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In Defense of “Cheap Architecture”

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by

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Like everything else, I dedicate this project to my mom.

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For my mom, Augusta, I just want to be more like you. For my dad, Dylan, thank you for showing up and loving me. For my sisters and greatest rivals, Clementine and Grace, you set the bar.

For my love, Sofia Luz, I think you are the smartest person I've ever met; listening to you think is bliss. Thanks, Alaska.

For Ray and Joe, we could have walked anywhere, but we walked to school, and I haven’t stopped since.

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Introduction

Opening Episode

Cheap architecture is like a Subway sandwich, it probably wasn't made by Frank Gehry, and regular people make it all the time without the help of a professional. However, like a delicious Subway sandwich, the cheap architecture of Lacaton & Vassal and Tatiana Bilbao Estudio provides a guiding light for the way things could be made.

When I say cheap architecture I mean valuable architecture produced by an architect willing to adhere to a low budget. Generally speaking, cheap architecture is defined by the latter, and the word cheap is charged with negative connotations of junk, mass production, and profit margins. However, I'm talking about unique architectural projects that are committed to their given restraints (and sometimes even appreciate them). Monetary constraints dictate an architectural project's available materials and the labor used to produce and maintain the project. The architect of a low-budget project must actively work to lower the cost of labor and materials to avoid lowering the value of the building. If they don't, they'll have to systematically remove necessary elements of the project to appease their budget limitations. Typically these projects begin as submissions to architectural competitions and these competitions are responsible for setting the financial limits. In this relationship, an architect is handed two motivations: to win the competition and to stay within the budget. As a result, cheap architecture can be valuable and inexpensive.

Contemporary artists work within a similar logic. Large and impressive contemporary sculptures are also unique products that are produced out of a delicate balance between the art's value and the artist's budget. An artist who works with a limited supply of money must work

with their art fabricator to invent how to build their sculpture. There is no model for creating valuable yet inexpensive art just like there is no model for valuable yet cheap architecture. Artists rely on innovation in labor and materials to bring their ambitious projects to life. And if the artist fails, they must compromise either the value of their work or their limited budget, producing either a poorly made or over-budget piece of art. The same goes for cheap architecture.

I'm focusing on two architectural practices that currently produce valuable low/under budget architecture. When I say valuable architecture I mean architecture that achieves its original social vision. I'm specifically interested in the Tatiana Bilbao Estudio and Lacaton & Vassal architecture firms as examples of architects who have actively embraced using less money. The Tatiana Bilbao Estudio is a Mexican architecture firm that promotes unpopular yet financially and environmentally valuable building materials. The firm spent the first half of the 2010's promoting earth-based construction via expensive and private forms of vernacular architecture. However, following the 2017 Puebla earthquake, they recently turned their attention to low-income housing with the construction of *Casa Marbel* (fig. 0.1) (2017-2018). After the earthquake, Tatiana Bilbao Estudio stepped in to promote earth-based re-construction, which is cheaper and better for the environment than alternatives like concrete. Here, Tatiana Bilbao Estudio has had the greatest impact on Mexican domesticity.[1]

As for Lacaton and Vassal, the firm has been credited with saving France's Social Housing, yet, they have never demolished a building to construct a new one. Instead, they use innovation and technology to restructure and add to the existing architecture. As a result, the firm

[1] Johanna Lehne and Felix Preston. "Making Concrete Change - Chathamhouse.org." Chatham House, June 13, 2018. https://www.chathamhouse.org/sites/default/files/publications/2018-06-13-making-concrete-change-cement-lehne-preston-final.pdf.

always comes in under budget and produces the most possible SHON (Surface hors oeuvre nette or Net Surface Area). With their *Transformation of 530 Dwellings* (2016), they used a simple move of craning in a new exterior to entirely transform the apartment building (fig. 0.2). They used a crane to attach rows of balconies to both sides of the building and then added outward facing doors to the original apartments to open them up to this new usable and sun-lit space (fig. 0.3). True to fashion, Lacaton and Vassal gave the residents of the 503 apartments more usable space and stayed under budget. Not a single family was removed from the building during or after construction.

The Status of Architectural Criticism

Architectural criticism designs the public's aspirations for architecture and reinforces what's already happening in the field. A brief inspection of *The New York Times*' architecture column reveals a focus on local architecture and the environment. Former chief art critic and current architecture critic at *The New York Times* Michael Kimmelman focuses on issues in (mostly local) public housing and the environment. For Kimmelman, who also designs walking tours of New York for the *Times* readership, occupying the physical space of architecture is critical.[2] Architecture as understood by Kimmelman isn't just something you think about, it's something to experience. In addition, Kimmelman understands problems in architecture holistically and often brings in topics from outside of architecture to understand larger questions.[3] Founder and editor-in-chief at *Dezeen* Marcus Fairs who led Dezeen's 2021 *Carbon*

[2] Michael Kimmelman (2020, October 16). "Walking New York City's 42nd Street." The New York Times. Retrieved December 11, 2021, from https://www.nytimes.com/interactive/2020/10/16/arts/walking-42-street.html.

[3] Michael Kimmelman, & Doherty, B. (2021, January 27). "Recycling in America is a mess. A new bill could clean it up".The New York Times. Retrieved December 11, 2021, from https://www.nytimes.com/2021/01/27/arts/design/recycling-packaging-new-york.html.

Revolution series is almost entirely focused on environmentalism in architecture.[4] Fairs presents large-scale environmental questions that deal with entire industries and material practices within architecture. Other contributions from Fairs highlight both the fantastical built and conceptual work of well-known architects and firms from all around the world.[5] In comparison to Fairs' environmental criticism, the project-based articles read like celebrity news publications. Unlike Fairs and Kimmelman's macro-architecture criticisms on the effects of climate change and public housing, I'm providing a micro criticism of architecture and the cost of built architecture. Cheap architecture provides a viable solution at the scale of a single building to the larger issues described by Kimmelman and Fairs.

Literature Review

Architect and urbanist Matthew Soules contends that there was a shift over the past 40 years that turned buildings into a medium of financial capitalization and not just a product of finance capitalism.[6] As a result, he argues, contemporary culture and capital can't be distinguished. In agreement, my definition of cheap architecture defends the role of cost in dictating the design and construction of well-built architecture. Soules utilizes negative examples such as iceberg homes used to bury wealth, zombie urbanism that produces persistent under-occupancy, and ultra-thin pencil towers deviously used as objects of speculation. I, on the other hand, will investigate how architecture can be a resistance to finance capitalism.

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[4] Marcus Fairs. "Carbon revolution." Dezeen. Retrieved December 11, 2021, from https://www.dezeen.com/carbon/.

[5] Marcus Fairs. (2021, November 12). "The ten most popular architecture and design events of 2021." Dezeen. Retrieved December 11, 2021, from https://www.dezeen.com/2021/11/11/most-popular-events-2021-dezeen-events-guide/.

[6] Matthew Soules. *Icebergs, Zombies, and the Ultra-Thin: Architecture and Capitalism in the 21st Century*, New York: Princeton Architectural Press, 2021.

Likewise, architect and architectural educator Peggy Deamer understands recent architectural design not as an autonomous reflection of the economy but as a part of it.[7] Deamer claims that when contributing to the built environment, architects have and will always need to navigate the effects of their economic conditions. If architectural and economic histories are one and the same, then the architecture of the present and the future is and will be tied to its corresponding economic conditions. My definition of cheap architecture responds to the need for architectural design that embraces restraining economic conditions (e.g., low budget).

Peggy Deamer has also investigated the impact of digital fabrication and other technologies on the client-architect-contractor trichotomy.[8] Deamer suggests that digital fabrication allows contractors to affect the design of the buildings they build. As a result, the technology-driven shift in the client-architect-contractor trichotomy has transformed the value of architecture and the role of architectural labor. I agree that digital fabrication and technologies such as 3-D printers can reduce costs and produce examples of cheap architecture. However, unlike Deamer, I'm interested in exploring the effects of unique prefabrication paired with rudimentary technologies on the client-architect-contractor trichotomy.

Deamer scrutinizes the influence of neoliberalism on labor practices within architecture.[9] According to Deamer, architects should resist current models of work (e.g., the disappearance of work-life balance, and the division of labor). Instead, architects need to prioritize a work environment that uses alternative measures of success over profit. Her call for more ethical and equitable labor practices will guide my evaluation processes of cheap architecture.

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[7] Peggy Deamer. *Architecture and Capitalism: 1845 to the Present*, London: Routledge, 2014.

[8] Peggy Deamer and Phillip Bernstein, *Building (in) The Future: Recasting Labor in Architecture*, United States: Princeton Architectural Press, 2012.

[9] Peggy Deamer. "(UN)Free Work: Architecture, Labour and Self-Determination," *Architectural Design* 88, no. 3 (February 2018): pp. 16-23, https://doi.org/10.1002/ad.2296.

Director of Graduate Education and Pickard Chilton Professor in Iowa State University's Department of Architecture Douglas Spencer, argues that since the 1960s architects have promoted the private sector's control of land and design, and since the 90s, architecture itself has mimicked characteristics of neoliberalism.[10] According to Spencer neoliberalism is a subversive attempt to gently shape our view of the world, and seems to drive certain contemporary architectural production. Spencer's critique of contemporary architecture calls into question exactly why I have prioritized the development of cheap architecture and the validity of cheapness as a positive characteristic.

Methodology

I am arguing for the necessary increase in design and production of cheap architecture to make unique and valuable buildings more affordable. To define cheap architecture, I have amassed a pool of four examples built during my lifetime, ranging from fig. 0.4, Lacaton & Vassal's *Transformation of 530 Dwellings* (2016) to fig. 0.1, Tatiana Bilbao Estudio's *Casa Marbel* (2017-2018). While Matthew Soules offers pessimistic examples of financially motivated buildings, I'll focus on locating more hopeful architectural projects. However, there are limitations to cheap architecture. A critical and repeated failure of "cheap architecture" is its tendency to exist as a fleeting gimmick.

While selecting examples of "cheap architecture" to include in my project I avoided conceptual drawings and propositions because architecture has to be built in order to be considered cheap. Although Tatiana Bilbao's architectural drawings play a significant role in this project, I limited myself to focusing on her drawings of completed buildings. If an example of

[10] Douglas Spencer. *The Architecture of Neoliberalism: How Contemporary Architecture Became an Instrument of Control and Compliance*, London: Bloomsbury Academic, 2018.

"cheap architecture" only exists on paper then there remains a possibility for the project's ideals to be surrendered, such as its interesting design or reasonable budget. In order to assess their value, each example of cheap architecture will be judged through the lenses provided by Peggy Deamer and Douglas Spencer. More specifically, to evaluate examples of cheap architecture, I will focus on two characteristics of built architecture: the cost and the significance. Although I will rely on recent architectural history, this is a criticism, not a historical project, and I am trying to come up with a new category of architecture.

Chapter Outline

The first chapter will focus on two examples of Lacaton & Vassal's retrofitted cheap architecture that were accomplished without demolition. This chapter tells the story of how Lacaton & Vassal first developed their transformative architecture with the *Transformation of the Bois le Prêtre Tower* (Fig. 0.5) (2011) where they performed one material move to reimagine and revitalize a modern housing development's 96 apartments in Paris, France. Then with their *Transformation of 530 Dwellings* (fig. 0.4), they produced a convincing example of how their transformative architecture could be scaled up. With this project, the pair of Pritzker prize-winning architects used their transformative architecture to extend the living spaces of 530 apartment units and increase natural light without removing a single resident.

The second chapter covers how the architect Tatiana Bilbao presents notions of utopia on her firm's website and then converts those ideas to our physical reality. Specifically, I will deal with two realized examples of Tatiana Bilbao Estudio's cheap architecture that are defined by their materials. Her *Casa Ajijic* (fig. 0.6) (2010-2011) was built using rammed earth to accommodate the project's relatively small budget and the client's dream of a large house.

Rammed earth is a renewable construction material that is less expensive and has a higher compressive strength than wood, brick, or concrete. The *Casa Ajijic* project allowed Bilbao to experiment with using earth-based materials to deliver a large house within her client's relatively small budget. Then, Bilbao further developed earth-based construction by working with eco-blocks to produce *Casa Marbel* (2017-2018) (Fig. 0.1). Eco-blocks are miniature versions of rammed earth rapidly produced by a hydraulic press. It is eco-blocks that allow Bilbao to proliferate her earth-based architectural method to affect the greatest number of people.

Problems With Architecture and Limits of "Cheap Architecture"

The low cost of cheap architecture means it is accessible to everyone. If everybody can potentially be the client of cheap architecture then why is it not more prevalent? I suspect that, currently, cheap architecture is reserved for established institutions that can leverage their institutional status for an architect's best effort at a reduced price. And if this is true, then who is cheap architecture for? Are institutions the gatekeepers of cheap architecture? Can architects move beyond large institutions and apply their own self-imposed constraints and produce cheap architecture for anyone and everyone?

The modern St. Louis, Missouri housing project *Pruitt-Igoe* is an example of how institutions and the clients of architecture can send architectural projects off the rails. The federal housing committee responsible for the *Pruitt-Igoe Housing Project* did not allow for the project to be designed in the image of their budget (Fig. 0.7). Instead, the client (the government) upheld their restraining budget only after Minoru Yamasaki had already designed the project. And then, instead of allowing for their budget to grow to accommodate Yamasaki's vision, they deemed many of the project's most important features too expensive and cut them (such as low-rise units

dispersed among their larger counterparts, playgrounds, ground-floor restrooms, and additional landscaping).[11] As a result, the more successful original plan for the *Pruitt-Igoe Housing Project* was not inexpensive, and the federal housing committee's accepted plan for the *Pruitt-Igoe Housing Project* was not valuable/successful (they cut costs to fit their budget and turned the project into something that didn't work). If the original plan for the *Pruitt-Igoe Housing Project* was produced for a lower budget then the final project would have been inexpensive and valuable.

I think modern architects' dream of affordable architecture, such as Minoru Yamasaki's *Pruitt-Igoe*, was diminished by their clients' attempt to retroactively cut costs and their architecture may have failed as a result. And I think contemporary architecture, such as Tatiana Bilbao's earth-based houses and everything made by Lacaton and Vassal, is more successful because it is cheap architecture.

Unchecked and harmful practices of material extraction in architecture are contributors to the exhaustion of resources and degradation of the planet. Industry standards such as concrete construction are nonrenewable. Environmental expenses are reduced in cheap architecture by either hacking existing architecture or through the use of locally sourced and renewable alternatives. My examples of cheap architecture reduce waste by using readily available materials like dirt and the existing skeletons of old buildings to provide the structures for new ones (fig. 0.4, 0.6, and 0.1). Although reducing cost and increasing quality is the goal of cheap architecture, sustainability is an expected byproduct.

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[11]Luke Fiederer. "Ad Classics: Pruitt-Igoe Housing Project / Minoru Yamasaki," ArchDaily (ArchDaily, May 15, 2017), https://www.archdaily.com/870685/ad-classics-pruitt-igoe-housing-project-minoru-yamasaki-st-louis-usa-modernism.

The architecture of the future is reserved for the wealthy elite, and the working class is either uprooted or left to live in their leftovers. For instance, affordable housing projects developed during the 20th century are often exclusively occupied by the working class. Retrofitting decrepit modern housing projects for the use of contemporary social housing improves living quality without displacing the original population (fig. 0.8). Cheap architecture can allow societies to invest in projects necessary for societal good that are not necessarily profitable for developers.

Iconic and innovative design is typically reserved for wealthy European and American publics and is withheld from the majority of the public. As a result, inexpensive architecture is typically repetitive and uninteresting. Even in the 21st-century technology such as mobile 3d cement printers are used to print entire neighborhoods of identical affordable homes instead of handing over the keys of innovation to the users who might choose more original designs. Unique and inexpensive architecture is made accessible when architects intentionally produce it within a limited budget.

Chapter 1: Retrofitting Modernity

1.1 Intro

Over the course of 23 years, from 1950 to 1973, the city of St. Louis, Missouri destroyed an entire low income housing neighborhood and replaced those homes with a modern public-housing project.[12] They soon after destroyed that very same housing project. In 1950, using funding provided by the Federal Housing Act of 1949, the city of St. Louis commissioned the replacement of the DeSoto-Carr neighborhood with *Pruitt-Igoe* (fig. 1.1), a modern public-housing project designed by Minoru Yamasaki (1912-1986), built between 1951-1955. However, in 1973, the city of St. Louis and the federal Department of Housing finalized the demolition of that same housing project. The *Pruitt-Igoe* project reveals an unnecessary cycle of destruction and construction that devoured hundreds of living units and produced a waste field. Today, if one were to visit St. Louis and the *Pruitt-Igoe* housing development, one would find an uninhabited and fenced-off demolition site. Although early critics originally pointed to failures within *Pruitt-Igoe's* modern design, the development's demolition and not its construction represents the real monumental failure. Currently, only 10 of the project's original 23-hectares have been reclaimed, and the remaining site has been pushed further into a state of decay.[13] In 1993, the city of St. Louis began dumping rubble from other local construction projects onto the site of what used to be the *Pruitt-Igoe* development, ensuring it could not be inhabitable in the

[12] Michael R. Allen, and Nora Wendl. "After Pruitt-Igoe: An Urban Forest as an Evolving Temporal Landscape." *Studies in the History of Gardens & Designed Landscapes* 34, no. 1 (January 2, 2014): 101–12. https://doi.org/10.1080/14601176.2013.850241.

[13] A hectare is a metric unit of square measure equal to 10,000 square meters.

future. Today, the once fully-inhabited 23-hectare plot of land is now predominantly unoccupied, serving as a warning against unnecessary demolition

Although *Pruitt-Igoe* was made obsolete and destroyed after 23 years, its concrete structure was durable enough to last another 75 years.[14] That's like throwing away a dozen slightly brown bananas because you don't want to eat the mushy parts. Instead, those bananas could be turned into banana bread, or in the case of *Pruitt-Igoe*, transformed into a new building.[15] The French architecture firm Lacaton & Vassal's architecture of transformation, without demolition, provides a different and positive path to redeveloping decrepit modern housing projects. They use balconies to extrude a new vertical layer from each side of an existing building, as if it were a 3-D model in Rhino.[16] In doing so, they are able to re-imagine the modernist project with a few seemingly simple though highly effective interventions in architectural design projects.

1.2 From Bordeaux to Niamey

Founded in 1987, by Anne Lacaton (1955 -, Saint-Pardoux, France) and Jean-Philippe Vassal (1954 -, Casablanca, Morocco), their aim was to change standards in architecture by removing demolition from the shared vocabulary. During Lacaton and Vassal's formal training in Bordeaux and informal training in Niamey, Niger, they developed the mantra "Never demolish,

[14] "Durability." Portland Cement Association. Accessed March 19, 2022. https://www.cement.org/learn/concrete-technology/durability#:~:text=The%20design%20service%20life%20of,functional%20obsolescence%20rather%20than%20deterioration.

[15] Julia Moskin. "Banana Bread." The New York Times. The New York Times, January 21, 2009. https://cooking.nytimes.com/recipes/1013989-banana-bread.

[16] IIT DC "Rhino Basics Extrude." YouTube. YouTube, October 12, 2016. https://www.youtube.com/watch?v=IR-Mj8Oeub8.

always add."[17] Today, Lacaton & Vassal have used cheap architecture to save three French large-scale social housing projects: the *Bois le Prêtre Tower* in Paris (2011) (fig. 0.5), the *Chesnaie housing estate in* Saint Nazaire (2014 & 2016) (fig. 1.2), and the *Grand Parc housing estate* in Bordeaux (2016) (fig. 0.4).

Lacaton and Vassal met in the late 70s while attending *Ecole d'Architecture of Bordeaux (ENSAP)* and both graduated in 1980 with degrees in architecture. When they started their education in Bordeaux, the school was run by a "Boss" named Claude Ferret (1907-1993).[18] Under Ferret, the curriculum at the *Ecole d'Architecture of Bordeaux* revolved around the teachings of the "Boss". However, soon after Lacaton and Vassal arrived, in 1977 Ferret left, and the school's administration was reorganized. After Ferret's departure, the *Ecole d'Architecture of Bordeaux* became a non-hierarchical environment run by a collection of new French masters that included the open-minded French architect Jacques Hondelatte (1942-2002).

It was in Hondelatte's workshops where Lacaton and Vassal were first exposed to the egalitarian design practices that they have applied to their transformative architecture. Instead of setting the curriculum himself, Hondelatte assisted his students as they ran the workshops according to their interests. Frédéric Druot (1958 -), Lacaton and Vassal's frequent collaborator and former classmate, remembers the late Hondelatte as "their guru without dogma".[19] Unlike Ferret, Hondelatte's method of instruction (or non-instruction) prioritized the input of students and empowered them through collectively designed workshops.

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[17] Anne Lacaton, Philippe Ruault, Jean-Philippe Vassal, and Museo Colecciones ICO. 2021. *Lacaton & Vassal : Espacio Libre, Transformación, Habiter = Free Space, Transformation, Habiter*. Edited by Fundación ICO.

[18] "Story" *ENSAP.* Accessed on March 2nd. http://www.bordeaux.archi.fr/ecole.html

[19] "Frédéric Druot or the strategy of stepping aside" *Le Moniteur.* (February 2nd, 2012) Accessed on March 13th. https://www.lemoniteur.fr/article/frederic-druot-ou-la-strategie-du-pas-de-cote.1926394

However, it was their time in the city of Niamey, Niger, located in West Africa, that provided the catalyst for their joint architectural practice and international firm. In the late 1890s, Niger was colonized by France. By 1926, France made Niamey the colony's capital. Niamey was suffocated by the French regime. Although it was chosen for its strategic location on the bank of the Niger river, domestic water rights were restricted to British colonists during French rule.[20] In addition, Uranium was discovered in the desert of Niger, in 1957, and quickly became a major subject of french-financial speculation. Although in 1960, Niger eventually regained its independence, the new revenue derived from uranium profits continued to be predominantly under the control of Areva, a French company. Following the discovery of Uranium, Niger experienced an increase in rural to urban migration, and the capital city of Niamey's population ballooned from 33,816 in 1960 to 400,000 in 1988. Niamey's infantile urban density presented alluring opportunities for overhaul and redesign. And in 1980, a young freshly educated Jean-Philippe Vassal arrived in Niamey. After graduating from *ENSAP*, Vassal elected to spend a year working as an urban planner in Niger as an alternative to France's otherwise obligatory peacetime conscription. Although the program only lasted a year, Vassal opted to stay in Niger and continue working as an urban planner until 1985.[21]

While working in Niamey, Vassal's urban planning specifically "dealt with the temporary settlements of nomads in the dry season around villages…"[22] Vassal was working to accommodate cattle-farming Nigeriens, who followed their cows' grazing patterns and needed

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[20] Sara Beth Keough, and Scott M. Youngstedt. *Water, Life, and Profit: Fluid Economics and Cultures of Niamey, Niger.* Berghahn Books, 2019. Pg. 40-50

[21] Jean-Philippe Vassal and Anne Lacaton. "Curriculum Vitae" Lacaton & Vassal. Accessed February 12th 2022. https://www.lacatonvassal.com/data/documents/20210415-100842lv_cvv_chrono_v5Ang-bd.pdf.

[22] Lacaton & Vassal Architectes, Fernando Márquez Cecilia, and Richard C. Levene, eds. *Lacaton & Vassal: 1993 - 2017*. El Croquis, 2017, 177/178. Madrid: El Croquis edition, 2017. Pg. 10

temporary living spaces within the permanent population of Niamey. Vassal's work with nomadic populations introduced the young architect to the finite nature of construction materials. He couldn't rely on new construction to produce enough domestic units to accommodate the rapidly expanding population of Niamey. Instead, he learned to use what he had.

During Vassal's time in Niamey, his former classmate, Lacaton visited him frequently and remembered Niger as "... one of the poorest countries in the world, and the people are so incredible, so generous, doing nearly everything with nothing, finding resources all the time, but with optimism, full of poetry and inventiveness. It was really a second school of architecture…"[23] In the 80s, Lacaton was visiting a city that's urban population had increased 12 times over and she recognized the challenges of retrofitting an old city for a new and diverse population. In Niamey, the rapid population growth increased material scarcity and revealed the value of used objects: their utility. Together Lacaton and Vassal witnessed communities move into new spaces and realize the potentiality of existing materials in relation to their current situation "... a corrugated panel or even a fridge door could be suitable for a door."[24] By embracing material constraints, new citizens of Niamey successfully used existing materials to help in their expansion of liveable urban spaces. Lacaton and Vassal's "Never demolish, always add" architectural philosophy was entirely inspired by Nigerien construction practices. In Niamey, the duo learned that there can exist no hierarchy in materiality, instead, everything in a space has a potential value which is realized the moment you can do something with it.

The duo completed their first joint architectural project while Vassal worked in Niamey. The budding architects designed and constructed a small house entitled *Paillote* (1984) (fig. 1.3)

[23] "Anne Lacaton and Jean-Philippe Vassal Biography." *The Architecture pritzker Prize,* Accessed on February 16th. https://www.pritzkerprize.com/laureates/anne-lacaton-and-jean-philippe-vassal

[24] Lacaton & Vassal Architectes, Fernando Márquez Cecilia, and Richard C. Levene, eds. *Lacaton & Vassal: 1993 - 2017*. El Croquis, 2017, 177/178. Madrid: El Croquis edition, 2017. Pg. 11

on the bank of the Niger River.[25] Unlike their recent projects, which are all accompanied by detailed expense reports, and clearly identified clients, there is very little information attributed to *Paillote* other than its location and date of completion. The site was selected by Vassal, who picked a wind-exposed outlook, atop a sand dune, against the advice of a local representative (unnamed). Using locally sourced straw and sticks, construction took 2 days and the result was a 5-meter straw dome that permitted cool breezes from the nearby Niger river. Although he had been warned against building on the exposed sand dune, a young and ambitious Vassal failed to take into account the experience of the user. The wind destroyed the first iteration within 6 months. To solve the wind problem, Lacaton and Vassal hacked the available materials.[26] First, they added a 3-meter high stick fence which encircled the original dome and protected it from the wind. Then, next to the dome, they added a square 6 by 6-meter straw roof that provided a wall-less indoor/outdoor living space. The second and final iteration of *Paillote* used the same materials as the original, but improved the space and combated the hostile environment; it lasted a total of two years. Although it was ultimately destroyed by the wind, their first building taught the two architects that existing inhospitable situations can be transformed into spaces for use.

While living in post-colonial Niamey, Lacaton and Vassal's experiences informed the aesthetics of their current architectural practice. Not a visual aesthetic per se, but a set of guiding principles. Historically, architecture has been used as a tool of 'modernization' in the way of breaking down and rebuilding neighborhoods, using imported materials and concepts for buildings in the rebuilds. Yet in Niamey, everything Lacaton and Vassal did had to be completed using the existing supply of local available materials. To address the failures of their first

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[25] Laura Raskin. "The Pritzker Prize Honors French Architects Lacaton & Vassal." *Architectural Record* 209, no. 4 (April 2021): 23–24. https://search.ebscohost.com/login.aspx?direct=true&db=asu&AN=150017169&site=ehost-live.

[26] Hacking as one does digitally. Using a clever tip or technique for doing or improving something.

building, *Paillote,* they rebuilt it using the same locally sourced materials as in the original. In Niamey, Lacaton and Vassal's minds were hardwired to design for a world absent of excess, regardless of location. The young architects then returned to France in 1985 and founded Lacaton & Vassal in 1987.

1.3 Experiments with balconies

As they began practicing architecture in France, urban renewal campaigns were being launched by the federal government with the intent to destroy all existing large-scale housing projects. These projects came to exist following the utter destruction caused by the second World War.[27] By the end of the war, most of Europe had been destroyed, and the flattened cities were perceived as the ultimate tabula rasa for European modernization.[28][29] In France, modernization was carried out in the form of large housing projects called *grand ensembles*. Modern architects and French politicians viewed mass housing construction as the key to providing "Housing for all. A rational organization of the national territory. Universal access to public services of all sorts. A modern nation of socially mixed neighborhoods."[30] The *grand ensembles* were mass produced according to a standardized design and constructed using prefabricated concrete slabs, which allowed for their easy reproduction and proliferation. As a result, the concrete towers quickly surrounded most of France's famously beautiful cities and created the French suburbs or *Banlieues.* However, the scope of France's modernization efforts was not matched by the project's physical manifestations. Architects designed the *grand ensembles* for anonymous

[27] In 1945, the second World War ended when the Axis Powers surrendered in Japan.

[28] Kenny Cupers. *The Social Project: Housing Postwar France* (Minneapolis: University of Minnesota Press, 2014).

[29] Tabula rasa is a clean slate on which ideas can be formed without preconceived influences.

[30] Cupers. *The Social Project: Housing Postwar France*. Pg. 13.

clients, and as a result, the repetitive concrete compounds appealed to no one. Wealthy middle class people didn't want to live in them, and in the 70s, efforts to create socially diverse communities in the *grand ensembles* failed. The mostly-white middle class families left to live in new single family homes built by private real estate developers and only the low income families who couldn't afford to relocate, remained.

Similarly to the *Pruit-Igoe* housing estate in America, the *grand ensembles* eventually failed to meet Modernists lofty expectations due to poor management and white flight. Although originally designed to help produce a socially-blended France, the *grand ensembles* too quickly fell out of fashion with their wealthy inhabitants. As a result, the wealthy families left, and the public came to view the *grand ensembles* as symbols of failed modern architecture. In 2004, the French urban renewal initiative entitled *Programme National de Rénovation Urbaine* declared war on the *grand ensembles* triggering the demolition of 160,000 homes, of which only 140,000 were replaced.[31] However, they shouldn't have destroyed any of them. Urban renewal programs, following the destruction of *Pruitt-Igoe* have become too comfortable utilizing demolition as a solution to the problems of modern housing developments.[32] This paper does not contest the need for new and improved housing projects, however, housing offices are failing to see the down-side of unwarranted destruction. As previously stated, the empty lot which now exists where *Pruitt-Igoe* used to stand should serve as a warning against the destruction of housing projects.

Instead, all construction of future high capacity housing projects should begin on the top floor of existing structures. While modernizing French public housing, architect's used so much

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[31] "Le Programme National De Rénovation Urbaine (PNRU)." ANRU. Accessed March 21, 2022. https://www.anru.fr/le-programme-national-de-renovation-urbaine-pnru.

[32] Sylvain Chareyon, Florence Goffette-Nagot, and Lucie Letrouit, "Impacts of a French Urban Renewal Program on Local Housing Markets." *GATE Lyon Saint Étienne*, October 2020, Accessed March 16th 2022. file:///Users/henpenlauren/Downloads/SSRN-id3716316.pdf

concrete that, today, for the first time ever, construction projects don't need to start on the ground. This is where Lacaton and Vassal re-enter the picture. According to the duo,

> The modernists made inhabiting a central subject of architecture. Unfortunately, they were confronted with the difficulty of the big number, the excesses of industrialization, and the error of the tabula rasa, which makes even less sense today. We can continue these principles of architecture in the city nowadays, no longer by replacing, but instead by adding, superposing, paying attention to what already exists, and by trusting the inhabitants.[33]

A "tabula rasa" is a building site void of preconceived ideas, and the modernists in Europe relished the opportunity to work within a version of this following the destruction of World War II. Although they designed the *grand ensembles* for "inhabiting" the modern architects were entrapped by the freedom to design architecture without context. However, designing a building in an identity-less space is inherently anti-inhabitant because it requires erasing the existing context in the process of creating the clean slate. Unlike the modernists, Lacaton and Vassal believe that contemporary architects can not rely on a tabula rasa when designing vernacular architecture.[34] Regardless, in 2004, the *Programme National de Rénovation Urbaine* planned to destroy all existing *grand ensembles* to create a twenty-first-century tabula rasa. Lacaton and Vassal vehemently opposed the French urban renewal plan because as Vassal declares they see the *grand ensembles'* "... possibilities and not their negative conditions."[35] Instead, they proposed using transformative architecture to preserve the *grand ensembles* and allow for the construction of a 15 story high rise apartment building to begin on the 15th floor.[36]

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[33]Anne Lacaton and Jean-Philippe Vassal. "Ceremony Acceptance Speech" *The Hyatt Foundation / The Pritzker Architecture Prize.* September 14th, 2021. https://www.pritzkerprize.com/sites/default/files/inline-files/2021_Ceremony%20Acceptance%20Speech_Lacaton%20and%20Vassal.pdf

[34] Vernacular architecture is architecture built with the intent to house and or support communities.

[35] Lacaton & Vassal Architectes, Fernando Márquez Cecilia, and Richard C. Levene, eds. *Lacaton & Vassal: 1993 - 2017*. El Croquis, 2017, 177/178. Madrid: El Croquis edition, 2017. Pg. 15

[36] Frédéric Druot, Anne Lacaton, and Jean-Philippe Vassal. *Plus: Les Grands Ensembles De Logements: Territoire D'exception*. Barcelona: Gustavo Gili, 2007. Pg. 49

To date, French housing offices have selected Lacaton & Vassal to transform three *grand ensembles*: the *Bois le Prêtre towe*r in Paris (2011) (fig. 0.5), the *Chesnaie housing estate* in Saint Nazaire (2014 & 2016) (fig. 1.2), and most recently the *Grand Parc housing estate* in Bordeaux (2016) (fig. 0.4).[37] Unlike the flawed 1984 *Paillote* site selection process, Lacaton and Vassal begin their transformations by first interviewing a building's existing population, then using these interviews they form the objectives of their architecture. During the *grand ensemble* interviews, they realized that the existing apartments were poorly insulated, lacked sufficient natural light exposure, and were too small. In their first transformation, of the *Bois le Prêtre Towe*r in Paris, they experimented with hacking the existing architecture in response to the inhabitant's complaints. Attaching balconies to the existing concrete structures to insulate and expand liveable space was the key cost-reducing architectural hack that they have applied to all three *grand ensembles*.

Originally designed by Raymond Lopez in 1962, renovations of the *Bois le Prêtre Tower* in the 1990s sealed over the building's few small balconies and left the inhabitants trapped inside the red and white concrete tower. Although the building stands on the edge of Paris overlooking the Eiffel tower, if you were living there before Lacaton and Vassal transformed it, you might have missed the spectacular view of Paris's most iconic piece of architecture (fig. 1.4).[38] From the building's original structure, balconies now protrude like the feathers of a piloerect-bird, and the once closed-off living rooms of the *Tour Bois-le-Prêtre* finally open up to views of the Eiffel tower.

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[37] The *Bois le Prêtre Towe*r transformation began in 2005, *La Chesnaie housing estate* began in 2006, and the *Grand Parc housing estate* began in 2011.

[38] Lacaton and Vassal were awarded the project by the Parisian housing committee in 2005, they finished transforming the building in 2011.

However, Lacaton and Vassal's balconies are more than just a space for getting a breath of fresh air and smoking cigarettes. In their transformations, they have reinvented the balcony as a partially enclosed indoor/outdoor living space that they optimistically refer to as a "winter garden."[39] The interior of each winter garden extends seamlessly from the existing building's concrete structure and is large enough to fit a dining room table surrounded by chairs. In the transformation of the *Tour Bois-le-Prêtre,* they used a massive crane (Fig. 1.5) to lift and attach the winter gardens onto the building's existing facades. The prefabricated balconies were made by combining concrete, aluminum, glass, and polycarbonate panels which are usually only found in the construction of greenhouses. These polycarbonate panels can be slid open like windows to allow a cool summer breeze in or shut to form walls that help insulate the apartments from the harsh French-winters. Lacaton and Vassal first discovered them, in 1993, while failing to create an attached atrium for their *Casa Latapie* (fig. 1.6)*,* as Vassal recalls "We imagined a lush inner garden full of bougainvillea and palm trees."[40] They chose polycarbonate panels because they convert sunlight into heat creating an energy-efficient environment capable of housing tropical plants in temperate climates. After construction finished the owners of the house immediately repurposed the space and set up a "... room with a sofa, some chairs, two tables, three armchairs; a sort of transparent room that soon became the most used part of the house..."[41] By using the polycarbonate walled space as a living room the inhabitants of the *Casa Latapie* totally changed how Lacaton and Vassal understood the material. For Lacaton and Vassal, balconies have become intentional spaces for year-round book reading (fig. 1.7) and dinner parties (fig. 1.8).

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[39] Lacaton & Vassal Architectes, Fernando Márquez Cecilia, and Richard C. Levene, eds. *Lacaton & Vassal: 1993 - 2017*. El Croquis, 2017, 177/178. Madrid: El Croquis edition, 2017. Pg. 15

[40] Lacaton Et al. *Lacaton & Vassal: 1993 - 2017*. Pg. 15

[41] Ibid

While transforming the *Tour Bois-le-Prêtre,* Lacaton and Vassal simultaneously wrote a book entitled *Plus,* which detailed the philosophy of their burgeoning transformative architecture.[42][43] In this book, they asked themselves "...has architecture ever managed to find its *Raison D,être*?"[44] [45] In response, they immediately cited a few modern architectural projects (fig. 1.9), praising the architects for taking into account the inhabitants by producing "... exemplary cases of architectural finesse."[46] [47] However, both their question and response excluded the reality that people have always given their homes more purpose through secondary edits, a sort of do it yourself (DIY) architecture.

DIY architecture is when an inhabitant alters a building counter to the architect's original intent. In particular, balconies have consistently been utilized by DIY architects as they push back against modern architecture. This contentious space is best exemplified by the hanging clotheslines and enclosed balconies of Georges Candilis's Moroccan housing complex entitled *Carrières Centrales* (fig. 1.10) (1952). The housing complex's apartments were originally designed with large open-air balconies (fig. 1.11) that cover the building's facade. However, over the years most residents have walled off the original balconies with cinder blocks (fig. 1.10) to extend their apartments' usable space out onto the balcony. These walled off balconies prove that Lacaton and Vassal's *Transformations* were not the first examples of manipulated balconies that produced more liveable space. So, what's the difference between their twenty-first-century

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[42] Frédéric Druot, Anne Lacaton, and Jean-Philippe Vassal. *Plus: Les Grands Ensembles De Logements: Territoire D'exception*. Barcelona: Gustavo Gili, 2007.

[43] Plus was published in 2007 and construction on the *Bois le Prêtre Towe*r transformation began in 2005.

[44] Druot Et al. *Plus: Les Grands Ensembles De Logements: Territoire D'exception*. Pg. 49.

[45] *Raison D,être* translates to *purpose* in english.

[46] One example they provide is Marcel Lods, Paul Depondt and Henri Beauclair's *GEAI Housing Estate* in Grand'Mare, Rouen, France, (fig. 18) (1968–1969).

[47] Druot Et al. *Plus: Les Grands Ensembles De Logements: Territoire D'exception*. Pg. 49.

Transformations and DIY balcony architecture? Well, in Morocco, the labor of fixing the apartments was left to each of the building's inhabitants. In contrast, Lacaton and Vassal are working towards creating a luxurious world where people don't need to retroactively change their homes to effectively live in them. As professional architects, Lacaton and Vassal's transformative architecture brings attention to the need for more usable space in vernacular architecture. Their efforts were officially recognized following the completion of *Transformation of 530 Dwellings*, which helped Lacaton and Vassal earn architecture's most prestigious award, the *Pritzker Prize*.

1.4 Model Transformation

Lacaton and Vassal are not the Pritzker Prize-winning architects that we have come to expect. Traditionally, the Pritzker Prize has been used to celebrate *starchitects*, often white upper class men, who capitalize on their celebrity status to command huge budgets for the production of visually iconic architecture.[48] Unlike previous Pritzker prize winners, such as Frank Gehry (fig. 1.12), Lacaton and Vassal are not *starchitects*, "[t]hey seek beauty, aiming to redefine the concept, yet they do not prioritize formal elements over functionality."[49] Although their *grand ensemble* transformations are visually stunning, beauty is a byproduct of their transformative architecture and not the focus. Regardless of their disregard for beauty, a few years after completing their *Transformation of 530 Dwellings,* Lacaton and Vassal won the Pritzker Prize validating the success of their cheap architecture.

The *Transformation of 530 Dwellings,* their most recent and largest transformation to date, was actually the transformation of three buildings within the *Cité du Grand Parc* social

[48] The word starchitect blends the words star and architect to describe celebrity architects. Frank Ghery's Bilbao effect provided the catalyst for this classification of architecture.

[49]Anatxu Zabalbeascoa. "Bigger, Better, and Still Affordable", Domus N° 1034, 2019, p. 424-429 https://www.lacatonvassal.com/data/documents/20190624-1647391904_DOMUS_1034.pdf

housing project located in the city center of Bordeaux, France.[50] Originally completed in 1960, the three buildings were constructed using prefabricated-concrete panels, and they follow the same design plan as the other previously mentioned *grand ensembles*. Their pixelated exteriors consisted of a few windows and small open-air balconies (fig. 1.13) placed in between yellow, white, and burgundy shapes (fig. 1.14). Although the apartment's few small windows and balconies hinted at the existence of an outside, their suffocating interiors (fig. 1.15) were defined by a lack of natural light and cramped rooms (fig. 1.16). To begin their transformation, Lacaton and Vassal interviewed all of the inhabitants in the three buildings, "[t]he 530 inhabitants of the homes in the three blocks agreed on their priorities. They continued to live in their apartments during the renovations, and… the facade was clad with a new balcony that insulated and extended the buildings."[51] [52] In Bordeaux, a notoriously flat city, the addition of balconies to the three buildings took advantage of their significant height to produce views of the entire area.[53] [54] Once again, Lacaton and Vassal used winter gardens to address the needs of the inhabitants by opening up and expanding each apartment's usable space.[55] Now, all of the 530 apartments' living rooms seamlessly continue out onto large winter gardens with luxurious views of Bordeaux (fig. 1.17).

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[50] There was one larger building entitled building G, and two smaller buildings entitled buildings H and I.

[51] Anatxu Zabalbeascoa. "Bigger, Better, and Still Affordable", Domus N° 1034, 2019, p. 424-429 https://www.lacatonvassal.com/data/documents/20190624-1647391904_DOMUS_1034.pdf

[52] Winter Garden's decreased energy consumption by 66%.

[53] "Bordeaux Topographic Map, Elevation, Relief." topographic. Accessed March 25, 2022. https://en-us.topographic-map.com/maps/fqr/Bordeaux/.

[54] While the shortest of the three towers is 10 stories, the tallest is 15 stories.

[55] The usable square footage was increased from 44210 sqm to 67710 sqm.

It is no longer a debate whether or not Lacaton and Vassal's method for saving modern social housing projects is a feasible solution. In their unprecedented *Transformation of 530 Dwellings*, they produced more than twice as many apartments as their first two transformations combined, making it the culmination of their experiments in transformative architecture. In addition, their transformation cost less than a third of what the estimated price was to demolish and reconstruct the 530 apartments. Even though the Bordeaux Housing Office allocated 160,000 euros per unit for the cost of construction, Lacaton and Vassal's proposal only required 50,000 euros per unit.[56] By successfully completing their largest transformation ever at a reduced cost, Lacaton and Vassal proved that their simple method for producing cheap architecture can, and should, be replicated. The *Transformation of 530 Dwellings* is proof that if *Pruitt-Igoe* had not been destroyed, Lacaton and Vassal's cheap architecture could have successfully saved the massive decrepit St. Louis housing complex.

1.5 Zooming Out

Unfortunately, while Lacaton and Vassal's *Transformations* model a successful version of cheap additive architecture, expansions are still predominantly tools only utilized by wealthy landowners. *Architectural Digest's* youtube channel, the largest architecture-focused account on the platform, champions expensive historic homes that have been retrofitted with beautiful modern interiors and clever additions.[57] Their video, touring Formula one Heiress Petra Ecclestone's 170 million pounds 18th-Century London Mansion exemplifies this version of

[56] Jean-Philippe Vassal and Anne Lacaton. "Transformation of 530 Dwellings." Lacaton & Vassal. Accessed March 25, 2022. https://www.lacatonvassal.com/index.php?idp=80#.

[57] As of today, their account has 5.11 million subscribers, about 4.5 million more than the next largest.

transformative architecture.[58] Although the house wasn't originally constructed with a basement, during the video Ecclestone explains how she recently had 15 meters excavated from beneath the house to provide space for a spa, gym, massive play area (fig. 1.18), and a pool decorated with a neon sign that reads “the world is mine” (fig. 1.19). Ecclestone’s expensive subterranean extension is an example of what the architect and urbanist Matthew Soules calls “iceberg homes.”[59] London’s most expensive neighborhoods are governed by zoning regulations that restrict “above-grade additions”, to subvert these laws wealthy homeowners extend their historic mansions deep into the earth. By exploiting the underground loophole, Ecclestone was able to purchase a historic house for 60 million pounds and transform it into a hidden mega-mansion worth 170 million pounds.[60] Conversely, Lacaton and Vassal’s winter gardens are cheap and beautiful examples of how additions can expand and improve low-income apartments’ usable space. Their transformations of the *grand ensembles* proved that additions are not just for rich people.

Currently, with the exception of Lacaton and Vassal, the majority of transformative architecture is completed by wealthy landowners living in historic homes, and DIY architects hacking their modern apartment complexes. I think if additive architecture can permeate through all classifications of constructions we can significantly reduce the cost of architecture, both environmentally and financially. Expansions and additions like the *grand ensembles*’ winter

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[58] Architectural Digest. “Inside a £170m 18th-Century London Mansion Owned by an Heiress | on the Market.” YouTube. YouTube, October 15, 2021. https://www.youtube.com/watch?v=zE_P-9zJdsg&list=PLpi4YdMCC43866-wVoj2JoH9K59cZpASz&index=9.

[59] Matthew Soules. *Icebergs, Zombies, and the Ultra Thin: Architecture and Capitalism in the Twenty-First Century*. New York: Princeton Architectural Press, 2021. Pg. 82

[60] Ariel Foxman. “An Exclusive Look inside Petra Ecclestone's Sprawling London Estate.” Architectural Digest. Architectural Digest, October 15, 2021. https://www.architecturaldigest.com/story/an-exclusive-look-inside-petra-ecclestones-sprawling-london-estate

gardens should be used to save all durable yet poorly designed spaces. I think American social housing projects and old defunct factories are prime candidates for transformation into habitable or social spaces. Similar to the French *grand ensembles,* their steel and concrete skeletons can provide the building blocks for future construction projects. Although architecture will always be destroyed as climate change worsens and the world experiences more and more unavoidable natural disasters (covered in chapter 2), we need to stop relying on unnecessary demolition to provide space for new architecture in the twenty-first century.

Chapter 2: Revisiting Materiality

2.1 Introduction

Materiality, the stuff that things are made of, has to be at the center of any critique of built architecture. In *Chapter 1: Retrofitting Modernity* I highlighted how architects can avoid demolition by utilizing abandoned concrete buildings to provide the structures for their construction projects. The architecture of the previous chapter began after the building's rigid concrete skeleton had already been built. In *Chapter 2: Revisiting Materiality* I am taking a step back in the construction process to discuss what to do if there is not a readily available abandoned concrete structure to take over. How can we rebuild after a natural disaster destroys all of the previously built architecture? How can we build better structures from scratch? If there is no variety in architecture's materiality then the cost of the materials will increase, both environmentally and financially. Although concrete construction is appropriate in certain situations, it can not be used to blanket the earth. When you have to ship concrete long distances to reach construction sites it becomes too expensive to purchase. In the case of a single-unit domestic construction project, instead of using concrete, the readily available dirt from the construction site can be turned into earth-based construction materials. Materiality should be a reflection of the building's context.

In Mexico, the future is on track to be made entirely out of concrete. After a natural disaster, the federal government gives each affected family a prepaid debit card that can only be used at designated stores to rebuild their houses in concrete.[61] In 2000, the government began the

[61] "Mexico's Traditional Housing Is Disappearing-and with It, a Way of Life." The Architectural League of New York, April 18, 2018. https://archleague.org/article/mexicos-traditional-housing-disappearing-way-life/.

pro-concrete *Piso Firme* program.[62] It mandated that all of the country's earth-based floors had to be replaced with concrete ones, a regulation that is still in effect to this day. [63] These two pro-concrete policies are a part of a wider held belief that the nation's traditional earth-based architecture is unsanitary, and that concrete is the most hygienic and socially acceptable alternative. It's clear, however, that the affected communities are not the ones benefiting from the government's concrete fetish. Instead, earthquakes and *Piso Firme* mean millions of guaranteed dollars for companies like *Cemex*, Mexico's largest producer of concrete.[64] Tatiana Bilbao (1972 -, Mexico City, Mexico) wants to destigmatize earth-based construction, a positive building method for both the environment and the inhabitants of the architecture.

Mexican concrete homes are modern erratics (fig. 2.1).[65] They travel great distances before landing on construction sites where they stand still for centuries until they're shaken loose by earthquakes.[66] In contrast, the affordable red sedimentary walls of Bilbao's contemporary houses rise out of the earth like the cliffs of Mexico's Copper Canyon (fig. 2.2). Unlike modern concrete homes, Bilbao's houses are a continuation of their environment's existing topography rather than a foreign addition.

Concrete construction is a wildly unsustainable building method that begins far away from a house's designated lot, inside a quarry. First, large blocks of limestone and clay are mined

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[62] "Mexico's 'Piso Firme' Program. Millions Saved: New Cases of Proven Success in Global Health." Center for Global Development 2016. http://millionssaved.cgdev.org/case-studies/mexicos-piso-firme-program.

[63] As of the most recent count, conducted in 2012, the government has replaced 2.7 million dirt floors with cement ones.

[64] M. Garside. "Capacity of Biggest Global Cement Producers 2021." Statista, February 16, 2022. https://www.statista.com/statistics/297845/cement-producers-capacity/.

[65] In Geology an erratic is a rock or boulder that differs from the surrounding rock and is believed to have been brought from a distance by glacial action.

[66] An erratic is a rock that differs from the surrounding geology and is believed to have been brought from a distance by glacial action.

in the Yucatan peninsula and then heated up to nearly 2000 degrees Fahrenheit inside a factory to produce cement.[67] [68] Next, the cement mixture is combined with an aggregate at the factory (of gravel and sand) and transported via truck to the intended construction site. Here, it is finally mixed with water to form the home's concrete foundation and structure. In total, this intensive process produces *8% of all global co2 emissions.*[69] Seriously. Alternatively, Bilbao believes houses should be constructed using locally available soil which costs less than concrete and produces virtually no environmental pollution.[70]

The Mexican government's continued support of concrete construction, both financially and politically, has shaped the public's opinion on vernacular materiality. Today, concrete homes symbolize wealth and social advancement. While earth-based construction, conversely, was vilified by the government's pro-concrete disaster relief stipulations. In contrast, Bilbao has begun intentionally designing her homes using earth-based materials. First, she used rammed earth to construct two different affordable vacation homes. Then, more recently, she utilized rapidly produced mud bricks to facilitate reconstruction following the devastating 2017 Puebla earthquake. On her website, *tatianabilbao.com*, she presents all of these houses together as a cohesive town full of earth-based construction projects (fig. 2.3). The homes in this fictional town represent Bilbao's very real but slow integration of earth-based materials into her built

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[67] "How Concrete Is Made." How concrete is made. Portland Cement Association. Accessed March 29, 2022. https://www.cement.org/cement-concrete/how-concrete-is-made.

[68] This step alone contributes 4% of all global co2 emissions!

[69] Johanna Lehne and Felix Preston. "Making Concrete Change - Chathamhouse.org." Chatham House, June 13, 2018. https://www.chathamhouse.org/sites/default/files/publications/2018-06-13-making-concrete-change-cement-lehne-preston-final.pdf.

[70] Gernot Minke. *Building with Earth: Design and Technology of a Sustainable Architecture*. Basel: Birkhäuser, 2021. Pg. 12

architecture. This chapter is a decolonial investigation of how Bilbao uses her architectural practice to reframe the public perception of traditional earth-based building materials.

2.2 Fictional Urban Planning

"Fictional urban planning" is the process of designing community spaces that correlate to, but do not represent our physical reality. Most video games, fantasy fiction novels, and children's stories develop their own "fictional urban plans", think *Animal Crossing: New Horizons*' custom islands (fig. 2.4).[71] These made-up spaces are critical reflections of the town's that we live in, commute to, and visit. They utilize the same building blocks as our physical reality, such as houses, roads, and community spaces. However, fictional urban planners rearrange these essential components to reimagine our urban spaces. In *Animal Crossing*, every player begins in a tent on a unique desert island. Then, as time passes they gather materials and design a town from scratch to attract the largest possible population of satisfied inhabitants. In the game, a player who is particularly opposed to the lack of parks in their physical reality might develop a fantastical park city where everyone lives in a treehouse (fig. 2.5). However, It's incorrect to believe that these fictional spaces are any less real than our concrete homes and the cities that we live in. Our physical spaces are made up of cultural conceptions that were developed by political structures. This was made evident by the Mexican government's disproportionate support of concrete construction projects. The government produced a cultural sentiment that concrete construction was superior to traditional earth-based construction methods, even though concrete construction is not necessarily more sanitary and it is destroying

[71]Animal crossing is a social simulation video game series developed and published by Nintendo. It is an endless and non-linear game in which a human takes up residence in a village inhabited by anthropomorphic animals.

our planet.[72] Now, the physical reality in Mexico is made from concrete, not because concrete is the truest form of construction, but because the government influenced cultural material conceptions.

I think that Bilbao's architecture practice fosters fictional urbanism which is positive. When she founded her eponymous firm Tatiana Bilbao Estudio, in 2004, she imagined a world where all houses are beautifully designed in a wide variety of building materials. This world does not exist in our physical reality, instead, it can only be found on the Tatiana Bilbao Estudio website. The website is an interactive map (fig. 2.3) that places all of Bilbao's disparate projects into a harmonious town full of beautiful and diverse architecture. In Mexico, the government's material policies mean that future towns have to be built in concrete regardless of their context. In Bilbao's fictional reimagining of a Mexican town, there are earth-based homes, a concrete aquarium, and an open-air botanical garden full of lush greenery, all within walking distance of each other. Here, materiality is a tool Bilbao uses to respond to her architecture's setting. The houses are constructed using earth-based materials because it is readily available at all construction sites. In addition, the houses exist next to public spaces like the aquarium and the botanical gardens. In the aquarium, concrete is put to work retaining massive pools of water to support the fish. Earth-based construction wouldn't cut it here because that much exposure to water can lead to erosion and swelling.[73] While, in the botanical gardens, the predominance of trees and plants acknowledges the need for domestic architecture to exist in tandem with

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[72] Johanna Lehne and Felix Preston. "Making Concrete Change - Chathamhouse.org." Chatham House, June 13, 2018. https://www.chathamhouse.org/sites/default/files/publications/2018-06-13-making-concrete-change-cement-lehne-preston-final.pdf.

[73] However, earth-based building materials can be treated to become water resistant. In the case of a domestic setting where the earth-based material is exposed to rain, the house can easily be shored up with spray on water repellent to avoid damage. Minke, Gernot. *Building with Earth: Design and Technology of a Sustainable Architecture*. Basel: Birkhäuser, 2021. Pg. 38

beautiful natural environments. If you hover your mouse over one of these buildings it comes to life, with its details filled in with watercolors (fig. 2.6). At the bottom of the page, its title is displayed with a link to more information. However, this trick only works for Bilbao's completed projects. The rest of the town is filled with non-interactive buildings (fig. 2.7), promises of future interventions by Bilbao in the built environment. For the completed buildings, however, the link takes the user to a new page with images of the building, its client's name, and other construction details, grounding the structure in our physical reality. Although Bilbao's built architecture exists spread out across the real world as physical constructions, she designed them for the ideal town that currently only exists inside *tatianabilbao.com*.

To depict the houses in her fictional town, Bilbao utilizes hand-drawn cartoon-esque imagery (fig. 2.8). In her drawings, she abstracts the physical building's essential characteristics, shingles on a roof become a few short dashes and four conjoined lines make a door (fig. 2.7). This creates a comic-like aesthetic where buildings become a small collection of lines. The world Bilbao developed with these drawings is soft and playful, free of harsh realities. There is no visible trash, destructive weather, or ugly architecture. Everything is in good condition and while the buildings are close to each other, there is a buffer of open outdoor space between each drawn structure (fig. 2.7). Bilbao says that these drawings "bring together utopia and reality."[74] They do. While the subjects of the drawings root them in our physical reality (they represent physical structures), Bilbao's cartoon aesthetics mean the drawings are simultaneously separated from their physical manifestations. As a result, her flat two-dimensional drawings are abstracted representations of three-dimensional buildings.

[74] Ulf Meyer. "A New Bilbao Effect -." World Architects, 2019. https://www.world-architects.com/en/architecture-news/insight/a-new-bilbao-effect.

Bilbao's drawings are a direct contradiction to the dominant trends in contemporary architectural modeling, where computer-based three-dimensional models are king. Similar to the realist's nineteenth-century artistic movement, in twenty-first-century three-dimensional modeling, there is no abstraction. Computer-aided design (CAD), made popular by at-home software like *AutoCAD* (1982), inspired late twentieth and twenty-first-century architects to draw their buildings as realistically as possible, in three dimensions.[75] When an architect draws a house as a hyper-realistic three-dimensional computer model, they're trying to imitate the house's physical structure, a process Bilbao banned in her studio.[76] In doing so, they limit the scope of the drawing because it only supports one imaginary end product. A client who sees a three-dimensional computer model of their house will start to expect their house to look exactly like the computer model. Bilbao's website, where her architecture is represented by cartoon-esque drawings, is a critique of three-dimensional models that tell us what physical architecture should look like. In contrast, Bilbao's two-dimensional town allows us to dream.

Although today she works as an architect and a fictional urban planner, Bilbao was first exposed to urban planning as an employee of the Mexican Government. A young Bilbao got her first job ever working as an advisor to the Ministry of Development and Housing, from 1998 to 1999. In Mexico City, the Ministry of Development and Housing is responsible for producing social housing, managing population growth, maintaining public spaces, developing disused areas, and conserving the urban landscape. While working at the Ministry, she was exposed to an arm of the government that she remembers as having no power because it was "...tied to so many

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[75] John Walker founded the company AutoDesk in 1982. Walker's company produced AutoCAD, the first CAD software made for PC's as opposed to mainframe computers.

[76] Amy Frearson. "'We Banned Renders' from the Design Process Says Tatiana Bilbao." Dezeen, December 10, 2019. https://www.dezeen.com/2019/12/04/tatiana-bilbao-banned-renderings-architecture-interview/.

things… political parties… economic situations… special interest groups..."[77] This period of her career was rife with bureaucracy. In fact, the notion that Bilbao's office was developing or housing Mexico City's population is misleading because, prior to Bilbao's involvement, the majority of Mexico City's urbanization had already been carried out informally.[78]

The Ministry of Development and Planning was a bystander during the most crucial years of Mexico City's urban development.[79] In the 1950s, as Mexico's economy transitioned from agricultural to industrial, rural dwellers migrated from the countryside to Mexico City in search of work. As a result, the city's population began expanding at an unprecedented rate.[80] In response, the Ministry of Development and Housing attacked the city's growing population by banning land subdivision to reduce growth. With urban expansion frozen inside Mexico City's limits, many low-income families were forced to move to the city's outskirts where the anti-subdivision regulations were more relaxed. There, the federal government turned a blind eye as citizens and private developers informally developed 60% of the land around Mexico City. They accomplished this through illegal land subdivisions and by squatting on available land. However, without the Mexican government's support, these massive informal developments lacked "...governmental provision of services or infrastructure."[81] These new mini-cities did not have clean water or health services. So, in the 1960s, civilians living in these communities were forced to band together and form civic groups that lobbied the government to provide the

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[77] "Interview Tatiana Bilbao." Wash Magazine, 2019. https://washmagazine.com/Interview-Tatiana-Bilbao.

[78] Jose Castillo and Sarah Raines. "Urbanisms Of The Informa: Transformations In The Urban Fringe of Mexico City." *PRAXIS: Journal of Writing + Building* 1, no. 2 (2001): 103. http://www.jstor.org/stable/24328827.

[79] "Fig. 3. Urban Area and Population Growth in Mexico City Proper and the Larger Metropolitan Area (MCMA Is Mexico City Metropolitan Area), 1325 to Present." Accessed April 3, 2022. https://www.ecologyandsociety.org/vol23/iss1/art1/figure3.html.

[80] In 1950 the population of Mexico City was 3.1 million and by 1980 that number had ballooned to 14 million.

[81] Castillo, Et al. "Urbanisms Of The Informa: Transformations In The Urban Fringe of Mexico City." Pg. 103.

infrastructure and support required to meet their basic human needs. It's here, *after* the creation of Mexico's urban environment, that the Ministry of Development and Housing entered the picture. In the 1970s, after a decade of demanding that the government provide these communities with their essential rights, the community activists were finally heard. In 1973, two decades after the communities were informally developed, the Ministry of Development and Housing began providing urban services to the outskirts of Mexico City and retroactively provided clear and legal land deeds to residents.[82]

It's clear that the Ministry of Development and Housing played a secondary role in the urbanization of Mexico. When Bilbao joined, in the 90s, this was still true "...when I entered the government in Mexico, I realized that we have more power when we are part of the civil society. Especially as an architect."[83] As a member of the Ministry of Development and Housing, she was relegated to playing catch up to Mexico's informal development. Although she came to the government as an eager junior employee, she quickly realized that she had no real agency as a civil servant. And in 1999, after only two years, she left the Ministry of Development and Housing to begin working as a private architect.

While dining at a restaurant in Mexico City, in 1999, Bilbao ran into an old college classmate named Fernando Romero (1971-). This serendipitous meeting kickstarted her career as a private architect. She began working from outside the limits of bureaucracy to actually affect the built world in Mexico. Together Bilbao and Romero, the son-in-law of Carlos Slim (Mexico's wealthiest private citizen), co-founded the architecture firm Laboratorio de la Ciudad de México (LCM). At the time, Bilbao's co-founder Romero, inspired by his old boss Rem Koolhaas, was

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[82] Jose Castillo and Sarah Raines. "Urbanisms Of The Informa: Transformations In The Urban Fringe of Mexico City." *PRAXIS: Journal of Writing + Building* 1, no. 2 (2001): 107. http://www.jstor.org/stable/24328827.

[83] "Interview Tatiana Bilbao." Wash Magazine, 2019. https://washmagazine.com/Interview-Tatiana-Bilbao.

interested in using their company to become a *starchitect* and his connection to the wealthiest family in Mexico meant an endless supply of high-budget projects with iconic designs like their *Ixtapa House* (fig. 2.9) (2001). They designed the *Ixtapa House* for a wealthy client as the client's second home. Located on a private beach, this iconic circular vacation home was 30 times larger than most homes in Mexico and is exemplary of LCM's early work.[84] [85] At LCM, the firm's portfolio was entirely made up of iconic structures and expensive homes like the *Ixtapa House.*

However, Bilbao was looking for ways to address the housing needs of all income levels in Mexico. The projects she and Romero worked on at LCM directly contradicted the new socially conscious aspirations that she developed while working for the government. Discouraged by the firm's focus on ultra-wealthy clients, in 2004, Bilbao left the company that she had helped found "I realized that I was not in a place where I could share any of the ethos behind the work with these guys, and I decided to leave."[86] Unlike Bilbao, Romero idealized the legacy-building work of larger firms like Rem Koolhaas's OMA, and he made monumental projects a priority at LCM.[87] After Bilbao left, Romero tried to erase her from the history of LCM and he rebranded the firm, changing its name from LCM to FR-EE (Fernando Romero Enterprises). Although LCM/FR-EE was founded by Romero and Bilbao in 2000, after Bilbao left, Romero erased her participation in the firm's projects from the website. The company's

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[84] The *Ixtapa House* is 1350 sq meters compared to the average 43 sq meter home provided by the government.

[85] Based off of the *Ixtapa House's* 1350 sq meter measurement in comparison to the average 43 sq meter Mexican house

[86] Gamolina Julia. "Forms of Care: Tatiana Bilbao on Responsibility, Opportunity, and Staying True to Your Values." Madame Architect. Madame Architect, December 14, 2021. https://www.madamearchitect.org/interviews/2021/11/29/tatiana-bilbao.

[87] Romero's first job was in Koolhaas's OMA office, which undoubtedly served as inspiration for LCM's original 3 letter acronym.

"About Us" section of their website still acknowledges that the company was founded in 2000.[88] However, Bilbao, a co-founder, was intentionally omitted from the company's history. Under the new "FR-EE" acronym, the firm worked with Romero's father-in-law Carlos Slim to build the 70 million dollar honeycomb-esque *Soumaya Museum* (fig. 2.10) (2011), furthering Romero's status as a *starchitect*.[89]

Unlike LCM/FR-EE, where the firm's portfolio is laden with ultra-pricey work, Tatiana Bilbao Estudio doesn't just design private domestic projects. At Tatiana Bilbao Estudio, they prioritize the design and construction of affordable housing such as Casa Marbel (fig. 0.1) (2017-2018). This inexpensive house was built in the small farming village of Ocuilan de Artega and replaced a family's home destroyed by the 2017 *Puebla* earthquake. For about $6000, Bilbao constructed three small structures that wrap around a courtyard with a flowering tree at its center.[90] [91] In total, the property has twice as much living space as other comparable concrete homes built in the town after the earthquake. This was made possible by Bilbao's use of eco-blocks, a cheap building material that allowed her to stretch the project's budget (subsection 2.4 Quick Bricks). During an interview, Jacques Herzog (1950 -) asked Bilbao "...you depend on commissions that come from rich people. On the other hand, you invest some ideas in how people can live who have less money… what is possible in this field of social housing…?" Bilbao emphatically responded that

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[88] Free. "About Us." Accessed May 3, 2022. https://fr-ee.org/about-us/.

[89] Nicholas Casey. "Emperor's New Museum." The Wall Street Journal. Dow Jones & Company, March 3, 2011. https://www.wsj.com/articles/SB10001424052748703300904576178381398949942#:~:text=A%20Rodin%20collection%E2%80%94the%20second,museum%20worthy%20of%20international%20buzz.

[90] "Until the Tremor Has Passed." World Habitat, January 21, 2022. https://world-habitat.org/news/our-blog/until-the-tremor-has-passed-hasta-que-pase-el-temblor/.

[91] After earthquakes the government gives low-income families $6000 usd for totally destroyed houses and $750 for partially damaged ones.

"All of us need beauty… I think that all of us, all of us, everybody should have the opportunity. In Mexico, housing is a constitutional right… But they haven't provided that because for me a house should be beautiful… a place to inspire your life… I think that as architects we are able to provide that."[92]

In his question, Herzog described Bilbao's practice as a sort of Robin Hood-ish firm, and in doing so, he separated the homes that she has designed for her wealthy clients from the homes that she has designed for her other clients. For Herzog, architecture is a luxury, and an architect's natural client is the person that can afford an architect's expensive fee.[93] If this is true, then, the majority of houses should be excluded from the consideration and focus of architecture. For Bilbao, beautiful and intentionally designed domestic spaces should be available to everyone. As an architect, she believes that she can positively influence all kinds of houses by intentionally designing houses for clients of all income levels.

The beginning of Bilbao's career, first, as a government employee and more recently as a member of LCM/FR-EE, were negative experiences that taught Bilbao exactly how not to work. As an employee of the Mexican government, she was merely trying to catch up to the informal development carried out by the general public. The constant game of catch-up meant there was no time for Bilbao, as a trained architect, to offer her expertise and positively influence the way structures were built. While her first foray into the world of private architecture, as a co-founder of LCM, was derailed by the company's disproportionate focus on designing expensive and iconic structures. At LCM, although Bilbao had gained the influence over design that she lacked as a civil servant, her work still neglected the majority of Mexico's population. In contrast, her drawings for Tatiana Bilbao Estudio imagine a world where all homes are valuable and

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[92] TheLouisianaChannel. "Jacques Herzog Meets Tatiana Bilbao: Everybody Deserves a Decent Home." YouTube. YouTube, September 3, 2019. https://www.youtube.com/watch?v=J8XTmkqivmk.

[93] "Profile - Herzog & De Meuron." Herzog & de Meuron. Accessed April 6, 2022. https://www.herzogdemeuron.com/index/practice/profile.html.

intentionally designed by architects, regardless of their budget. She has begun to build this imagined reality in the physical world by experimenting with earth-based construction.

2.3 Beautiful Mud Homes

Bilbao started experimenting with earth-based construction in her houses for private clients mainly because the government would not provide funding for earth-based public projects. She recalls: "...I have had the opportunity of exploring many possibilities when I have had a lot of budget, which has allowed me to understand where the basic ideas are when I don't have a budget."[94] Before she implemented the earth-based materials in her affordable housing, she experimented with the houses/villas she designed and built for the Mexican elite. To build her houses, she utilized different forms of earth-based materials that all fall under the umbrella of loam. Loam is composed of a construction site's indigenous soil "a mixture of clay, silt (very fine sand), sand, and occasionally larger aggregates such as gravel or stones."[95] Although it contains similar ingredients to concrete, loam doesn't need to be treated with heat and doesn't require the addition of unique materials, such as limestone. To build fancy affordable summer houses Bilbao experimented with rammed earth which is loam repeatedly compacted within an impermanent framework.

In the construction of her fancy affordable summer houses, Bilbao is revisiting earth, a historically indigenous building material that has been defamed by the Mexican Government. In Mexico, people have always used earth-based building materials, in fact, "The Sun Pyramid in Teotihuacan, Mexico, built between the 300 and 900 AD, consists of approximately 2 million

[94] Amy Frearson. "'We Banned Renders' from the Design Process Says Tatiana Bilbao." Dezeen, December 10, 2019. https://www.dezeen.com/2019/12/04/tatiana-bilbao-banned-renderings-architecture-interview/.

[95] Gernot Minke. *Building with Earth: Design and Technology of a Sustainable Architecture*. Basel: Birkhäuser, 2021. Pg. 11

tonnes of… earth."[96] The Sun Pyramid (fig. 2.11) belongs to a long history of earth-based construction in Mexico that predates the current government.[97] Only recently, as a result of the Mexican Government's pro-concrete disaster relief stipulations and *Piso Firme,* indigenous Mexican earth-based construction has been denigrated in favor of concrete. During an interview, one indigenous Mayan-Mexican homeowner explained, "[w]ell, I like [traditional houses] better, but in my village if you want to get married you have to have concrete block."[98] In Mexico, the government artificially produced a negative cultural sentiment surrounding earth-based materials. As a result, earth-based materials, which can produce "better" houses maintain a negative image and indicate a perceived lower socioeconomic status. Although Mexico has a long rich history of earth-based construction projects, the current government's pro-concrete regulations actively put down earth-based construction in favor of protecting the financial interests of construction and concrete companies.

Traditionally, Mexican earth-based construction has been produced using adobe bricks, a process that is slowly being phased out by the Mexican government's pro-concrete regulations.[99] Adobe bricks are baked in the sun after being hand-formed from a mixture of locally sourced materials such as sand, gravel, clay, water, and straw. This simple but materially efficient process is defined by images of open fields with hundreds of hand-shaped bricks drying in the sun (fig.

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[96] Gernot Minke. *Building with Earth: Design and Technology of a Sustainable Architecture*. Basel: Birkhäuser, 2021. Pg. 10

[97] Mexico was colonized by Spain in 1500, which is 600 years after the Sun Pyramid was built using earth. The Sun Pyramid is a complex and massive Pre-Columbian structure built by the Teotihuacanos, a historically mysterious group of people who lived just West of what is now Mexico City. However, the name "Sun Pyramid" was actually given to the pyramid by the Aztecs. Although the pyramid is the third largest in the world, it is unknown what the Teotihuacanos called it.

[98] "Mexico's Traditional Housing Is Disappearing-and with It, a Way of Life." The Architectural League of New York, April 18, 2018. https://archleague.org/article/mexicos-traditional-housing-disappearing-way-life/.

[99] Amy Frearson. "'We Banned Renders' from the Design Process Says Tatiana Bilbao." Dezeen, December 10, 2019. https://www.dezeen.com/2019/12/04/tatiana-bilbao-banned-renderings-architecture-interview/.

2.12). As the hot sun dries each brick, a gradient appears in the material. The gradient ranges from a dry light brown, where the sun hits the brick most directly, to a rich dark brown, hinting at the water still contained in the non-exposed portion of the brick. Then, the bricks are flipped over, by hand, to dry all the way through before they are stacked, forming the walls of an earth-based structure. This process is only possible when the bricks are thin enough to be dried by the sun. Otherwise, they will remain waterlogged and will fall apart. During the construction of an adobe house, all of the bricks can be made by hand using the materials readily available at the site. Unlike concrete construction which produces 8% of all global co2 emissions, traditional adobe construction does not require any machinery and is a low-energy method for developing earth-based structures.[100]

Similar to adobe bricks, Bilbao's rammed earth construction projects do not require heavy processing or mining. However, unlike adobe construction which relies on the sun's heat to harden each brick, repeated ramming is used to solidify rammed earth. As a result, rammed earth walls can be made thicker than adobe walls because they don't count on the sun's ability to penetrate the entire material. To build a rammed earth wall a layer of loam is poured into a wood framework and then compacted by sustained ramming.[101] Picture someone standing above a freshly poured layer of loam, smashing the material deeper into a wooden framework with a jackhammer-esque handheld tool.[102] This process is repeated over and over again to form unique layers stacked on top of each other. However, because the contents of the earth pulled from the

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[100] Johanna Lehne and Felix Preston. "Making Concrete Change - Chathamhouse.org." Chatham House, June 13, 2018. https://www.chathamhouse.org/sites/default/files/publications/2018-06-13-making-concrete-change-cement-lehne-preston-final.pdf.

[101] As previously mentioned, Loam is composed of the following: a mixture of clay, silt (very fine sand), sand, and occasionally larger aggregates such as gravel or stones.

[102] The jackhammer-esque tool was equipped with a wide blunt end.

construction site will vary, the color of each new layer differs from the last. As a result, the color and visual aesthetic of a rammed earth wall are not uniform, instead, it is a beautiful spectrum of earth tones. Each layer of a rammed earth wall can be easily distinguished from the next by their different colors and the rough thin line that separates them, like rings on a tree (fig. 0.6), reminding the building's inhabitants of the hands and time required to produce each wall. With her rammed earth houses, Bilbao is furthering the indigenous Mexican tradition of energy-efficient earth-based construction.

Rammed earth's luxurious and raw texture lends itself to creating beautiful exteriors. In 2010, Bilbao first successfully used it to complete *Casa Ajijic* (fig. 0.6) (2010-2011), an affordable summer house. The *Casa Ajijic* is a large summer home located on the shores of the Chapala lake in Jalisco, Mexico. It was entirely constructed using wide 20-inch rammed earth walls that look like soft desert sunsets. The extreme thickness of each wall means the house will last longer than an adobe structure, which has significantly thinner and less sturdy walls.[103] In addition, the thick walls aren't covered up or painted over so they define both the house's interior and exterior visual aesthetics. Only the odd wood staircase or metal appliance differentiates the inside from the outside. When discussing how she discovered rammed earth as a viable vernacular building material Bilbao explained,

> In the Ajijic house, we needed to find a material that would allow us to build a very big house, or very big for the budget. We had to find a material that would allow us to do that. After discarding a lot of them, we looked at what was there in the place. The answer was earth… I started researching it and we found a really good way of using this material, when you understand the possibilities of the material. That material allowed us to build this house in the way we wanted.[104]

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[103] Gernot Minke. *Building with Earth: Design and Technology of a Sustainable Architecture*. Basel: Birkhäuser, 2021. Pg. 51

[104] Amy Frearson. "'We Banned Renders' from the Design Process Says Tatiana Bilbao." Dezeen, December 10, 2019. https://www.dezeen.com/2019/12/04/tatiana-bilbao-banned-renderings-architecture-interview/.

The *Casa Ajijic's* client requested a large house and offered a relatively small budget of $100,000. In order to accommodate the client's vision, Bilbao experimented with materiality to reduce construction costs. Wood couldn't be used because the house's construction site was located on Chapala lake where Bilbao claimed wood "...is super expensive, not cultivated, and therefore not an option."[105] While bricks could not be used because they require the construction of a concrete foundation to transfer weight from the house to the soil, which increases construction costs. Alternatively, rammed earth walls are so thick they don't require a foundation for support. By building the *Casa Ajijic* out of rammed earth Bilbao eliminated the need for a concrete foundation and was able to use the site's readily available earth as the primary building material, reducing cost. By revisiting earth-based Mexican indigenous construction Bilbao was able to accommodate the *Casa Ajijic* client's dream of a large house without decreasing the building's visual appeal or increasing the project's relatively small budget.[106]

Although Mexico has a long rich history of earth-based construction projects, the current government continues to actively put down earth-based construction in favor of concrete construction. They protect the financial interests of concrete producers because earth-based construction is inherently less profitable than concrete construction. Concrete is a capital good and its production supports multiple industries. To build a concrete house, materials have to be mined, processed, distributed, and then constructed. While, an earth-based house cuts all of those industries out because it does not require the mining, processing, or shipping of any unique materials. Instead, earth-based construction is a localized industry that sources materials directly from the earth beneath a construction site. However, without the Mexican Government's support,

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[105] Tatiana Bilbao, Gabriela Etchegaray, Hilary Sample, and Ivonne Santoyo-Orozco. *A House Is Not Just a House: Projects on Housing*. New York, NY: Columbia Books on Architecture and the City, 2018. Pg. 89

[106] The Casa *Ajijic* is 3756 sqft. So, at 100,000 dollars in total, it only cost 26.6 dollars per sqft.

in Mexico, there are no public spaces set aside for the development of earth-based construction. To circumvent the government's pro-concrete regulations, Bilbao used traditional spaces of architectural labor to deploy new techniques in earth-based construction. She used the skills that she developed at LCM/FREE, as an architect to the ultra-wealthy, to secure private spaces for her experiments with earth-based materials. By taking on a prototypical architect's project like the *Casa Ajijic*, she was able to use her wealthy clients' money to fund her first earth-based house. Next, she finally began to slowly implement her discoveries in truly cheap architecture: affordable reconstruction efforts following natural disasters.

2.4 Quick Bricks

In 2017, the Mexican state of Puebla was struck by a devastating 7.1 magnitude earthquake. It took the lives of 369 people and affected about 35,000 more.[107] Immediately following the catastrophic earthquake, the Mexican government gave affected low-income families debit cards worth $6,000 each.[108] The only caveat was that these cards had to be used to build small concrete houses.

The pro-concrete stipulation that the Mexican government attached to its disaster relief funds were in complete disregard to the recipients' needs. The amount of money given to each family was derived from the estimated cost to build a 43 square meter house using concrete, the bare-minimum size requirement for government-sponsored housing in Mexico.[109] To put that into

[107] Duncan Hawley. "On Shaky Ground: The Physical Facts of Recent Earthquake Events in Mexico." *Teaching Geography* 43, no. 1 (2018): 32–35. https://www.jstor.org/stable/26455216.

[108] "Reconstruction Progress a Year after September 2017 Earthquakes." Gobierno de México. Accessed March 31, 2022. https://www.gob.mx/epn/prensa/the-government-has-promoted-policies-and-programs-to-achieve-a-society-in-which-women-participate-on-equal-terms-with-men-epn?tab=.

[109] Tatiana Bilbao. "A House Is Not Just a House." Architect, October 17, 2018. https://www.architectmagazine.com/design/a-house-is-not-just-a-house_o.

perspective, 43 square meters is about half the size of the average New York City apartment.[110] However, in actuality most homes in Mexico support two to three generations of families and a 43 square meter house could not provide a humane living space.[111] Although each debit card had exactly enough money to construct a house sufficient for one person living in New York City using steel-reinforced concrete, they would have had more than enough money to rebuild a large multi-family house using earth-based materials. Unfortunately, the cards could not be used for earth-based endeavors. In order to qualify for the government's disaster relief funds, families had to agree to rebuild their homes using concrete.[112] This guaranteed that the reconstructed houses would be too small to support any family larger than three people. In addition, the cards were only authorized for the purchase of materials from a small group of government-approved concrete distributors. This meant that low-income families who lost everything in the Puebla earthquake would be forced to rebuild what were once multi-generational homes as single person homes.

If the Mexican government had embraced earth-based construction, in 2017, their reconstruction efforts would have actually met the needs of the affected families. However, the government instead enforced pro-concrete regulations that prioritized concrete producers. The government's relationship with the concrete industry is an example of what Bilbao calls "…the shackles that influence policy. And rarely does this policy align with what society and the voters

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[110] Amy Plitt. "NYC Apartments Are Shrinking, but Not as Much as Other Cities." Curbed NY. Curbed NY, September 21, 2016. https://ny.curbed.com/2016/9/21/12999536/nyc-apartment-sizes-decrease.

[111] Curtis Huffman. "Living Arrangement Dynamics" 2019. https://www.demographic-research.org/volumes/vol41/50/41-50.pdf.

[112] "Mexico's Traditional Housing Is Disappearing-and with It, a Way of Life." The Architectural League of New York, April 18, 2018. https://archleague.org/article/mexicos-traditional-housing-disappearing-way-life/.

need. So it is very difficult to align the interests of the constituents and their representatives."[113] To promote earth-based construction and get around the Mexican government's anti-earth regulations, Bilbao teamed up with the Mexico-based non-profit organizations *PienZa Sostenible* and *Love Army*. The former, *PienZa Sostenible,* is an environmentally conscious organization dedicated to achieving the goals set by the *United Nations'* "2030 agenda".[114] [115] After the earthquake, *PienZa Sostenible* descended upon the state of Puebla to promote sustainable reconstruction efforts. Specifically, they wanted to curb the use of concrete in reconstruction, which is an extremely unsustainable building material. Bilbao, who had recently received critical acclaim for the success of her earth-based *Casa Ajijic*, was the perfect candidate to carry out their sustainable goals. To secure funding for the project, *PienZa Sostenible* connected Bilbao with *Love Army,* a non-profit organization that works with celebrities to raise money for charitable causes. *Love Army* reaches a broad audience around the world by working with both internet stars such as Jerome Jarre, Juanpa, and Casey Neistat and traditional celebrities like Ben Stiller. With the money provided by *Love Army's* celebrity campaigns, Bilbao no longer needed the government's support to finance her earth-based reconstruction efforts, following the 2017 earthquake. With funds provided by *Love Army*, Bilbao began constructing her first low-income earth-based houses, using eco blocks, an unbaked and mechanically formed miniature version of rammed earth that can be rapidly reproduced.

The machines that produce eco blocks are to earth-based construction as electric inkjet printers are to printing a Bard senior project. On one hand, adobe bricks rely on the slow process

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[113] "Interview Tatiana Bilbao." Wash Magazine, 2019. https://washmagazine.com/Interview-Tatiana-Bilbao.

[114] "Transforming Our World: The 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs." United Nations. United Nations. Accessed April 20, 2022. https://sdgs.un.org/2030agenda.

[115] The 2030 agenda consists of 17 goals that all prioritize future sustainable development.

of the sun's heat to harden them, while eco blocks are quickly produced by feeding dirt into a machine which uses hydraulics to compress the material and push out a brick the size of a loaf of bread.[116] These bricks are smaller and easier to make than rammed earth, allowing Bilbao to efficiently extend her earth-based ambitions to affordable housing. Using this cost-efficient alternative to concrete, she helped Marbel Torres Montiel, a flower wreath-maker who lost her home in the Puebla earthquake. After interviewing Marbel to understand her specific vernacular wishes, Bilbao designed and rebuilt Marbel and her family's entire house using rapidly produced eco-blocks instead of concrete: *Casa Marbel* (fig. 0.1) (2017-2018).

Marbel and her husband Ismael, live in Ocuilan de Arteaga, Mexico, a small village that was devastated by the 2017 Puebla earthquake. They are both wreath makers and to make their beautiful wreaths they use flowers and branches from the trees located on their property. After their home was completely destroyed during the earthquake, they asked Bilbao to preserve the property's remaining trees. To accommodate this, Bilbao imagined the house as three square earth-based buildings that wrapped around an open space with an avocado tree at its center, forming a square courtyard. One wall of each of the three square buildings faces the avocado tree. These three inward-facing walls form three sides of the square courtyard. While the fourth side was left open, creating a clear front entrance to the property. In addition, the three structures were given roofs that from an outside perspective form a single and continuous gable roof (Fig. 2.13).[117] If you are looking at the home from the front it looks as if it were cut into thirds, with the middle section setback from its original place between the outer two sections, leaving a space for the courtyard. From the front, the building on the left's roof is short and angled up towards

[116] "Eco Brava Interlocking Block Making Machine." GEETHY GROUP, 2014. https://www.youtube.com/watch?v=mQc6uMpDFmE.

[117] A gable roof is formed by two equilateral slabs sloping downward in two opposite directions at an angle from a central ridge.

the avocado tree and the center building's roof is also short and continues this trajectory. While the building on the right's roof is the longest and its slope is an inversion of the other two, forming the second half of the continuous gabled roof. So, the apex of the combined structure's roof is actually located above the right side of the square courtyard where the peak of the center building's roof meets the peak of the building on the right's roof. Instead of appearing as four separate entities, the interior courtyard and three surrounding structures (with their continuous roofs) give the impression of a single uniform home. As a result, the *Casa Marbel* is a beautiful collection of earth-based indoor/outdoor spaces where walking between buildings feels like walking between rooms.

All of these buildings were constructed out of earth-based materials using Love Army's crowdsourced money, which was about the same amount that the government gave affected families to build small concrete homes. To complete the buildings' structural walls Bilbao used eco-blocks, then, she finished the three houses, using a light-colored wood for the windows, doors, and furniture.[118] From the front, the building on the right is the largest and contains both Marbel and Ismael's bedroom and their children's bedroom. On the inside of this structure, a thick wooden wall doubles as storage space and divides the two bedrooms. This multi-purpose wall has built in drawers for storing blankets and cabinets for clothing. Both of these bedrooms have a pair of windows and a separate entrance, providing privacy. The center building contains the house's bathroom. This structure consists of an exterior sink and two interior rooms: one for the shower and one for the toilet. As a result, all three of the bathroom's utilities can be used by different people at the same time. To provide natural light and airflow to the toilet room, Bilbao ingeniously made its exterior eco-block wall a lattice. By using a lattice wall instead of a

[118] *Love Army* provided about $6000, equivalent to the money provided to other family's by the Mexican government.

window, she made the interior of the toilet room both refreshing and private. The third and final structure is one large volume that makes up the house's kitchen. While three of the kitchen's walls were constructed using eco-blocks, the fourth wall that faces the center courtyard is made up of two large wooden sliding doors. This means that it can disappear, opening the kitchen up to the central courtyard for dinner parties or cooling it down during long days of cooking. Bilbao's reconstruction of Marbel and her family's home is an indoor/outdoor home with small spaces for quiet reflection and large areas for social gatherings.

The *Casa Marbel's* unique materiality allowed Bilbao to design a larger house than was possible for Marbel and her family had they used the Mexican government's pro-concrete debit cards. $6,000 was not enough to successfully construct the *Casa Marbel* out of concrete. However, in a single day, Bilbao was able to turn the soil from the *Casa Marbel* construction site into enough bricks for the large compound's three structures.[119] This rapid construction process produced beautiful and large living spaces that adequately supported the needs of the inhabitants. By using eco blocks Bilbao was able to transfer the successes of her expensive earth-based homes to easily reproducible low-income housing. So why does the Mexican government continue to promote concrete construction? Instead of making affected low-income families the center of the Puebla earthquake housing crisis, the government prioritized construction profits. Earthquakes and low-income housing projects in Mexico have become opportunities to support the Mexican concrete industry.

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[119] To build all three earth-based structures, Bilbao utilized an eco-block machine capable of producing about 2,500 bricks a day. The largest of the three structures, Marble and her family's bedrooms, required about 1,000 eco-blocks to build. The remaining two structures, the bathroom and the kitchen, were both significantly smaller and could easily be constructed using 1,500 bricks. So, It's fair to assume that the eco-block machine produced enough bricks in a day for all three of the *Casa Marbel's* structures. This is furthered by the lack of drying time required by eco blocks. Meaning all of the bricks required to construct the three structures would literally be available for construction within one day.

2.5 Zooming Out

A keen interest in questioning and pushing the limits of materiality has to remain at the center of all future architectural projects. The Mexican government's public-facing reasoning for their anti-earth-based policies was based on claims that earth-based construction is unsafe, disregarding the positive potential applications for the material. Although specific points in earth-based construction can indeed be improved, that doesn't mean Mexican vernacular architecture should completely disregard a material that has always been a key building block in Mexico, long predating the current government.[120] As advocates for successful design practices, architect's can not wholly dismiss any one material because there is always the possibility that those unwanted materials will be relevant in a future context. For instance, by experimenting with earth-based building materials, a material vilified by the Mexican government, Bilbao was able to decrease the environmental and financial cost of building a home. Through her consistent dedication to revisiting materiality, she was able to unlock new possibilities within earth-based building materials and construction practices. As a result, in both her affordable summer homes/villas and post-earthquake reconstruction projects, construction began and ended at the actual location of the home.

Natural disasters that destroy our towns and buildings will always offer new opportunities to revisit materiality. In 2011, a few years before the Puebla Earthquake, in Christchurch, New Zealand there was a massive 6.2 magnitude earthquake. Following the devastating earthquake, New Zealand's government instigated a temporary era of emergency building code.[121] Among

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[120] "Mexico's Traditional Housing Is Disappearing-and with It, a Way of Life." The Architectural League of New York, April 18, 2018. https://archleague.org/article/mexicos-traditional-housing-disappearing-way-life/.

[121] Liz McDonald. "Cardboard Cathedral Is Allowed to Stay after Rush to Secure Consent." The PressNews, September 23, 2021. https://www.stuff.co.nz/the-press/news/126451442/cardboard-cathedral-is-allowed-to-stay-after-rush-to-secure-consent.

the many affected buildings that the earthquake destroyed, Christchurch lost an iconic Anglican cathedral originally constructed in 1864. As a result, the Anglican church's staff was allowed to build a temporary structure to replace its church. However, that government's building code grace period would expire in 2021, and the church would be forced to replace any temporary structure with a permanent one built out of steel or concrete. They hired Shigeru Ban (1957-), a contemporary of Tatiana Bilbao, who used disregarded materials to design a transitional church capable of becoming the congregation's permanent home.

While Tatiana Bilbao's domestic structures promoted earth-based construction methods, elsewhere in the field, Ban's disaster relief architecture championed the exploration of paper as a semi-permanent construction material. To accommodate the Anglican church Ban elected to do the project pro-bono and primarily used paper tubes, a cheap alternative to the building's original stone structure.[122] The result was *Cardboard Cathedral* (2012-2013), an A-frame building with a single large interior volume filled with natural light by a huge stained glass window, directly above the building's entrance (fig. 2.14).[123] Instead of using stone, Ban constructed both sides of the A-Frame with recycled industrial-grade paper tubes.[124] The exterior of these tubes come pre-treated with waterproof and fire-resistant chemicals because they are intended to be used in volcanic environments, like an aluminum foundry (fig. 2.15). So, Ban didn't need to alter the tubes to turn them into safe and long-lasting building materials. By exploring paper, a typically delicate building material, Ban was able to discover a robust and readily usable building

[122] Andrew Barrie. "Cardboard Cathedral by Shigeru Ban in Christchurch, New Zealand." Architectural Review, July 20, 2020. https://www.architectural-review.com/architects/shigeru-ban/cardboard-cathedral-by-shigeru-ban-in-christchurch-new-zealand.

[123] Shigeru Ban. "Cardboard Cathedral / 紙の大聖堂." SBA_CCC. Accessed April 25, 2022. http://www.shigerubanarchitects.com/works/2013_cardboard-cathedral/index.html.

[124] In total, there were 98 paper tubes used in the construction of the cathedral. The tubes were all 65.6 feet long and had a diameter of two feet.

material. Although the *Cardboard Cathedral* was technically a temporary structure, by using paper tubes, he inexpensively designed a durable structure with an expected lifespan of 50 years.[125] Consequently, in 2021, Ban's "transitional" church was reassessed by Christchurch's city council and they retroactively ruled that the structure could serve as the Anglican church's permanent home.[126] Bilbao and Ban both produced cheap architecture and gave new life to valuable building materials left behind in our rapid progression towards a capitalist concrete future of building materials.

As the world experiences more and more natural disasters due to climate change, it is imperative that affected nations use these natural tabula rasas as opportunities to promote cheap building materials.[127] Specifically, countries like Mexico and New Zealand should accept the use of cheap building materials such as recycled paper tubes and eco blocks which are both financially and environmentally inexpensive. If nations devastated by natural disasters use inexpensive building materials to rebuild, then reconstruction efforts can focus on producing well-designed spaces that are large enough to accommodate the intended families. Eco blocks can facilitate a smooth transition from concrete, an expensive and extremely unsustainable building material, to earth-based construction which is inexpensive and produces virtually no

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[125] Amy Frearson. "Shigeru Ban Completes Cardboard Cathedral in Christchurch." Dezeen, December 29, 2015. https://www.dezeen.com/2013/08/06/shigeru-ban-completes-cardboard-cathedral-in-christchurch/#:~:text=The%20building%20was%20designed%20by,permanent%20cathedral%20can%20be%20constructed.

[126] Liz McDonald. "Cardboard Cathedral Is Allowed to Stay after Rush to Secure Consent." The PressNews, September 23, 2021. https://www.stuff.co.nz/the-press/news/126451442/cardboard-cathedral-is-allowed-to-stay-after-rush-to-secure-consent.

[127] Shannon Heyck-Williams. "Climate Change. Natural Disasters, and Wildlife." National Wildlife Federation, November 2019. https://www.nwf.org/-/media/Documents/PDFs/Environmental-Threats/Climate-Change-Natural-Disasters-fact-sheet.ashx?la=en&hash=DFC7F87116E03583B1F81B3A64CB88FEF55039BC.

environmental pollution.[128] When we are inevitably recovering from the world's next natural disaster, we need to intentionally rebuild our towns and cities using cheap and sustainable building materials to provide comfortable living spaces for the people that need them.

[128] Unlike concrete construction which produces 8% of all global co2 emissions, traditional earth-based construction methods do not require any machinery and are a low-energy alternative for developing structurally sound domestic structures.

Conclusion

I had a hard time selecting a topic for my senior project. It was a long and tedious process that lasted from August 2021 to December of that same year. When I finally decided to start writing about cheap architecture, I based my choice on a hunch that small architectural budgets will always yield good architectural projects. A sort of "from a piece of coal we get a diamond" mentality.[129] A belief rooted in the capitalistic notion that by applying pressure to something we can force it to become better. Specifically, I was inspired by Thomas Heatherwick's (1970-) inexpensive *Aberystwyth Creative Studios* (2009) (fig. 3.1). For this project, Heatherwick was hired by a public university in Aberystwyth, Wales, that had limited funding and wanted 16 interesting-looking artist studios.[130] So, using the university's relatively small budget he designed eight unique double-unit buildings out of warped steel. To bring down construction costs, he avoided using expensive thick steel and instead worked with 1/10 mm stainless steel sheets (fig. 3.2). In addition to being inexpensive, these ultra-thin sheets were also more malleable than typical building steel and Heatherwick used them to create unique facades for each building, reminiscent of scrunched-up tin foil. These metal shells were then filled with sprayable insulation to produce cheap, lightweight, and inexpensive exteriors that met the needs of the university. I thought that the *Aberystwyth Creative Studios'* interesting aesthetics were proof that

[129] Gage Diamonds "Diamonds Aren't Made from Coal. So Why Does Everyone Think They Are?" Gage Diamonds, August 30, 2021. https://gagediamonds.com/blog/diamonds-arent-made-from-coal-so-why-does-everyone-think-they-are/.

[130] About 1.4 million dollars to build 16 artist studios (contained in 8 double-unit buildings).

budget restrictions always yield ingenuity in architecture. However, just like the common "diamonds from coal" refrain, I was wrong.[131]

Diamonds aren't made from coal, and small architecture budgets don't make good architecture. Architects who are willing to consistently adhere to those small budgets make good architecture. The *Aberystwyth Creative Studios* exists in stark contrast to all of Heatherwick's other architectural projects. Most notably, Heatherwick's *Vessel* (2017) (fig. 3.3), a tourist attraction consisting of stairs reaching towards the sky, was reportedly "...100 percent over its initial budget of $75 million." [132] And that was only a year into its two-year construction process. The *Vessel*, an exuberant and audacious structure, is more representative of Heatherwick's architectural style. After *Aberystwyth Creative Studios,* there was never another budget that could reel in and control Heatherwick. In fact, his infamous *Garden Bridge* project was killed in 2017 due to an insane runaway budget that went "…from a promised £60m in 2013, to £100m, to £185m, to £200m and possibly more…"[133] So, in reality, Heatherwick was never interested in making cheap architecture, the success of the *Aberystwyth Creative Studios'* was an aberration and he never repeated it. I now know that cheap architecture is not successful because it is financially limited. Instead, it is successful when architects make a habit of consistently embracing those limitations. Thomas Heatherwick doesn't make cheap architecture, instead,

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[131] The diamonds from coal rumor was reportedly started by Henry Kissinger. Although both are forms of carbon, in reality, many diamonds predate plant life on earth, which is the key ingredient in coal. In addition, diamonds are found significantly deeper inside the earth than coal.

[132] Andrew Russeth. "Can Someone Please Stop the Construction of Thomas Heatherwick's $150 m. Monstrosity in Manhattan?" ARTnews.com, November 18, 2019. https://www.artnews.com/art-news/reviews/can-someone-please-stop-the-construction-of-thomas-heatherwicks-150-m-monstrosity-in-manhattan-6995/.

[133] Rowan Moore "Thomas Heatherwick: Pied Piper who has the very rich under his spell" The Guardian, August 19th, 2017. https://www.theguardian.com/artanddesign/2017/aug/19/thomas-heatherwick-pied-piper-has-the-very-rich-under-his-spell

Tatiana Bilbao, Anne Lacaton, Jean-Philippe Vassal, and all of those who embrace their limited budgets make cheap architecture.

The architects that I highlighted in this project, unlike Heatherwick, continue to exhibit a constant commitment to cheap architecture by actively embracing budget limitations. In chapter one, I detailed how Lacaton and Vassal's architecture is a product of both their flexible approach to the permanence of already built architecture and rigid adherence to financial limitations. Over the last 37 years, the duo has applied their financially responsible approach to architecture to 120 architectural projects in 28 different countries.[134] Currently, Lacaton and Vassal are finishing designs for the housing transformation of a former hospital into a 138-unit, mid-rise apartment building in Paris, France, and a hotel and commercial space in Toulouse, France. While Lacaton and Vassal work to reduce architectural costs by reusing modern French buildings, in Mexico, Tatiana Bilbao experiments with materiality to produce cheap buildings built from scratch. In chapter two, I explained how she developed a fictional utopian town on her website and consistently works to merge that idyllic space with our physical reality by promoting material experimentation in domestic architecture. For each fictional structure that exists on her website, there is the possibility for an intervention into the built world. So far, her eponymous studio, Tatiana Bilbao Estudio, has converted 26 of her fictional drawings into physical architectural projects, with 9 more still in the process of being built.[135] While I used chapter two to highlight her earth-based *Casa Ajijic and Casa Marbel* projects, between 2012 and 2016 she also completed *Los Terranos* (Fig. 3.4), a pair of earth-based houses located in Monterrey, Nuevo León, Mexico. They are beautiful vacation homes located in a forest and Bilbao utilized the

[134] Anne Lacaton and Jean-Philippe Vassal. "Lacaton & Vassal." Lacaton & Vassal. Accessed April 30, 2022. https://www.lacatonvassal.com/.

[135] Tatiana Bilbao. "Tatiana Bilbao Estudio Website" Tatiana Bilbao Estudio. Accessed April 30, 2022. https://tatianabilbao.com/.

inherent natural colors of their earth-based walls to immerse the buildings into their natural surroundings. While the *Casa Ajijic* was completed in 2011 and the *Casa Marbel* was completed in 2018, *Los Terranos* (2012-2014) are evidence of Bilbao's decade-long dedication to experimenting with earth-based building materials, having spent almost every year of the 2010s working on earth-based construction projects. At the moment, Bilbao is finishing a new affordable housing model in Apodaca, Nuevo León, Mexico, where she is designing townhouses for communal living to accommodate high population growth rates across Mexico (Fig. 3.5).[136] Both Tatiana Bilbao and Lacaton & Vassal continue to exemplify how cheap architecture needs to be made.

In my project, I highlighted the hypocrisies of current affordable housing models. Contrary to its name, *affordable* housing has a long history of providing profits to developers, construction companies, governments, and extractive industries. In the twentieth century, France's modern social housing projects were an opportunity for French politicians and modern architects to carry out personal agendas. However, they are considered some of modern architecture's greatest failures because they neglected the needs of the people living in them to fulfill the aspirations of their creators. Having eventually failed to meet their lofty expectations, the French government elected to destroy and replace them all, further increasing their cost and pushing them farther away from their goal of providing sufficient housing to low-income families. Similarly, in Mexico, federal housing subsidies are plagued by anti-earth-based stipulations that stigmatize traditional indigenous building techniques by restricting the funds for the purchase of concrete building materials. The Mexican government uses federal housing subsidies to guarantee absurd profits to concrete companies. So, instead of providing low-income

[136] Tatiana Bilbao. "Tatiana Bilbao Estudio: Urban Redensification – Apodaca." Tatiana Bilbao Estudio | Urban Redensification – Apodaca, 2017. https://tatianabilbao.com/projects/urban-redensification-apodaca.

Mexican families with the most beautiful and comfortable living environments possible, Mexican affordable housing prioritizes the Mexican concrete industry. While low-income housing is used by the world's poorest individuals, it means massive guaranteed contracts for all parties involved. As a result, the main goal of low-income housing is to improve the bottom line, allowing for the most possible profit to be extracted from affordable housing projects. Today, when domestic construction budgets are reduced to their smallest size to produce affordable housing, beauty is the first thing to go. A cheap building's aesthetics are viewed as superfluous when compared to things like its size, stability, and hygiene. However, when it comes to the human experience beauty exists on even ground with all of the previously mentioned characteristics. Future affordable housing has to reposition itself to place equal value on beauty as all other aspects of the structure, because humane affordable housing that is designed to last a long time does not need to lack architectural beauty.

Cheap architecture is anthropocentric which means it is subversive to capitalism. It is the practice of valuing the human experience as the guiding light in the architectural design process. As a result, beauty remains a key priority of cheap architecture. In cheap architecture, the architect removes profit as the main priority of low-income construction and replaces it with the human experience. Why is it that, today, beauty and comfort metrics are only considered when designing buildings for rich people? If we disregard essential characteristics like beauty and comfort when building low-income housing, it will fail. It's not worth it to build a substandard concrete structure just to tear it down and build another one after a few years. Architects who actively adhere to reduced budgets can teach us how to build functional spaces to be lived in, beautiful places that work and will work for a long time.

Figures

Figure 0.1, Tatiana Bilbao Estudio, *Casa Marbel, 2017*-2018,

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Figure 0.7, Minoru Yamasaki, *Pruitt-Igoe Housing Project,* 1951-1955,

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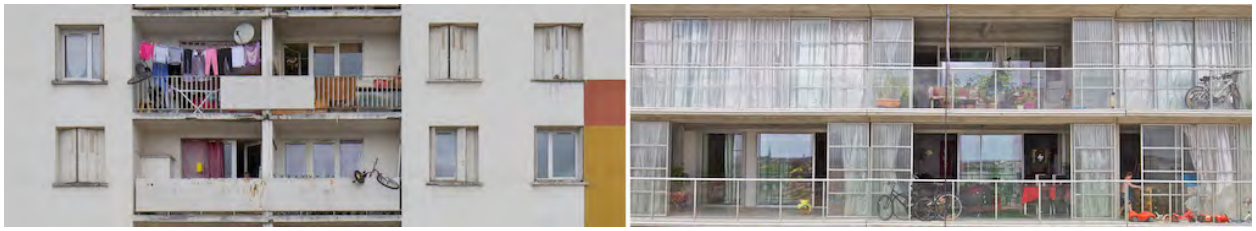

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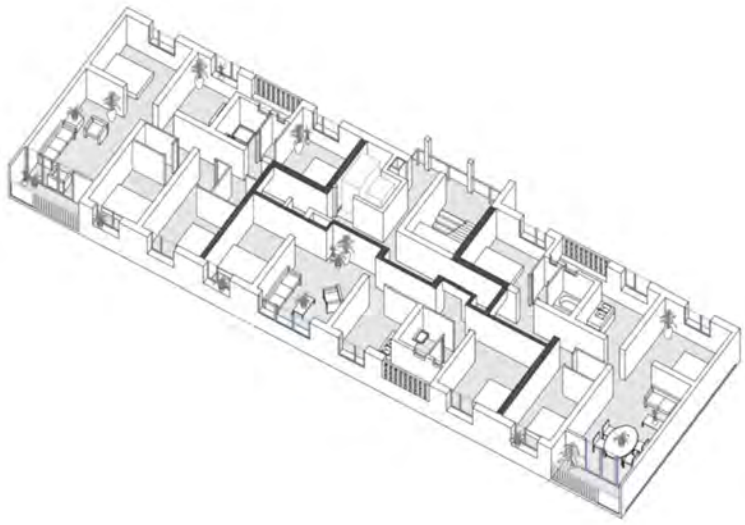

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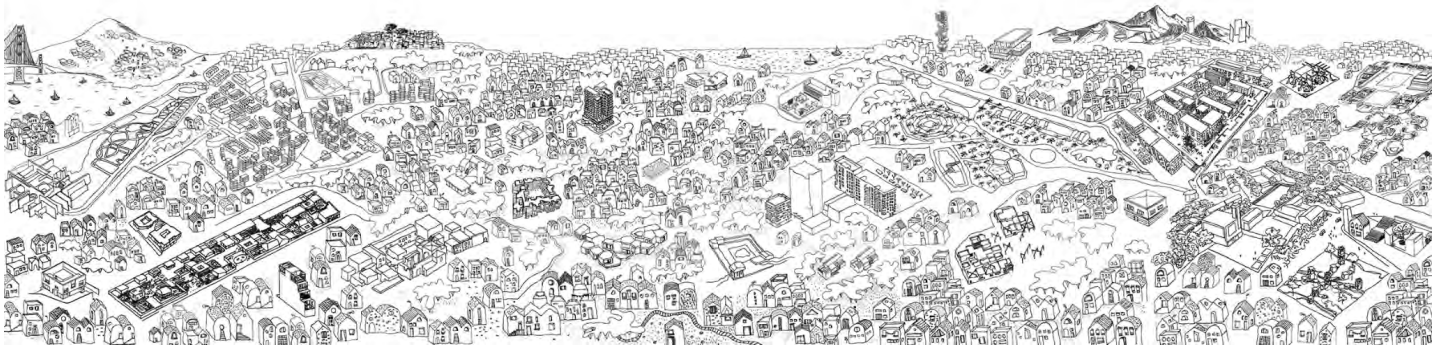

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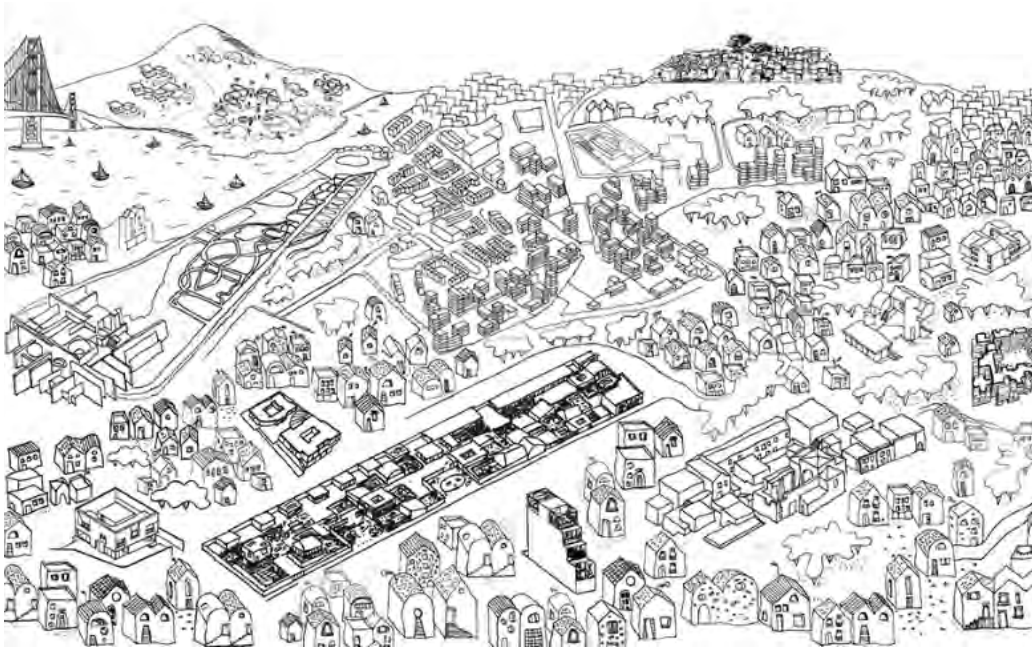
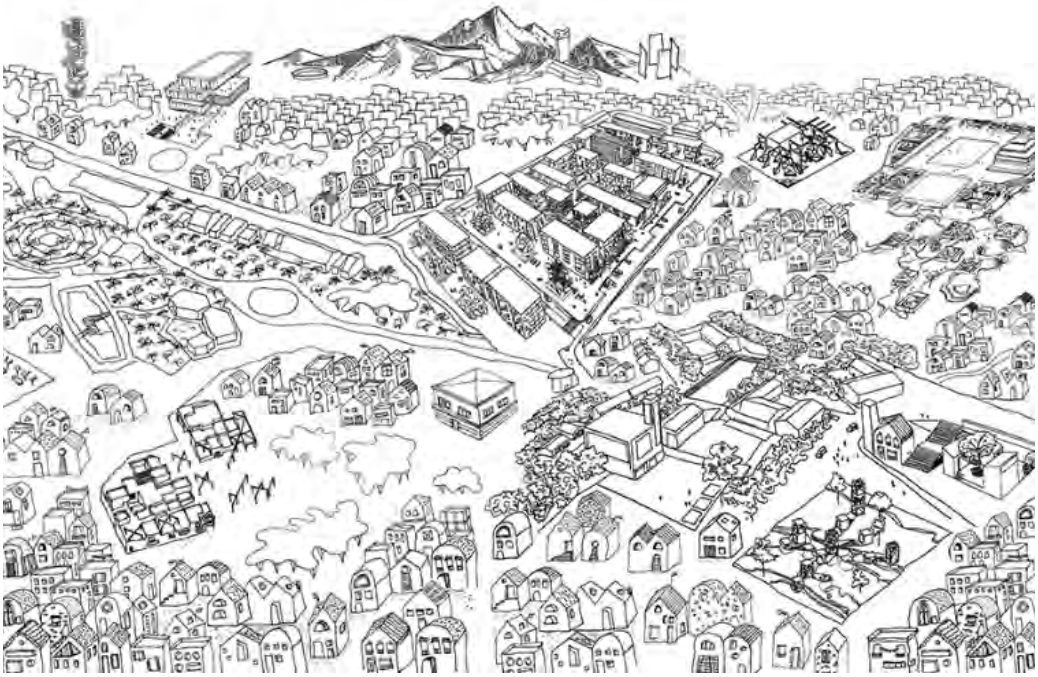


Figure 2.3 (Zoomed in.)



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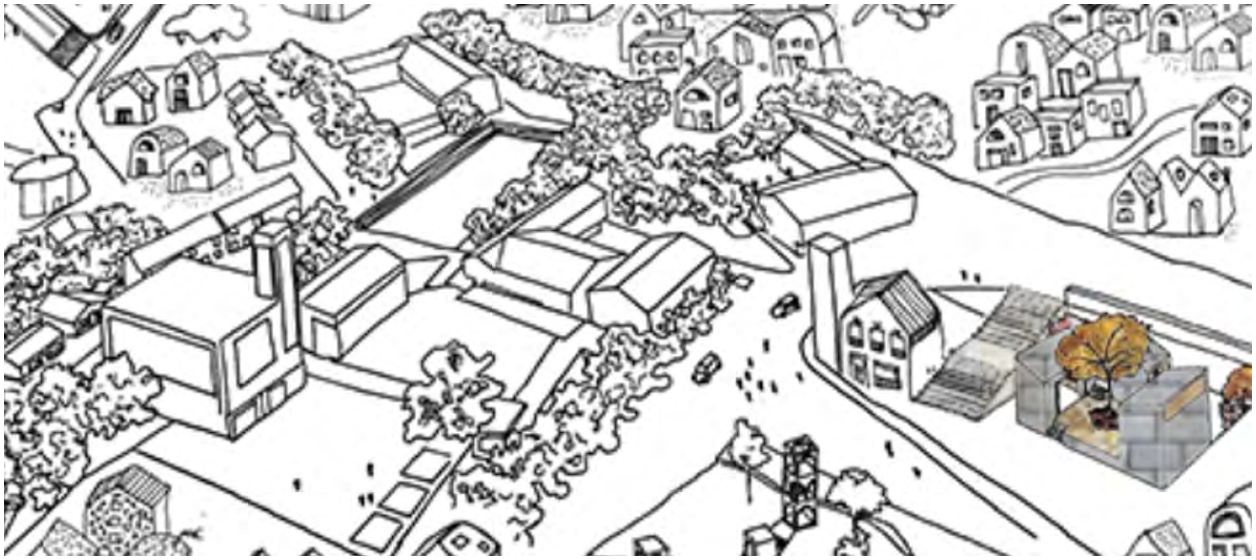

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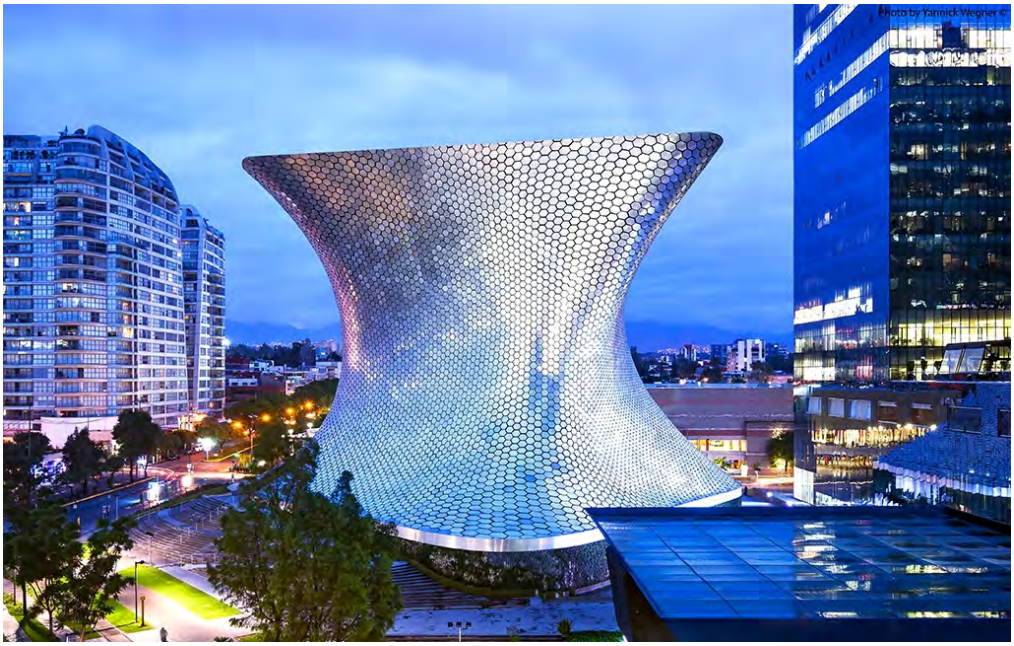

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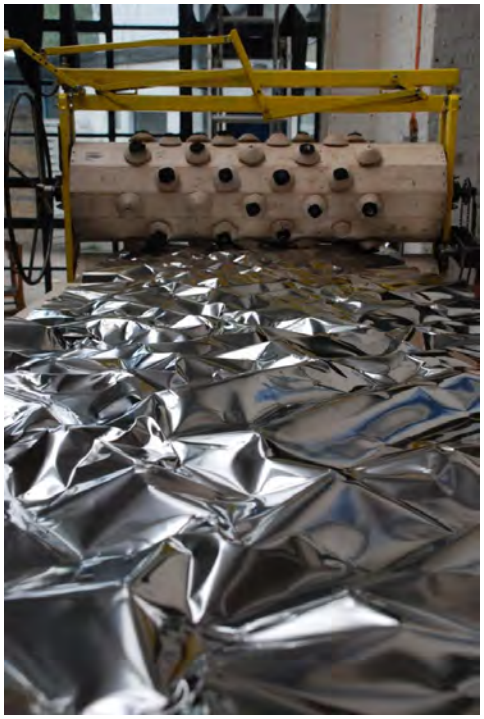

Figure 3.2, Thomas Heatherwick*, Making the Skin of the Aberystwyth Creative Studios,* 2009

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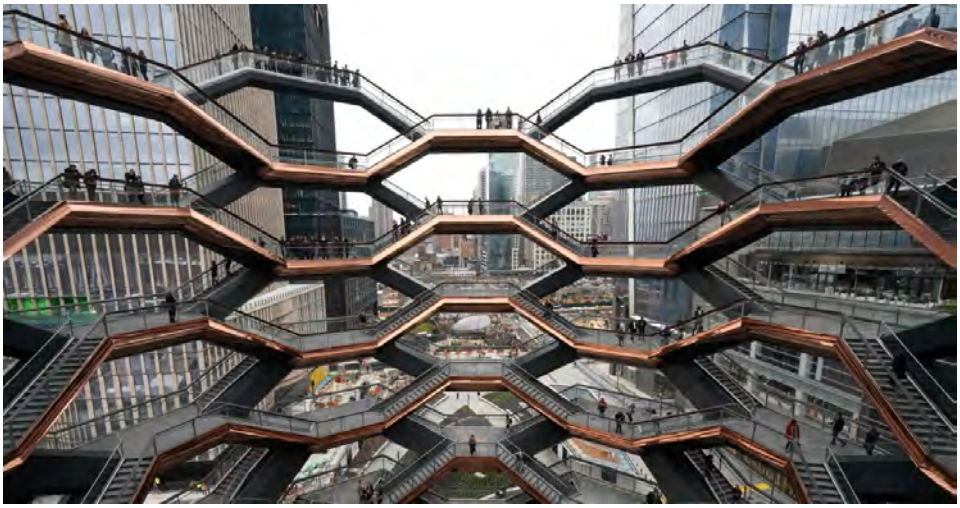

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Figure 3.4, Tatiana Bilbao Estudio, *Los Terrenos,* 2012-2016,

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Figure 3.5, Tatiana Bilbao Estudio, *Urban Redensifcation-Apodaca,* 2017

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