formal outcome.
I always advise students to be aware of where one’s ego is in the process of creating architecture. If they’re approaching the practice as a kind of free-wielding opportunity to create things for their own satisfaction, without concern for their outcome on people’s lives, you get caricature. Sculpture is about the will of the artist, but architecture is about that spirit functioning within real-life constraints. And I don’t mean this negatively: the constraints are the forces of life that you need to respond to: gravity, the perception of space in terms of our psyche, energy, comfort, and shelter. If you skillfully mold these constraints into an organic response to an environment, you achieve a fitness in the Darwinian sense, and can create a hospitable, satisfying space of great beauty.
Hand-on Exploration: LEGO® Builds

Symmetry

The Egyptian or Mayan pyramids are classic examples of symmetry. If you place a vertical plane (flat surface) through the center of a pyramid plan, parallel to one of its sides and compare the two halves, you will see that they are identical and could be mirrored over the center axis.
If you look at the floor plan of the Kukulkan's Pyramid in Chichen Itza, you will discover that a line drawn through the center of the square floor plan, parallel to one of its sides, will divide it into two symmetric halves. A line, drawn diagonally from a corner through the center to the opposite corner will divide the floor plan into two symmetric triangles.

A symmetrical design embodies a sense of balance, or equilibrium. Symmetry is often used in classical architecture to impress: it conveys order and has a monumental appearance.
The exercise for you to explore Symmetry:

In order to understand symmetry, it is good to start with the opposite: a simple nonsymmetrical LEGO® composition. Make a simple LEGO sketch-model that is nonsymmetric (like the example on the left).

By mirroring the image of the sketch-model you have chosen, it will form a symmetrical structure, which is symmetric from two sides (from its front and its back side). This is called bilateral symmetry. Do you know any buildings in your city that have this structure?
If we mirror this sketch-model again, we get an object that has two orthogonal planes of symmetry. It will become symmetrical from four directions: its front, its back, and its sides.

Or you can take the first sketch-model and join four of the same structures together, rotating them by 90 degrees; the new structure will have rotational symmetry. Rotational symmetry makes an object look the same after a certain amount of rotation—in this case, 90 degrees.

What architectural structure could that represent? Try to add context to your LEGO sketch-models to understand the influence of symmetry.
"I was trying to find a symmetry that would read "in all directions."

"I did a sequential build of small pieces. The first one explored symmetry over one axis; the next over two, like x and y. The next one over three, x, y and z. Then it gets complicated, as in the last one where I try to add a diagonal axis to it."

Make some LEGO sketches that express symmetry.

LEGO® bricks. It was a three-step exercise:

1. We asked Saride Architects to give their interpretation of "symmetry" using the Hands-On Exploration with Saride Architects.

2. Then it gets complicated, as in the last one where I try to add a diagonal axis to it.
Divide your model into two and rebuild it, exploring symmetry.

“You can do a 2D symmetry: it would be like a drawing. Mine is 3D, evolving into a growing spiral.”

“There’s a strong relationship between understanding symmetry and section.”
“You feel the relationship between symmetry and balance as in weight distribution in a very direct way.”
Develop your model, thinking of the architectural expression.

“I just want to test how detailed I can get with these bricks. This is a freeway, with a ramp, a curb, and a bridge.”

“I’m trying to spin a stacked city—adding layers upward and creating these diagonal pathways.”
“I broke the rules of the build and expressed both symmetry and asymmetry in this flexible model.”

“Some of our projects maybe look symmetrical, but in the detail they are asymmetrical, which creates an important tension. How far can you push symmetry and still get a feeling of it?”
“A lot of our work is geometrically based, and then we push it to that point of tension. It's sort of a reaction toward the Renaissance and other historical periods in architecture.”

“To understand symmetry, you have to explore asymmetry, and visa versa.”

“LEGO is like a three-dimensional sketchbook. With the freedom of play, you create your own problems and then solve them.”
The selection of LEGO® bricks provided with this set will help you to translate your ideas into LEGO sketch-models. You are not required to have any specific knowledge or expertise in building with LEGO bricks. Your creative journey starts the moment you set your first two bricks together. You decide the size and complexity of your LEGO construction. To help you in your creative process, we would like to provide a few tips on the building techniques that you may find relevant when designing houses or other structures.
Technique #1: LOCKING

Placing one LEGO brick across two others seems simple, but it's one of the most important building techniques to know. By LOCKING two or more bricks together with one that lies across them on top or underneath, you create an assembly that can hold more weight and stay connected better. The more you lock the LEGO bricks in your model together, the stronger and sturdier it will be!

When placing windows in your building, for example, it is important to lock them before going to finish up the roof or going to the next floor.
Technique #2: SIDEWAYS BUILDING

Now we move from one of the most basic LEGO building techniques to one of the most unusual ones. Most of the LEGO bricks in your collection have studs on top and tubes or holes on the bottom so that they can be stacked on top of each other. Some less common pieces, though, have studs or holes that point in different directions.

Thanks to these special LEGO elements, your creations don't have to just be built straight up and down. Try adding bricks that stick out on the sides, then build out from them to add even more details and shapes to your models. This extremely useful technique is what we call SIDEWAYS BUILDING!

When it comes to adding details to your model, like these windows, the sideways building technique is unique.
Technique #3: SIZE-SCALING

Size-scaling is all about taking something BIG and figuring out how to build it SMALL. An expert at this technique can look at a collection of LEGO bricks and choose the piece that's exactly the right size, shape, and color to represent an important detail on a model. You may be surprised at how some of the more unusually shaped LEGO bricks can be used in microscale building!

The size-scaling technique is also useful if you want to show how your building looks in existing surroundings: for example, a part of a city.
Technique #4: DETAILS
Details are CAREFULLY CHOSEN LEGO ELEMENTS that don't have to be important for your model's strength and stability; instead, they HELP TO TELL YOUR CREATION'S STORY. With the RIGHT DETAILS in place, people will be able to tell what your model is all about, just by looking at it. SO CHOOSE YOUR DETAILS WISELY!

Details don't necessarily have to be on your model: details can also be used to show the surroundings.
Technique #5: ALTERNATIVE USES

Do you know what you want to build, but you can't find just the right piece to build it with? Then it's time to GET CREATIVE WITH ALTERNATIVE USES! First, spread out your bricks on a table and examine them. Pick them up, flip them over, and really look at them from every side. You might just find one that would be perfect for the job if you use it in a way that you haven't thought about before: maybe attaching it with sideways building, or upside-down, or combined with another piece to make an entirely new shape.

The more you PRACTICE BUILDING WITH YOUR BRICKS IN NEW WAYS, the better you'll be at finding alternative uses!

By using the jumper plate, you can offset the columns between the studs, and achieve more realistic spacing of columns.

The jumper plate allows you to push the window and the door back (inside) by half a module, making the structure look more realistic.
Technique #6: BUILDING IN SECTIONS

Large, thin pieces can be tricky to build directly onto the main body of a model. You’ll often have better construction stability if you build a MULTI-PIECE SECTION like this spaceship’s front end separately and then attach it when it’s done.

When doing buildings where big parts are hanging out, it is a good idea to split the build, and make subsections before you assemble the model.