The Master of Science in Architecture Studies, a two-year program of advanced study beyond the first professional degree in architecture, is founded on research and inquiry into contemporary problems of architectural design and practice in the US and around the world. The program reflects the idea that architecture and its ancillary disciplines are not just professional pursuits but also fields of knowledge and inquiry.

The SMArchS program at MIT is administered through six ‘areas of study’ reflecting the different disciplines taught within the Department of Architecture: Architectural Design; Architecture & Urbanism; Building Technology; Design & Computation; History, Theory & Criticism; and the Aga Khan Program in Islamic Architecture. Over the years, the challenge has always been to see if the work of SMArchS students could be more than MIT’s many and varied intellectual parts. The best SMArchS work is synthetic, drawing from the many fields of high specialization that MIT offers. In addition, thesis work is often more than that, true occasions for intellectual invention and surprise beyond disciplinary boundaries. For many students, this work will define their subsequent careers, offering them, in their future challenges, a beacon and inspiration to steer by even as they break new ground in situations that we can perhaps today only dimly imagine.
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This thesis examines the urban transformation of Beirut between 1830 and 1930. Evolving from a local market city importing European goods and exporting local produce into a transit city for the re-export of European commodities, Beirut developed from a quadrilateral of thick crusader walls enclosing a labyrinth of narrow streets into a thriving business center highlighted by the French-designed Place de l’Étoile. The new center connected the city with the port and with its hinterland through two major thoroughfares lined with modern office buildings that, for the first time, accommodated underground storage spaces. What made Beirut develop in this direction? What is particular about its development vis-à-vis other Ottoman cities? What made the Beirutis center the markets the way they did? I argue that this urban transformation is a manifestation of a French economic plan that had been at play in Beirut a century before the French Mandate in 1918. The project uses a number of primary textual sources, as well as visual material, to uncover the features of this plan, to investigate the political events that ensued, and to assess their impact on the urbanization of the city.

The existence of a French plan, which preceded the French Mandate, precludes the historiographical tradition of splitting the urban narrative between Ottoman and French, while most scholarship on Beirut in fact accepts this rupture. Beirut, between the late-nineteenth and early-twentieth century, acquired two distinctive statuses under two regimes; first, it was a capital of an Ottoman province (1888-1918), and later, post-World War I—with the demise of the Ottoman Empire and the inception of French colonial rule—it became the capital of the newly founded Grand Liban (1920-1943). The two administrative positions compelled an urgent need for urban renewal. However, the incessant intervention of European consuls—compelled by the need for regulating Ottoman debt and facilitated by the establishment of a semi-autonomous administrative district in Mount Lebanon—inverted the traditional balance of power, blurring the demarcations between state, society, and foreign powers. France’s incursion in the region in fact progressed from it being a financial investor—through private companies sponsoring the silk industry and other trades—in the early nineteenth century, to a major concession holder of various public works in the mid- to late-nineteenth century, to a military colonizer in the early twentieth century when French economic dominance became a governmental pursuit not anymore restricted to the operations of private businesses.

Map of Beirut, drawn in 1876 for Sultan Abdul Hamid II under the command of Julius Löytved, a dragoman at the German Embassy in Istanbul.
This thesis seeks to connect the physical and symbolic spaces of the gardens in the Qutb Shahi necropolis to the larger landscape as developed by the first five Qutb Shahi Sultans. Primary methods used in this process include a spatial analysis of the necropolis layout as it relates to the larger landscape and historical records of the Sultanate, surface survey, and mapping of the necropolis. Landscape analysis, including inquiry into the layout of the tombs, raises questions about how the necropolis plan originated and evolved. A surface survey of the site uncovers evidence of structures that were a part of the contemporary design layout. Analysis of the literature points to information about the ways that the Sultans inhabited the spaces and guides the landscape investigations.

The tomb gardens were an extension of the political and spiritual lives of the Qutb Shahis. They shaped the gardens and tombs chronologically, for instance, and evidence of processional ways can be seen today in direct axis with the tombs of Quli Qutb, Ibrahim Quli Qutb, and Muhammad Quli Qutb. The necropolis established the Qutb Shahi Dynasty as a particularly “local” dynasty with its significant size and presence in the landscape, announcing their lineage and presence.

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Macnabb Collection (Col. James Henry Erskine Reid): *Album of Indian Views*, c. 1902-03.
This thesis explores the idea of multi-layered composite structural sandwiches at the scale of architectural building components. Through a variety of exploratory methods, the thesis suggests a new reading of poché in a post-orthographic era of design production. By doing so, *Architectural Sandwiches* aims to challenge the preconception that architecture is a predominantly representational act by engaging design at the 1:1 scale through the physical medium of real materials.

Though the work is focused on a particular set of methods and materials, it serves as a vehicle to develop a conceptual argument for a hands-on material research practice in architecture, design, and academia. The intent of the thesis is to expand material engagement in architecture beyond methods of fabrication and propose ideas for new pedagogical and professional endeavors.

Sequence depicting process of ‘backfilling’ two separate composite surfaces to create a single volumetric element; one of many prototypes.
In the past two decades, large cities in China have experienced a population and construction boom causing tremendous changes in community structures, family compositions, and lifestyles. Personalized lifestyles are now central to the culture of our generation. At the same time, we have also witnessed changes in the manufacturing industry, from standardization to the democratization of consumption and production by emerging technologies. These shifts could greatly help to personalize and improve domestic living environments.

My thesis focuses on investigating the relationship between current housing and manufacturing technologies used in large cities in China. The design proposal envisions a sustainable and flexible building system that can grow and change in response to different domestic demands. Further, I explore and design new programs and possibilities through the renovation of current typologies.

The thesis serves as a guidebook for new types of personalized housing and form. In a broader context, the thesis envisions this new model as a manifesto to reflect on regulation, community planning, and housing design in the manufacturing revolution.
My research focuses on emerging building materials and construction through computation and simulation as a means to expand their possible uses within architecture. This is done through a collaborative approach between disciplines such as design, building technology, and computation.

Over the last decade, the role of digital processes within architecture has advanced rapidly while the connection to materials and their subsequent construction has remained largely an afterthought. However, if materials are considered and developed through an integrated methodology consisting of both a computational and a hands-on approach, then such factors such as tectonic constraints may become drivers in the design process.

The thesis has evolved over the last two years through full-scale exploration of composite manufacturing techniques. The focus thus far has been to develop a composites workflow that can be effectively applied within the field of architecture. The research combines pneumatic molds with the process of VARTM (vacuum-assisted resin transfer molding) in order to reduce production costs, increase efficiency, and produce functional variance.
Public housing, while remaining a vital affordable housing resource for over a million American families, has in recent decades experienced growing disinvestment and physical deterioration. Faced with an aging building stock, diminished federal funding, and rising utility costs, many housing authorities in cities across the US have responded to declining projects with demolition and private-sector redevelopment, often displacing existing low-income residents in the process.

This thesis investigates an alternative approach to public housing transformation and suggests that preservation, rehabilitation, and infill development can foster economically and environmentally sustainable public housing with minimal resident displacement. Through a careful analysis of a range of sites in New York and Boston, this study will explore how and when synergies between retrofits and new infill construction can greatly improve the energy efficiency and urban design of existing public housing. Recognizing that some existing housing projects are more suited to rehabilitation than others, the goal of this research is to generate a systematic framework for local authorities and developers that capitalizes on existing assets to revitalize public housing communities without demolition.
In the 2010 International Workshop on Housing, Health and Climate Change Meeting Report, the World Health Organization identifies housing as a primary cause of poor health in developing countries. The report cites inadequate protection from extreme heat as one of six major concerns for healthy housing environments. As India’s population rapidly increases, informal settlements face particular heat risk because of harsh climate conditions, substandard building construction and lack of access to electricity for mechanical cooling. There is a need for housing to provide thermal comfort and health by passive means at low cost. Climate specific passive cooling techniques are well known, but are rarely implemented in informal settlements because of density, lack of resources, design integration, and materials availability. Although heat risk is a public health concern, there is no exclusive metric for what constitutes a thermally healthy indoor environment. To address this, this thesis establishes thermal performance criteria for healthy indoor environments, and uses this criteria to explore the thermal impact of low cost roof assembly modifications as well as natural ventilation on indoor environments. This research uses data analysis to drive design decisions that lead to the development of appropriate, implementable solutions to improve thermal conditions in affordable housing.

Note: Thermal Autonomy is defined by US architecture firm Loisos + Ubbelohde as “[T]he percent of occupied time over a year where a thermal zone meets or exceeds a given set of thermal criteria through passive means only.”

Above: Existing construction types of slum housing vary, but generally house roofs are uninsulated and made out of sheet materials that provide very little resistance to heat from solar radiation. Photo: Madeline Gradillas.
The understanding of space relies on motion, as we experience space by crossing it. Tools that introduce motion into the design process are rare and usually focus on visualizing figures. Human behavior adds additional degrees of complexity since the interaction between humans and with surroundings is unpredictable. As a consequence, tools for simulating human behavior are often goal-oriented and mostly focused on analyzing emergency exit or egress.

In this thesis I propose that human motion sequences could be translated to a set of rules, known as Shape Grammars, that could in turn generate a non-deterministic behavior. The main challenge is to define the variables and the rules, which will be achieved by substantial data analysis. The proposed model, to be developed into a tool, consists of creating a tracking method to gather data and map it into an artificial intelligence agent-based simulation. I seek to upgrade visualization and goal-oriented tools to a functional simulation that returns spatial feedback at a large scale to inform, enhance, and test the design process and question the role of data in projecting what space could be.

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Motion Tracking and Simulating Motion in Space: Pedestrians in Public Places, Case Study

Paloma Gonzalez Rojas
Advisors: Terry Knight, Takehiko Nagakura, Readers: Patrick Winston, Alan Berger

Walk Across interactive Installation developed by Paloma Gonzalez for the MIT Museum. Photo: David Schialliol.
Designers are increasingly using code in their practice, often communicating with engineers and computer scientists through text-based code languages. In doing so, designers adopt mental models of computation that intertwine with their designs. However, in the programming languages accessible to designers, such computational models of thought are assumed to be known and are not made explicit, or are beyond expression. Language and diction are not the only obstacles; mental models such as iteration, recursion, and pointers are not distinguished from other specificities of language and not presented as required mental models.

Many of these models are simple, yet require explanation. In some cases, visual expression may be the most effective method of making these abstract models tangible. In this thesis, I propose a 3D, visual programming language that can represent code in space. This visual language will express the complex abstractions that define computational thinking by making models memorable in space, and will be useful to beginners and advanced computational thinkers.

01 An image of a prototype visual language representing an iteration computation; 02 Image while user moves around it in space
My thesis involves the creation of a novel self-assembly procedure. Self-Assembly refers to the spontaneous arrangements of building blocks into greater structures. The structures emerge by local interactions of the building blocks instead of through the intervention of an external-to-the-system designer.

In this project, I use an example of self-assembly in nature as an inspiration to design a unique, macroscale, self-assembly procedure. This example refers to the way viruses deliver content to cells and affect their structures. As the virus infects a cell, the capsid (membrane of virus) merges with the cell's membrane. Then, it injects its content (DNA/RNA) into the cell's fluid (cytoplasm). The content moves within the cytoplasm and changes structures in the cell through a variety of mechanisms.

This thesis is based on Morphocells. Morphocells (M-Cells) are building blocks with embedded magnets (Blocks) submerged into a sphere of magnetic clay. As two M-Cells come together they merge due to the magnetic properties of the clay and their Blocks assemble. This procedure can be implemented on multiple M-Cells. Furthermore, I experiment with parameters such as the shape of the Blocks, their hydrodynamics, the magnets' strength, and the amount of clay in each cell, in order to create complex structures with hierarchical relationships. This procedure could lead to self-assembly systems with high autonomy, precision, and complexity.
The tectonics of a knit material system can drive the discovery of architectural forms through variations in fiber type, density, and directionality. This project challenges the common practice of assembling discrete components to form a greater whole.

As an alternative, I explore a material-based design method which seeks to understand how the technique of knitting can be utilized to perform through its innate characteristics—stretching, flexing, curving, etc.—to discover new structural and formal systems. The ability to work with a material relies on a profound understanding of its physical (rather than digital) performance. For that reason, I will produce material samples intended for physical form-finding to study if the variables that create the system, such as fiber type, density, and directionality, lead to a new integration of form, structure, and fabrication. The goal is to demonstrate that a new architectural language can emerge from these interdependencies and prioritizing the active qualities of materials.
In the case of designers, architects, and artists, tools are part of a repertoire of cognitive, symbolic, and semiotic artifacts with which each explores and learns about design problems. The use of digital design tools currently relies upon a model of 'tool operation' in which a designer typically pauses in order to produce a digital or physical representation of an idea. Furthermore, in separating modeling and prototyping when working in a digital environment (with a mouse or keyboard), the acts of making and learning disappear. A designer cannot touch, feel or interact directly with the objects he creates; this moment of sensing, feeling, and discovery is lost. As physical modeling, gestures, and tools are mechanisms by which designers learn and think, I argue that a continued revision of the process of design through technology is relevant.

In this thesis, I propose an alternative way for designers to use digital tools, transcending from a model of 'operation' to 'interaction.' The proposed model seeks to implement a reciprocal form of making in the digital design process to incorporate aspects of improvisation, cognition, and creativity. To do so, I explore real-time interaction between mind, body, tools, and materials to engage insightful design processes.
Researchers in the emerging fields of Urban Informatics and the Biology of the Built Environment have been supplied with an abundance of new kinds of tools, methods, and data relating to human-environment relationships. However, the vast majority of approaches that make claims to sustainability adopt a problem-solving attitude with regard to social and environmental issues. I propose to investigate a design attitude that shifts from designing technologies aimed at optimization to technologies that sensitize about social and environmental matters of concern, therefore enabling a more coherent approach to sustainability. In other words, I suggest we don’t attempt to design sustainable whole systems, but design to extend human sensitivity in order to yield sustainability.

As a base for this inquiry, I will review existing theories about the role of technology in relation to matters of social and environmental concern. Then, I will examine my own creative agenda in relation to a design attitude which I believe is relevant to our socio-technological moment. I will consider my own projects across a variety of contexts (Underworlds, Waterfly, Local Warming, Makr Shakr) which investigate the sensitizing made possible first by the connection of bits to atoms, and most recently the connection of bits to biology.

Ashby’s electromechanical Homeostat (1948) and my proposed biological Represostat: investigations of agency and self-organization.
In January 1961, a travelling Small Industries Exhibition went on view in Colombo, Ceylon. Prepared by the USIA and OITF to support rapid industrialisation in the developing world, it was also an attempt to demonstrate American generosity, and to establish trade ties with non-aligned yet socialist-leaning nations.

The modest “gadgets and gizmos” on view were presented as being easily implementable and scalable. However, many of these machines embodied a much larger economic and cultural apparatus that was not so easily translated – from the doughnut-dispensing model kitchen that required wheat production to the auto repair booth that necessitated a large population of car owners to be feasible.

Meanwhile, Ceylon’s overly ambitious 1959 Ten Year Plan also framed in distinct terms the nation’s shift from agricultural to industry-based economy, influenced by its neighbours’ development plans and pervasive international development discourse.

This thesis examines how the ‘small’ is formulated by the USIA and the Ceylonese state, situated within larger dialogues on international aid and development. It calls attention to the problems of mediating between differing definitions of the term, and ensuing difficulties of scaling up the so-called small. It questions whether this smallness on display risks being mere spectacle, using the Small Industries Exhibition as a case study.

Exhibition-goers operate the driver trainer machine. Department of National Archives, Sri Lanka; Times Collection, 284.99.
Two hundred fifty-nine obelisk monuments sit atop the US-Mexico borderline west of the Rio Grande. Constructed and placed in three distinct phases (1848-1855, 1891-1896, and 1964-1968) these monuments were the product of international negotiations; disputes settled ranging from the violent expansion of sovereign limits to the historic course of a shifting boundary river. Commissioned, designed, inscribed, and positioned by both the United States and Mexico, the border monuments are unique bilateral artifacts, operating across and reflecting on separate territories and philosophies of nationhood.

Beyond symbol, border monuments served as impetus for two concurrent modes of documenting a single region. Each phase of monument construction was implemented by national survey teams, one from the United States and one from Mexico, that ran, marked, and reported on the international boundary. Their reports and individual methods of geographic survey, cartography, regional description, and personal account provide archival histories of two modes of viewing. The thesis investigates these sightlines, not only the lateral view of surveying the international border from monument to monument but also the cross-lateral views of the United States and Mexico, each constituting national limits through the documentation of a shared frontier.

In 1950, the Museum of Modern Art exhibited for the first time the work of an architectural office instead than a single designer. The exhibition's poster child was Skidmore, Owings & Merrill (SOM), billed in MoMA's press release as a firm driven by both the “discipline of modern architecture” and “the discipline of American organizational methods.” MoMA’s pivot to the showcasing of collaborative designers rather than individuals represented the broader emergence of large architectural offices in the postwar period. This thesis investigates the work of SOM, characterized by Frank Lloyd Wright with perhaps unbeknownst precision as a ‘plan factory.’ It does so by bringing to light a collection of artifacts which are the residual traces of the procedures and protocols undergirding the office’s built projects, as of yet overlooked by the chroniclers of the firm. The processes to which these artifacts point reveal how SOM’s in-house design of managerial logistics resulted in a subsequent architecture of logistics.

This thesis begins first in 1933, with the exhibition of products and urban-scale infrastructure at the Century of Progress; second, with a wartime advertising practice and subsequent federally-funded housing contracts; and third, with early “crude” efforts to calculate an ‘optimized’ architecture-by-spreadsheet in the ‘60s and ‘70s in partnership with IBM. This study of SOM’s extra-architectural designs ultimately reveals a similarity in production to the experimentation of the architectural avant-garde. Yet having emerged intrinsically from the conduct of a large organization, this evidence suggests a different way to understand the self-propagation of the corporate office, a model for building practice growing at an exponential rate in the contemporary field.

The prioritization of capital and policies for suburbanization was followed by urban decay in inner cities, and resulted in the diminution of the public realm in American cities.

The thesis questions the validity of quantitative readings of the public realm, exemplified by city rankings based on physical measurements of parks and landmarks. These materials only comprise a part of the contemporary public realm. I argue for a reading of the public realm that generates a macro-vision through a collection of thousands of micro-visions harvested from social network services. The thesis attempts to characterize social places by analyzing Instagram data and utilizes the findings to develop a responsive process for social place-making.

I begin the analysis through a quantitative comparison of physical characters in different areas through the intensity of geolocated posts, and continue to a qualitative analysis of the images and accompanying texts. Through this process, I extract spatial and temporal elements that define a specific ‘place’. I aim to apply these findings to make the place-making practices of cities more responsive to human behaviors.

Network of social places in Mattapan and South Dorchester
This thesis will attempt to address the following question: How can urban designers use community water systems to foster the cohesiveness of physical and institutional fabrics within informal settlements? In other words, how and to what extent can the design of water and sanitation infrastructure not only improve basic service provision, but also create new opportunities for community building?

The thesis uses Delegación Iztapalapa, Mexico City (CDMX) as testing ground for the proposal, which is intended as a site-specific exploration of design solutions to low-quality water provision conditions in one informal settlement in CDMX; a new institutional framework for infrastructure provision in informal settlements within the capital; and a broad argument for truly multi-performative infrastructure that moves beyond the current model (i.e. multi-use).

Citizen protest, Mexico. Source: Movimiento Evita Rosario
Automation technologies, developed by corporations to replace or gain “cooperation” of labor, are now small enough and cheap enough to be appropriated by that same labor. Thus, in-turn labor can substitute market-based consumption with self-production and regain the collective autonomy lost first through parliamentary enclosure, and now perpetually thwarted by low-paying, replaceable, service-sector jobs. Contrary to most “utopian” projects, however, this proposal does not require isolation from, but rather the leveraging of, capitalism’s incessant development. Furthermore, historical shifts in production modes, whether through new technologies or ownership models, often bring with it new urban formations and typologies. My thesis will map the design and trajectory of a new urban typology based on the above-mentioned appropriation of manufacturing technologies by a group of American middle and/or lower middle class households. This design will propagate within a selected existing area, showing its transformation over time into a distinct formation.

New Tools of Labor Power
This thesis will mine the data from two top-down sources (e.g. government GIS data that is already analyzed), and raw, bottom-up data available from various social media. Analyzing top-down and bottom-up data are for different purposes. Top-down data analysis will shed insight onto the relationship between the city and how this form allows innovation and function. This top-down point of view is how an urban designer understands a city. In contrast, data from social media will provide information about how local residents perceive a city, and what the image of the city is in their minds.

01 East Coast Headquarters
02 Washington D.C.
Food shapes territory. While only 3 percent of the world’s surface is occupied by cities, 38 percent is used for agriculture. Historically, people followed sources of food. However, the process of modernization and new technologies have pushed people out of this “rural” relationship and into an “urban” one. At the same time, land ownership shifted from town dwellers to wealthier city dwellers resulting in an almost total disconnection between the rural towns and the food industry surrounding them. Thus, it is critical to understand the effects of these shifts on diminishing towns and their inhabitants.

In this thesis, I examine this situation in the context of rural Argentina, specifically in the pampean region. Historically, Argentina’s economic model of grain exports created a territory shaped to fulfill another country’s demands rather than concentrating on the dietary needs of its own inhabitants. Currently, food is delivered from other regions of the country resulting in unnecessary travels with economic, logistic, and environmental consequences. As a response to this territorial logic, I propose a new network of food production based on shared agriculture. In this network, rural towns coordinate production and exchange to achieve food sovereignty and as a result, a new territorial logic.
In the last half century, Mexico City expanded enormously. The city’s growth followed a specific and persistent pattern of low-density neighborhoods and horizontal dispersion generated by the replication of no more than three or four approaches to city building. The city appears to have expanded by a simple arithmetic repetition, calibrated to generate figures to satisfy statistics and investors. The result is an apparent endless field of flat and precarious urbanization.

This thesis draws on this scenario, understanding urban design as a tool to critically address the current mode of expansion and to propose strategies to revert this process. The focus is on one specific type of territorial occupation: the urbanization of subsidized housing developments, which accounts for 17 percent of the total urban footprint of the city and has generated unlivable neighborhoods. The thesis is structured in three parts: research on Mexico City’s urban evolution, a theoretical speculation on the condition of territorial dispersal, and an urban design proposal.
Water is the blood of the city, but circulation is impeded by unprecedentedly fast urbanization, which reduces carrying capacity of natural streams and increases impermeability of run-off water. Urban waterfronts can be places of prosperity and opportunities, but more often are accompanied by flooding and health, environmental, and social issues, especially in the urbanizing regions.

The Pearl River Delta Metropolitan Region, the world hub of manufacturing in southern China, is one of the most rapidly urbanizing regions in the world. While the waterfronts at the outskirts of the city used to be villages surrounded by farmland and fishponds, today most of these sites have been replaced by manufacturing industries and warehouses. As the city expanded, villages that were originally located in the countryside were absorbed into the territory of the city and became informal sites for migrant workers. The proposal argues that an ecologically-oriented waterfront development model should be designed to replace the government’s plan for an ornamental landscape. This alternative model could serve as an environmental habitat, as well as a catalyst for social and economic development. For different transects along the waterfront, such as urban villages, farmland, towers, wholesale markets, and industry, the relationship between hydrology and urban form should be transformed. Instead of a channelized riverbank with flooding hazard, the waterfront should return to a natural system and serve as both ecological habitats and recreational parks.

Aerial view of Lijiao village along with Pearl River. The government has a plan to tear down the village and build towers in the next ten years.
This thesis aims to explore the relationship between form, regulations, and community in the built environment. Deconstructing the envelope and the tactile manifestation of laws and regulations, this thesis illustrates the forces generating urban form. Through the examination of contemporary planning processes, it will question the degree of public engagement in the regulatory stages of design, as well as the level of accessibility to this information.

A twofold research structure is proposed in this work: First, through an overview of contemporary case-studies, this thesis will illustrate the correlation between urban planning and architecture with law, regulation, and policy. For each case study, it will offer a repository of regulation-based-forms in an effort to reveal the authority these relationships possess on city form.

Second, this thesis will examine the development of an accessible and self-explanatory platform for community engagement. This platform, a tangible apparatus for decision-making, will illustrate the relationship between urban form and regulated design and propose a transparent approach for regulation-based form-making.

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Christo and Jeanne-Claude, Mastaba, 1977
Population growth and related space constraints have led to a planning paradigm that promotes living and working in high-density urban areas. Increasing urban density however, leads to a conflict between space-use efficiency and access to daylight. To manage this conflict, cities have traditionally relied on zoning guidelines that propose simple, two-dimensional, geometric evaluation techniques to ensure fair solar access. This practice seems antiquated in times when computer-aided design tools enable architects to test designs before they are built.

Recent advances in building performance simulation (BPS) software allow architects to compute annual climate-based daylight performance metrics of urban environments accurately in high spatial resolution and in a timely manner. The use of such tools to inform zoning and urban development processes remains, however, underutilized even though the importance of simulation-based feedback in these early phases is self-evident; decisions made at this point may make or break the long-term daylighting potential of a whole neighborhood.

This thesis therefore presents a simulation-based framework for formulating nuanced prescriptive zoning rules along with a performance-based option for developers and designers interested in exploring innovative massing proposals. The framework is used to evaluate the daylighting performance of common urban block typologies in New York City. Key findings of this evaluation will be compiled into a set of recommendations towards performance-aware zoning regulations and development workflows.

Block typology evolution matrix with floor plate-mapped daylight access levels.
Unplanned urbanization in Mumbai has left the city in a dense congested state with only 1.7 m$^2$ of open space per person. The present dense living conditions also make it impossible to construct any large parks or centrally accessible public space in the city. To construct a park the size of Central Park, for example, would require the displacement of more than 100,000 people—an impossible solution in India. Therefore an alternate strategy to understand urban life and create public space is required for congested cities like Mumbai in which larger solutions are impossible.

In Mumbai, most of the public life is generated on the streets of the city. Temporary structures and other informal interventions activate streets and create a porous socio-economic layer. These interventions create various opportunities for social interaction, but are typically unaccounted for as they exist outside the formal realm. In this thesis, I focus on gaining a better understanding of the conditions that enable these informal interventions to take place and creating a methodology to measure the value these spaces add to the city.

Informal interventions transform a parking lot into a fun fair.
Reports on “ghost cities” in China frequently include pictures of thousands of empty high-rise residential buildings and acres of vacant land. These developments were made possible with government loans and a GDP-focused government. Each was planned with buildings, infrastructures, parks, and jobs—as a capital utopia. An article in the New York Times described these sites as cities with everything except people.

Ordos, a city in Inner Mongolia, was once a village in the desert with only two thousand people and is now an extreme version of a “ghost city”. Thanks to the discovery of huge coal and oil deposits, the city generated immense amounts of wealth and spent billions of dollars on urbanization. However, the fantasy didn’t stand long once the coal industry collapsed ten years later and forced numerous developments to abort construction. While Ordos was planned for one million residents its capacity is currently 500,000, with only 100,000 residents.

Alongside necessary reform policies on the resource industry in Ordos, the thesis argues that it is time to convert this concrete forest into a dynamic and lively city. By understanding the economic and social mechanism of “ghost cities”, the thesis examines the viability of the current spatial structure of Ordos. Ultimately, the thesis tries to explore the potential of urbanism to intervene into an industrial and economic collapse and suggest revitalization strategies.

The empty development of Ordos in Inner Mongolia, China. Image © Tim Franco, Flickr User: shanghaisoundbites.
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<td>2:05–2:35</td>
<td>Jeff Geisinger</td>
<td>2:05–2:35</td>
<td>Chaewon Ahn</td>
</tr>
</tbody>
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