Destructive Preservation: Figuring the Urban Ground

by

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What does it mean to invert the urban fabric? When figure becomes ground, and ground becomes figure, how does a neighborhood adapt to moving from extreme privacy to communal living? Despite the complete destruction of the existing fabric, the proposition immediately disallows a Utopian, Tabula-Rasla response. Although ghosted, the idiosyncratic identity becomes even more identifiable, and somewhat nostalgic; rather than the footprints being inhabitable buildings, they become holes in the built environment that one can walk out into (ground floor courtyard) or look down into (upper floor windows/terraces).

As one of the largest and most populated cities in the Middle East, the city of Riyadh is a clear example of a metropolitan city that is continuously growing in a low-density sprawl. This thesis aims to explore how we can re-imagine the city in the already-built environment as a way of densifying the fabric.

Despite its metropolitan nature, importance and large population, life in the city of Riyadh is more suburban than urban, with the majority of people living in stand-alone houses. The culture of habitat has, however, begun adapting in this generation, from completely segregated stand-alone houses, to duplex houses, to gated communities, and finally moving a little bit into high-rise living. The project aims to push the slow transition into a faster trajectory towards a super-block mega-structure. Different people would come together under one larger roof, where different programs come together and pull apart. A unified plinth acts as a mediator between different kinds of traffic, different kinds of users, and different kinds of spaces, blurring the lines between public spaces, religious spaces, housing, and working environments. The whole above-ground environment becomes a pedestrian space, while a lower level of the plinth pulls vehicular traffic below ground, and creates an expansive parking and road zone.
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The Context
The City of Riyadh

The city of Riyadh sits in the center of the country of Saudi Arabia, and acts as the country’s capital. Being the highest populated city in the gulf region, the city of Riyadh houses just over 6 million people, yet has an area of 600 sq miles, giving a density of 10,000 people/sq mile; a size, population, and density comparable to Los Angeles, and a density less than one fifth of that of the NY Metropolitan area.

Metropolitan cities in the Middle East, and around the world, are growing in two ways; on the one hand, growing vertically, in the same vain as New York. This is evidently happening in the commercial spine in Riyadh, as well as in the KAFD. On the other hand, we have urban sprawl happening right around these high-rise centers. The disconnect between the two is clear, and there is a sudden jump. I’m proposing that an intermediate zone, with this mat typology, can help mediate between the two.

In a city like Riyadh, where everyone relies on their cars to go the distance of a block, how can we reintroduce the idea of public, private, and pedestrian transport? More importantly, if we can create a zone of comfort where inhabitants of the space can get around on foot, and have many different programs within walking distance, can we adapt the idea of urban life in a spread-out city?
On the office space model; while there is office space available around the city, particularly in the central spine, the size of different spaces is specific and limited, and does not allow for expansion, or for smaller startups.

If we look at the DIFC (Dubai International Financial District) as a case study, we can see a much more successful living scenario. Many people live and work in the area, while many visitors come in for stores, restaurants, etc. The area is also populated with several hotels for visitors to stay in. This creates a live-work-play environment within one zone.

How can we create a live-work-play environment in a city like Riyadh, while pushing on the social and cultural lines, without breaking them? Thinking about the Doxiadis layout for the city; how can we reinterpret this city-scale plan at a much smaller scale?

What happens when one of his pinwheels attempts to accomplish the same diversity that his full masterplan does? And how can it be accomplished without the need to build up vertically?

The municipality is beginning to introduce public transit into the city, through building a high-line train system, and renovating the cross-country train lines, but it is still in the young stages of introduction.

In studying the social status of Riyadh, we see that it has a quickly- and constantly-growing population, with many young people studying abroad and returning to the country. There is constant adaptation in how the population lives, and the very restricted work and living environments are rapidly changing. For example, the number of females in the work environment, particularly in the private sector, is on the rise. Similarly, many restaurants no longer feel the need to conceal all their tables, and the separation between the men’s and family section has been blurred.

Two clear problems that can be witnessed in the city are the housing model and the office space model, particularly in the context of young professionals starting their lives and careers in the city.

Starting with the housing model; there is an embedded idea of housing where people want stand-alone houses with outdoor space, and water features are very desirable. High-rise living was conceivably not a desirable option, even in the center of the metropolitan city. While this is beginning to change, the new up-and-coming high-rise housing serves the upper class, with the high apartment prices and lack of salary inflation. This causes problems for young individuals moving to the city of Riyadh for business, where they are forced to live in either a very low-quality apartment building, or in a family setting of private villas and/or compounds.

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Diagram Showing Doshiadis’s Ambition vs Reality

Diagram Showing Doshiadis’s Layout
Comparison: Riyadh vs Other World Capitals
Above: Concept Model Showing Existing Condition, Analysis, Different Inversions, and Proposed Condition.
Inverting The Figure-Ground

Re-imagining a city’s fabric, by nature, suggests a destruction of the built environment. So, how can we rebuild a neighborhood, a megablock, or a city, while preserving its idiosyncratic nature?

The thesis aims to densify the fabric of the city of Riyadh through the inversion of the built environment. But, what does this inversion mean? When figure becomes ground, and ground becomes figure, how does a neighborhood adapt to moving from extreme privacy to communal living?

Despite the complete destruction of the existing fabric, the proposition immediately disallows a Utopian, Tabula-Rasa response. Although ghosted, the idiosyncratic identity becomes even more identifiable, and somewhat nostalgic. Rather than the identifiable footprints being inhabitable buildings, they become holes in the built environment that one can walk out into (ground floor courtyard) or look down into (upper floor windows/terraces).

Despite its metropolitan nature, importance and large population, life in the city of Riyadh is more suburban than urban, with the majority of people living in stand-alone houses. The culture of habitat has, however, begun adapting in this generation; from completely segregated stand-alone houses, to duplex houses, to gated communities, and finally moving a little bit into high-rise living. The project aims to push the slow transition into a faster trajectory towards a super-block mega-structure. Different people would come together under one larger roof, where different programs come together and pull apart. A unified plinth acts as a mediator between different kinds of traffic, different kinds of users, and different kinds of spaces, blurring the lines between public spaces, religious spaces, housing, and working environments. The whole above-ground environment becomes a pedestrian space, while a lower level of the plinth pulls vehicular traffic below ground, and creates an expansive parking and road zone.

Several Inversions happen within this project:
- Inverting the physical built environment; what used to be buildings in a field become holes in a mega-structure
- Inverting the idea of getting around; what used to be people driving to the corner bodega becomes people walking everywhere within their neighborhood
- Inverting the idea of privacy; what used to be houses with 6m walls around them becomes apartments open to a courtyard
- Inverting the daylighting; what used to be a solid wall with holes letting light in becomes a light-transmitting wall

Among other socio-cultural and socio-political influences that the project would bring forth.
Above: Concept Model Showing Existing Condition and Proposed Condition Perspective View
Above: Concept Model Showing Existing Condition and Proposed Condition
Top View
As a way of understanding the inversion, I looked at the work of Rachel Whiteread, where she casts the inverse of the built environment. While her projects act in a smaller artistic scale, their larger implications begin to touch on some of the ideas driving this thesis at an architectural and urban scale.

In particular, I looked at two of Rachel Whiteread’s projects: Ghost from 1990, and Untitled (One Hundred Spaces) from 1995. The former is a plaster cast of a space that is then aggregated as a second step to the project, while the latter is a set of casts of different materials that create a catalogue of spaces.

On Ghost:
“[Rachel Whiteread] created a positive from a negative, making a plaster cast of the interior “void” of a Victorian parlor measuring approximately 9 feet wide, 11 1/2 feet high, and 10 feet deep. Whiteread has said of this sculpture that she was trying to “mummify the air in the room,” hence the title. Whiteread created Ghost over a period of three months in an abandoned building at 486 Archway Road, North London, covering the interior walls with multiple plaster molds, each about five inches thick. When the plaster dried, she peeled the molds from the walls and reassembled them on a steel frame.” - National Gallery of Art Website, Project Description, Ghost

On Untitled (One Hundred Spaces):
“Rachel Whiteread’s casts of domestic and architectural voids using plaster, concrete, rubber, and polyester resins create tangible “memories” of normally unseen spaces. In a strange, sculptural inversion, what is invisible becomes visible and what is inside becomes outside. Whiteread’s work is firmly rooted in the reductive sensibility of 1960s Minimalism, but its clear connection to the empirical world expands well beyond the detached abstraction of the previous movement. Her evocations of familiar domestic spaces are often haunting if not uncanny.” - Guggenheim Museum Website, Project Description, Untitled (One Hundred Spaces)
Project Timeline

While the thesis takes one neighborhood and redevelops it using the new mat system, the project aims to re-imagine the urban fabric of the city at a larger scale, focusing on the intermediary zone between the commercial spine and the urban sprawl. This focus is due to the ambition of creating a transitional zone between the high-rise high-density, and the low-rise low-density.

The following pages show stills from a diagrammatic figure-ground animation that shows the thesis proposal as a system that propagates over time; starting with the built figure-ground, the project inverts different neighborhoods sequentially to develop the new urban fabric over the course of a few decades.

The systematic approach to the inversion is applied in every case:
- The one-to-one physical inversion of the built environment
- The systematic approach to the planometric zoning
- The sectional stacking under the roof

As well as the formal and environmental aspects of the project, etc.

Left, Top: Figure-Ground Plan

Left, Bottom: Shaded Topographic Plan
Above: Project Timeline Animation
Still Showing Start Condition (Frame 1)
Above: Project Timeline Animation
Still Showing End Condition (Frame 120)
Above: Project Timeline Animation
Stills Showing Frames 1-20
Above: Project Timeline Animation
Stills Showing Frames 21-40
Above: Project Timeline Animation
Stills Showing Frames 61-80
Above: Project Timeline Animation
Stills Showing Frames 81-100
Above: Project Timeline Animation
Still Showing Frames 101-120
The Intermediary Zone

The disconnect between high-rise and sprawl is very evident in Riyadh, and there seems to be a missing liaison; rather than have a line of sudden transition between the commercial spine and the urban fabric, I am proposing a new typology, where low-rise, high-density can begin to happen. Ultimately, as the project progresses over a few decades, it allows for the city to densify without the need to expand, as can be seen in the animation frames to follow.

How can we mediate between urbanity and sprawl?

We notice dense urban scenarios such as Manhattan, and other sprawled scenarios such as Detroit. Some of the more urban cities have a line between the urban and the sprawl. How can we create a new intermediate zone?

While this question touches upon a few different things, the goal is to develop a system that resolves different key architectural questions and issues. By trying to mediate between sprawl and high-rise, the Neo-Mat-building is an attempt at understanding how different architectural systems come together under a unifying roof, and how the typology begins to address certain urban and architectural issues.

How can we create a flexible system that creates a mega-structure, while achieving other architectural objectives? How do we create a flexible mat, to allow for diversity, and change over time?

"In some circumstance, Neo-Mat-building will possibly encounter the critique from the economic and social perspective, such as the lack of the flexibility due to the mega-structure, the huge investment on fundamental structure, the disorder of social diversity in totality, or the abuse of social space, and so on. However, instead of a stable and stereotyped entity, the concept of Neo-Mat-building covers from a regional urban system or the cluster in mega-structure to the small scale construction with a comprehensive system, from the visible object on the ground to the interaction between visible and virtual." - Yuan Zhu [Neo-Mat-Building]

How can we create a system that is all-encompassing?

From structure, to daylight, to program, different architectural elements require different systems to come together. Would it be possible to create a system that accomplishes these different elements simultaneously?
The Fabric of The Mat

How the mat acts as a system, as a building, and as an urban intervention becomes important within the city context, and even more so in how it resolves itself as it connects to an existing or a future fabric.

“At its origin in architectural discourse the mat was clearly a response to, and a sign of dissatisfaction with, the CIAM separation between uses and between urbanism and architecture. The mat is both structure and infrastructure.” -Hashim Sarkis [Le Corbusier’s Venice Hospital and the Revival of Mat Building]

“Instead of defining a distinct object, mat-building weaves itself into the surrounding context, creating a building that performs like a city, or transforming part of the city into a building.” -Timothy Hyde [How to Construct an Architectural Genealogy]

Most mats start with an orthogonal grid, which allows for simplicity and repetition, and also allows for an easier resolution at the periphery. With regard to the context surrounding the mat, and the form overall, this could be construed as somewhat of a cop-out; this is not to say that formal exuberance or frivolity is desirable, but that in certain instances, stepping way from the pure orthogonal grid can provide an interesting result. Even a step as small as Doxiadis’s pinwheel strategy allows for something intriguing that the pure orthogonal lacks.

“What [Alison Smithson] justifies in the 1970s as a natural condition of the “first primitive state” of mats has becomes a defining feature. Mats are by definition still developing.” -Hashim Sarkis [Le Corbusier’s Venice Hospital and the Revival of Mat Building]

In the case of many mats, an issue is how the program is resolved in a very segmented way, where residence is an aggregation, office is another, etc. This can be seen in the case of Masdar, in smaller mats (such as Le Corbusier’s Venice Hospital), or even in a larger scale of what can be construed as a mat; i.e. the land use plan that Doxiadis mapped out for the city of Riyadh.

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Despite this critique of most built mats, the typology itself aims to create a weaving relationship between different programs. “Mat-building consists of a horizontal weave of programmatic and circulatory elements, a play of solids and voids stabilized within a legible geometric order; the exterior conditions are purely contingent, the incidental result of overlaps and interconnections at the interior.” -Timothy Hyde [How to Construct an Architectural Genealogy]

The thesis aims to push this ambition into a reality, where the overarching roof brings together, underneath it, different programs, different users, and different conditions. This will be described in detail in the following chapter, under 03 - The New Urban Condition: The Layers of The Mat.
Below: Concept Diagram Showing Transformation of City Fabric at The Intervention Scale

- Built Environment
- Existing Stacking
- Inverting the Environment
- Pulling Vehicles Underground
- New Stacking
- New Environment
Above: Concept Diagram
Transformation of City Fabric at The Megablock Scale

Left: Site Model Photograph
Relationship Between Existing Urban Fabric and Interventions
The New Urban Condition
The Site

While the project identifies itself as an urban system of progression, the site chosen for the exploration of the thesis exemplifies the transitional ring that is lacking in the urban fabric.

First off, the site lies in a key location; sitting on the edge between the commercial spine and the typical urban fabric, the site becomes the perfect transitional space. Moreover, it is surrounded by 4 different-sized roads; on the West side, it is adjacent to one of the largest street in the city (Olaya Street), and less than 1000ft away from a major highway (King Fahd Road), while on the North side, it is adjacent to one of the smallest types of vehicular street, with the East and South streets being in the middle. Moreover, the new sky train being introduced in the city runs in parallel and in conjunction with Olaya Road, giving the site another type of access.

While the thesis is presented as a system that is applied to a neighborhood, it is not a project void of design. The first, larger, level of design comes in with the decisions made for the system; such as the zoning, the method of creating the roof, the stacking, the materiality, etc.

The second, more detailed, level of design comes in at the level of the site; the development of the sections of the building become a nuanced and rich exploration of balconies, cantilevers, atriums, etc.
Above: Topographic Plan Showing Section Cut

Section 1
Below: Urban Section
Section Showing The Relationship Between The Urban Fabric, The Project, and The Commercial Spine.
Ground: Pedestrian Public Plynth
Above-Ground: Programmatic Stacks
Top Floor: Special Programmatic Moments (Conference Rooms, Game Rooms, etc.)
Roof: Light-Transmitting Concrete
Roof Topography
Ground: Pedestrian Public Plynth
Basement: Pulling Vehicular Traffic Underground + Special Public Moments (Prayer Rooms, Galleries, Theaters, etc.) Lit From Above
The Layers of The Mat

The proposed mat acts both in plan and in section. While the different types of program are zoned throughout the building in plan as can be seen in more detail in the following chapter, under 04 - Considerations: Program, the stacking of the system becomes a key element of the project.

Starting from the basement level, the project pulls vehicular traffic underground to create an expansive zone of roads and parking. Moments of program happen under the larger courtyards, creating naturally-overhead-lit spaces.

The ground floor of the mat becomes a pedestrian plinth that brings together different kinds of program at the public level; from office lobbies, to hotel lobbies, to café, etc. It becomes a combination of indoor and outdoor space, with the courtyards allowing for a constant and free flow.

Moving up into the stacks of the building, the different zones of program take shape as more specific occupied space; here, apartments, offices, and other such program resides.

As we move up into the last level of the mat, we come upon a different kind of social space; unlike the ground floor, this space is less public, catering to those users of the in-between floors. The spaces in this top floor also become more specific than those on the ground floor; spaces such as game rooms, conference rooms, and other similar spaces take place in this “penthouse” zone. This space also has a higher floor-to-ceiling height, is not as full of structure (the roof sits on a space-frame that eliminates the need for many columns), and receives a lot of diffuse natural light through the walls and the roof. It also pulls the outdoor courtyard spaces in with balconies.

The building as a whole uses light-transmitting concrete for its walls, as a way of letting in more natural light, while diffusing it, and reducing the heat gain in the building. At certain moments, the concrete walls get perforated with windows as a way of letting direct light in, and allowing for views out. At other moments, the concrete walls open up to allow for access, openings, etc.
Project Moments

Moment A: Social Spaces

Moment B: Residential Spaces
Moment D: Access Spaces

Moment C: Formal Spaces
Moment A: Social Spaces

The types of roads in the city of Riyadh are broken down by their sizes, with different types of program allowed to be adjacent to them. As such, social spaces (which are mainly considered commercial, and sometimes residential-commercial), are adjacent to larger, noisier, faster roads. While some of the businesses have attempted to provide an outdoor area for use at night and in the colder months, most of them end up being outdoor seating along a large road.

With the inversion of the environment, the new mat rethinks this type of space as internalized rather than externalized; this provides courtyards for outdoor social space, as well as open/closed spaces where the indoor meets the outdoor. This also allows for the indoor spaces to have views out towards courtyards, as opposed to the existing views out towards the street.
Plan A
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Moment B: Residential Spaces

The current housing model in the city of Riyadh typically consists of stand-alone houses. With this setup, there are specific restrictions on setbacks: 2m from the plot edge inwards on a block’s interior side, and 1/5th of the road width on the street-facing sides. Because of this, as well as the boundary walls surrounding each plot, houses are pushed back as far as possible towards the internal edges of the plot, leaving a larger space in the front. This means that front yards are the external public space, while the back-yard zone becomes a 2m alley only used to get around the house.

In the new mat, with the tearing down of the dividing wall, the 2m alleys transform into 4m spaces; these become spacious hallways, balcony spaces, and railroad-type apartments. And, instead of being long, narrow spaces with tall surrounding walls, they become lighter spaces that look down upon courtyards, with bougainvillea flowers climbing up the walls, water features coming down from them, etc. They become transition zones:
- Transition between indoor and indoor
- Transition between public and private
- Transition between programs

The residential buildings merge into the ground floor plinth with play spaces, residential lobbies, and social spaces. Moving up into the stacks allows for apartment access, up to the final floor of social spaces, such as entertainment rooms, game rooms, etc.
Below: Rendering B
Residential Balcony and Courtyard
Moment C: Formal Spaces

The current office model in the city consists of either high-rise office space within the commercial spine, or a more disconnected, disorganized system of offices occupying the top floors of commercial spaces. There is no work zone within a neighborhood, which creates strange access situations and adjacencies.

The thesis reconsiders the existing work environment, and re-imagines the kinds of spaces that happen in the mat. Office space now works in a much more open-floor manner, with divisions coming in as necessary. This allows for more flexibility with the amount of space each company would need. The space would surround a larger courtyard with a more formal layout, allowing for the outdoor space to be utilized for breaks, casual meetings, etc.

Moving up through a section of this space, we start at the basement level with a unique space happening underground: the formal courtyard allows for light to filter down below ground, where key congregational, low-lighting spaces such as prayer rooms, galleries, theaters, etc. can happen. As someone walks through the ground floor, lobby spaces and workstations become the mediating space between the public plinth and the offices above. As one moves up through the office zone, there are different levels of office space, until the top floor is reached. The highest floor of the mat allows for a relief from the system below; by allowing for more light to filter in through the ceiling, and allowing for larger spans and higher spaces, it creates special moments of congregational space, such as conference rooms, meeting rooms, and break rooms.
Below: Rendering C
Formal Courtyard
Moment D: Access Spaces

Neighborhood roads in the city of Riyadh consist of a wide road with vehicular traffic flowing through faster than is safe. The road is surrounded by separation walls that block out access and views into the houses. In many cases, the road does not even have a sidewalk along the walls, forcing pedestrians to walk in the street. Moreover, the empty plot currently stand as sandboxes in the middle of neighborhoods.

The city has taken initiative to promote healthier lifestyles and the need for walking, by building a few pedestrian walkways around the city. However, they are still pretty spread-out, forcing people to drive to their walkways, and are too hot in the summer due to lack of shade.

The new mat re-imagines the environment by creating a shaded 4m walkway, which meets openings into courtyards for public access. This allows for more favorable pedestrian walkways within neighborhoods, as well as more manicured outdoor public spaces. It creates a network of public space that surrounds and feeds into the mat.

Meanwhile, vehicular traffic continues to run smoothly on the larger neighborhood roads, and then pushing down into the underground as it meets the new mat.
Below: Rendering D
Pedestrian Entrance
04

Considerations
Program

Although each block, neighborhood, and mega-block in the city has its own idiosyncratic identity, certain patterns of spacial layout repeat themselves within the figure-ground. We can clearly distinguish 4 different spacial layouts happening: large, one-off courtyards, medium courtyards, array of small courtyards, and courtyards adjacent to the exposed ramping streets. Each of these suggests a different type of space adjacency, as laid out in the diagram.

These adjacencies happen at the levels above the ground floor. In the ground-level plinth, however, the spaces adjacent to these courtyards take shape as a larger, open space with different things happening. In the case of the office zone, for example, the ground floor acts as a lobby-type space, as a way of liquidizing the transition from public space to individual offices.

Below ground, the majority of the space is reserved for vehicular access. However, key moments in the underground create diffuse-light congregational spaces, such as prayer rooms, galleries, and theaters. These spaces happen under the medium and large courtyards, with a ground-floor tiling system that allows for light to come in from above.
Large Courtyards / One-off Courtyards  
Commercial Spaces

Medium Courtyards  
Commercial Spaces

Array of Small Courtyards  
Residential Spaces

Street-Adjacent Courtyards  
Public Spaces
Getting Around

In many parts of the Gulf, personal vehicles are an almost exclusive means of transportation, and the scale of the urban fabric caters to that. But, if one is introducing a mat, it allows for this system to be altered.

How does vehicular and pedestrian transit feed into a mat? If one is to think about the module, we can think of it as such: Either transit becomes a type of module (as pictured in the top diagram), or transit becomes part of each module (as pictured in the bottom diagram).

Another question becomes whether the vehicular transport acts in the same sectional realm of the pedestrian or not (or does it only happen at certain moments?). In the image of Masdar’s transportation, there is a clear understanding of where people are versus where vehicles are. The scale of the module becomes an important factor in these decisions, as walk-ability is not infinite.

The map to the right shows the locations of the new rail lines, as well as their stops. If this project aims to reclaim the space above ground as a pedestrian zone, it becomes obvious that picking sites in close proximity to the new public transit would make sense.
Above, Left: Planometric Figure-Ground Diagram Showing Site Access

Above, Right: Axonometric Diagram Showing Vehicular Access Pulled Underground
Access

Pedestrian Access:
At ground level, pedestrians are able to access the mat from all 4 sides. On the sides adjacent to highways, the access consists of carvings into the building that allow for direct access from the sidewalk into select courtyards. On the neighborhood street sides, the exterior wall on the ground floor of the building pushes in 4m to allow for a new pedestrian sidewalk along the roads, since it currently is void of sidewalks. The access from this new shaded zone into select courtyards happens in the same way as the other sides, with carvings allowing for access into the courtyards.

Vehicular Access:
In order to stay true to the literal inversion, and as a way of preserving the urban fabric, the existing street network is kept as the access points into the neighborhood mat. The difference, however, happens in section; while the old network of roads happens at grade, the new network happens below ground, and creates an expansive zone of vehicular traffic and parking.

The different kinds of roads in the city are categorized as per the diagram. These are maintained at their scale throughout the system, with the majority of the inner streets being collector roads and major collector roads, with some arterial roads.
Average Weather and Rainfall in Riyadh
Source: worldweatheronline.com
Climate

The weather in the Middle East brings harsh summers, and relatively comfortable, albeit cold, winters. Despite this, or perhaps because of it, people in the Middle East have a desire to utilize outdoor space whenever possible, even if it needs active cooling in the summer, or active heating in winter. Or perhaps, on a more basic level, it is simply human nature to want to be outdoors, get fresh air, and be exposed to sunlight.

In the case of certain new developments in the Gulf, there has been an attempt to tackle this through design, with certain opportunities of covered or somewhat covered outdoor spaces (as in the case of Masdar), or narrow outdoor space with somewhat tall buildings that provide shading (as in the case of DIFC in Dubai).

“As it contrives to precipitate patterns of use and habitation, mat-building remains a process, regardless of the formal characteristics of its product.” - Timothy Hyde

The question becomes:
How do you design for the whole year, rather than for the optimal (or one specific) time of year?

As an attempt to tackle this question, considerations about shading, transformable spaces, etc. come into play in the thesis. There becomes a buffer zone between the exterior courtyard and the interior programmed space which allows for this flexibility: from ground level foldaway doors, to balconies on higher floors, to access points through spaces carved out of the poche of the figure, that spill out into a courtyard.
Daylighting

In any building, the consideration for the amount and type of daylight that enters the space is important. In the case of the mat building, this becomes even more important to understand and resolve; with a building that highly preferences the plan, and has large spans, getting light in through different types of windows and reflections allows for a more vibrant and interesting interior space.

For this thesis, the idea of getting light in from above, and getting indirect light in, both became very important. As a first study for this topic, I looked at different ways of getting light into a space, as well as different window types. From that, two aggregational tests were done; one where certain types repeat in section, the other where other types repeat in plan. This allowed for an understanding on how the space under the roof would work, and what it would entail for each type to happen; for example, overhead lighting requires the building to stop at a that level, so this became a useful lighting method for underground spaces that fell below courtyards.
Above: Diagram Showing Different Daylighting Strategies Acting Upon The Site
Appendix

Thesis Defense
Thesis Defense

December 17, 2015, 11:40 am
Media Lab, Building E-14, 6th Floor
Massachusetts Institute of Technology

Reviewers:

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Final Review Panels

Above: Defense Wall 1
Site, Concept, Timeline
Appendix

Research
Cities around the world have been growing in two ways; on the one hand, we have urban densifying, such as Manhattan, Chicago, Tokyo, Dubai, etc. These cities have become analogous with high-rise, dense, and fast life. More often than not, these urban central districts became too expensive to be lived in, and the need for suburban living became evident. This has forced another nature to exist around these city cores, where sprawl becomes the suburban fabric. This typology also exists in the core of some metropolitan cities such as Austin, Detroit, Riyadh, etc.

The disconnect between high-rise, high-density and sprawl is very evident, and there seems to be a missing liaison; rather than have a ring of sudden transition, I am proposing a new typology, where low-rise, high-density can begin to happen. The nature of this new typology becomes imperative to identify, where it can adapt to the urban city’s growth, and not become obsolete with expansion.

The proposed new typology is one that became prominent in the 1960s and 1970s, as a way to mediate between architecture and urbanism. However, rather than the 60s and 70s understanding of the Mat typology, I am interested in pushing this project as a Neo-Mat typology. The conception of the city from stem to cluster to mat had been addressed by Team 10 to delineate the architectural and urban systems as the assemblages of totality, in which way to develop the urbanized architecture or architectural urbanism. They were configured within the organized structure to organize the working cells into an open-ended unity. It was obvious that after several decades, the Smithsons’ Mat seemed to be newly developed not only by imitating or repeating, but by extending and developing propositions made by other like-minded practitioners. It is designated as Neo-Mat-Building in this article not only describing the current situation of urbanized architecture, but also inspiring the further development of network system between the architecture and urbanism.

Alison Smithson starts to line up different criteria shared by her case studies, as synthesized by Hashim Sarkis in his text; “By mat building, as defined by Alison Smithson’s 1974 article, architects usually mean a building type that is low-rise and high-density, that is homogeneous in its layout, and that consists of a systematic repetition of a simple element such as a column, skylight, or modular room. The repetition provides the framework, both conceptual and spatial, for different possibilities of inhabitation. By virtue of its seemingly endless repetition, the building becomes an environment unto itself.” - Hashim Sarkis [Le Corbusier’s Venice Hospital and the Revival of Mat Building]

Within the Neo-Mat typology, the thesis begs questions of Form, Atmosphere, Community, and Computation. Different thresholds come into play in the project; part-to-whole relationships, outdoor vs indoor, public vs private, boundaries, daylight, etc.

“Neo-Mat-building is an assemblage of aggregation, propagation and effects all over the place than a formal metaphor of the net-shaped mat. [...] Although the high density of Neo-Mat-building requires delicate interplay between variations and repetitions, it is no longer a mechanical and two-dimension duplication, but the extension and flow of the transfiguration of the same genies through the multi-dimensional spatio-temporal.” - Yuan Zhu [Neo-Mat-Building]

It is important to understand the current state of the typology, and how it can be pushed further. “Within a systematic field, Neo-Mat plays an infrastructural, operational performance rather than the formal and representational architecture. It is no more the solid geometric shape in space but the institutional matrix of interrelated endless networks “beyond building” and “extremely diagrammatic”. It acts as natural production entailed liberation of melting, transforming, adapting, eroding and reproducing through spontaneous auto-catalysis, overcoming the orthodox of “putting horizontal things on top of vertical ones.” Opposite to the tectonic vision of architecture as the legible sign of construction, Neo-Mat-building signifies a hybrid of the early neo-avant-garde investigation of signifying regimes with the later pursuit of no scales, no typology and no style.” - Yuan Zhu [Neo-Mat-Building]
As a way of exploring digital tools for generating architectural systems, the thesis proposes the mat building as a modern-day typology. In the 1960s, the mat typology became prominent in an attempt to mediate between architecture and urban design. A certain understanding of the mat typology developed: one with an orthogonal grid, repeating modules, and the potential to be never-ending. It becomes an additive process at an urban scale.

In looking at the different mat buildings that have started to be realized in the late 20th and early 21st century, we start to see an evolution in the understanding of the terminology. “Today mats are appearing everywhere. Whether seen as a counterpoint to the preoccupation with sculptural form or as what happens to architecture when it has to cover really large areas, no building type captures the predicaments of contemporary architecture more fully. The mat answers to the recurring calls for efficiency in land use, indeterminacy in size and shape, flexibility in building use and mixture in program.” - Hashim Sarkis [Le Corbusier’s Venice Hospital and the Revival of Mat Building]

The understanding of mat-building can be broken down into two streams, one where “mat-building” is the verb describing the process of designing an intermediary between architecture and urbanism, the other where “mat-building” is a noun that describes a building that preferences the plan, is of a certain scale, and acts as a larger entity. “At what point does mat-building culminate in a mat-building?” - Timothy Hyde [How to Construct an Architectural Genealogy]

My interest lies in the noun “mat-building”, where the scale remains within the realm of architecture. Specifically, I am interested in the nuance that can be presented and resolved within a mat building, specifically in plan and section. How does one introduce nuance into a relatively simple/straightforward system? If we are to expand to a more complex system, how can we keep the organization simple or logical, without it seeming arbitrary?

Both Timothy Hyde and Hashim Sarkis begin to introduce the notion of a different kind of mat building in their texts, where the studied mat typology is only at its initial stage. “What [Alison Smithson] justifies in the 1970s as a natural condition of the “first primitive state” of mats has become a defining feature. Mats are by definition still developing.” - Hashim Sarkis [Le Corbusier’s Venice Hospital and the Revival of Mat Building]

By starting with the generation of the plan, one can study different possibilities for density, porosity, and scale. The sectional richness of the mat then derives from the program; the boundaries between public and private, indoor and outdoor, humid and dry, above and below all introduce different idea of play in the way the building performs, and is occupied. These dichotomies allow for architecture to become interesting, particularly in a mat typology.

My research thus far has shown me that while many of the mat projects that have been proposed or built prove to be interesting precedents, they nevertheless are not mat-buildings in the sense of the noun, but rather in the sense of the verb. Going back to Timothy Hyde’s question, and following through his thoughts a little further in relation to the verb vs. the noun: “At what point does mat-building culminate in a mat-building? Does it require a minimum degree of programmatic complexity or formal coherence? […] The limited formal pedigree of these orderly mat-buildings excludes other possibilities for mat-building. Given the vast complexity of urban mat-building, for example, with its diverse demands for programmatic and infrastructural accommodation, a solution may require more labyrinth and less clarity than a grid can provide.” - Timothy Hyde [How to Construct an Architectural Genealogy]

Perhaps the issue is not the orthogonality of the grids, but rather their scales. In the case of NADAAA’s proposal for the Kuwait Masterplan, for example, the breakdown of the grid into a smaller and irregular scale allows for certain nuance to be developed within the unit and the module. This is the kind of complexity I am interested in.
Mat vs Neo-Mat

Yuan Zhu

“The Interconnections with Mat-building is neighboring and 2D influence, while that in Neo-Mat-building is transborder and over 2D influence. The weighting of linkage in Neo-Mat is different due to the significance of node and borders.”

Source: Yuan Zhu
Right: Sketch Showing Concept for a Mat Building
Appendix
Research
α- Precedents in Mat Building
The Mat Typology

This thesis proposes the mat building as a modern-day typology. In the 1960s, the mat typology became prominent in an attempt to mediate between architecture and urban design. A certain understanding of the mat typology developed; one with an orthogonal grid, repeating modules, and the potential to be never-ending. It becomes an additive process at an urban scale.

The understanding of mat-building can be broken down into two streams, one where “mat-building” is the verb describing the process of designing an intermediary between architecture and urbanism, the other where “mat-building” is a noun that describes a building that preferences the plan, is of a certain scale, and acts as a larger entity. In Case: Le Corbusier’s Venice Hospital And The Mat Building Revival, Timothy Hyde writes: “At what point does mat-building culminate in a mat-building? Does it require a minimum degree of programmatic complexity or formal coherence? Can the activity of mat-building be realized at any and all scales?” My interest lies in the noun “mat-building”, where the scale remains within the realm of architecture. Specifically, I am interested in the nuance that can be presented and resolved within a mat building, specifically in plan and section.

In looking at different mat buildings that have come up in the late 20th and 21st century, we can see the difference between the two. Some of the examples I’ve looked at include

- The New Kuwait Shooting Club / Villa Moda by Office dA
  Which uses a varying roof as a way of bringing together the different programs that happen underneath

- The Kuwait Masterplan by NADAAA
  Which starts to become a mabuilding in the sense of the noun, or rather a series of smaller mat-buildings that culminate in a larger urban mat

- Dune City by Ordinary Limited
  Which uses the classic mode of operation of the mat, which is a modular repetition

- The Brooklyn Mat Housing
  Which starts to deviate from the typical orthogonal grid seen in the 60s and 70s projects

- The Montijo Thesis Project by Jose Miguel Guerra de Sousa,
  Where the project takes on the new type of mat-building, or the neo-mat

- As well as Proyecto Fin de Carrera _ Granja Escuela En Las Ruinas de Oreja in Toledo, Rabat Agdal Train Station by Mecanoo, and Contemporary Arts Center Cordoba by Sobejano.
Yuan Zhu identified the neo-mat at the International Forum on Urbanism as “the extension and flow of the transfiguration of the same genies through the multidimensional spatio-temporal”.

The fabric of the city came into play in this project; if we consider the 60s and 70s mats that take advantage of an orthogonal grid so they can fit in easily, how can we start to look into the fabric to not be so restrictive and generic? How can we manipulate the fabric to do more? So, rather than work with the old-school mat, where the module does everything, working with a neo-mat allows for a system to provide a framework.

By starting to look at different grids and patterns, the aim was to study different ideas of organization, transformation, porosity, etc, where simple grids can start to create frameworks in a systematic but complex way. Meaning that even with an orthogonal grid, we can create differentiation. Or with random points within a Perlin field spacing, we can create a network with different densities. Or that shifting one of the two grid orientations can give you a noticeable difference.

So the project doesn’t become a Utopian, endless, patterned mat cityscape, and works within a system where nuance is introduced. The nature of this new typology becomes imperative to identify, where it can adapt to the urban city’s growth, and not become obsolete with expansion.

The question becomes: How can we create a flexible system that creates a mega-structure, while achieving other architectural objectives?

The goal is to develop a system that resolves different key architectural issues. How can we create a system that is all-encompassing?

From structure, to daylight, to program, to circulation, different architectural elements need different systems to come together. Would it be possible to create a system that accomplishes these different elements simultaneously?
Mat Buildings
Circa 1960s

“Today mats are appearing everywhere. Whether seen as a counterpoint to the preoccupation with sculptural form or as what happens to architecture when it has to cover really large areas, no building type captures the predicaments of contemporary architecture more fully. The mat answers to the recurring calls for efficiency in land use, indeterminacy in size and shape, flexibility in building use and mixture in program. [...] By mat building, as defined by Alison Smithson’s 1974 article, architects usually mean a building type that is low-rise and high-density, that is homogeneous in its layout, and that consists of a systematic repetition of a simple element such as a column, skylight, or modular room. The repetition provides the framework, both conceptual and spatial, for different possibilities of inhabitation. By virtue of its seemingly endless repetition, the building becomes an environment unto itself. [...] What [Alison Smithson] justifies in the 1970s as a natural condition of the “first primitive state” of mats has become a defining feature. Mats are by definition still developing.” -Hashim Sarkis [Le Corbusier’s Venice Hospital and the Revival of Mat Building]
New Kuwait Sports Shooting Club

Office dA

This project aims to create a domestic canopy for the public realms in Kuwait City. The project looks at gradients as a form of organization: a gradient of program from public to private, a gradient of the roof structure, and a gradient of integration. Moreover, it creates a public space that feeds up into the specific programs happening above.

This becomes a very important precedent for the thesis proposed in this book, as it presents itself in a similar manner in scale, in program, and otherwise.
Kuwait Masterplan

NADAAA

This project begins with the notion of re-imagining the courtyard house typology in today’s modern world, both in terms of design and in terms of density; on the one hand, by creating a larger block that consists of multiple housing units, and on the other by allowing for shared courtyards. It brings this into a larger scheme of a city development strategy, where this system can come into play with other elements to create a bigger entity.

The rigid orthogonal grid is, on the one hand, allowing for many possibilities; within a square grid, one is able to create many different variations of spatial control, while on the other hand, limiting; in the case of trying to relink to an existing city fabric, creating a square grid can be very limiting, seeing as most cities are not built upon a pure regular grid (particularly not a square one).
The project aims to reinvision housing in the arid desert of Africa, using a new technology; the claim is that by mixing a certain bacteria to sand, they are able to create sandstone. This kind of technological breakthrough, where harnessing the power of natural products to update materials allows for more sustainable construction. The claim is that this is only needed for the figure, whereas the field remains sand. This creates an ever-changing field for construction and expansion.

The project is not heavily documented, graphically, despite its publishing on several platforms; as such, the plan is based off of the different images found, and further information in regard to what other program exists around the housing, and modes of circulation, is limited.

SANDRA/ Dune City

Ordinary Ltd.

Above: Rendering
Source: Ordinary Ltd

Above: Plan Showing Housing Block
Reference Source: Architects
The project aims to re-envision housing in Brooklyn, by creating a typology that is only interior when it needs to be private (i.e. all circulation is exterior). The idea that different scales and configurations come together, particularly with a secondary grid overlaid above the initial square grid, deems it a successful effort in the idea of providing housing for different needs.

The complete outdoor-ness of the circulation causes problems in different weather situations such as winter, rain, etc. Moreover, the way the clusters work seems to be more contained and less of a sprawl, so the idea of limitless continuity is less obvious here.
This project aims to utilize the mat building as a way of bringing together architecture, urbanism and landscape in a way that revives the waterfront in Montijo. There is a clear figure-ground relationship between different programs, where the figure acts as more rigid program, while the ground of the building acts as the more open, public program.

The most public program happens above everything else; starting at the ground level, the roofscape ramps up to create a public promenade that allows views into the different zones. The intermediary levels start to mediate between the different programs, with the lower level being more specific. Although in many instances the more specific program acts as a figure condition, it acts as a field condition in other instances. For example, a theatre space requires noise and light isolation, and labs require access control. A cafe, however, does not require a figural isolation, and can run fluidly between other program.

I am interested in exploring the boundaries between public and private, indoor and outdoor, humid and dry, above and below. These dichotomies allow for architecture to become interesting, particularly in a mat typology. These constraints begin to inform the plan and the section of one’s building.

In this building, the diagrams provide a clear understanding of how these things come together. In this particular case, it seems that indoor and outdoor always communicate at a fluid program, while the figural program remains isolated. However, it would be interesting to create either a- an idea about shared outdoor space between figure and field, or b- outdoor space specific to certain figural program.
Above: Site Plan
Source: Guerra de Sousa

Right: Concept
Reference Source: Guerra de Sousa

Below: Sections
Source: Guerra de Sousa
Appendix

Research

b- Precedents in Parametric Design
Flow Studies; by Jenny Sabin

In looking at the possibility to design a project from scratch, it was important to understand different kinds of patterns, their successes, and their shortcomings.

How can digital tools and variations be utilized at the scale of the building? In most digital explorations today, we either see very small-scale, shallow explorations; such as a pattern being used as a frit for shading, or we see an opposite extreme of attempting to use data as a way to generate form. However, the tools we have can prove useful in terms of the architectural scale, not necessarily in the way that they are being used for mass customization, but rather in a more systematic way. For example, we can start to create organizational strategies that utilize these tools, allowing for both rigidity and diversity. Think of a plan initial organization that utilizes parametric design, which can allow for us to reach the idea of a module at the scale of a room, that can then be aggregated, scaled, etc. to solve the problems of the specific building.

This can start as an exploration of designing a framework that is variable, which can then be occupied in different ways, depending on the specific use. Depending on how specific and intricate the framework becomes, either the module plugs into the framework, or the framework provides several different possibilities for subdivision.

In a time where digital culture is a topic of discussion, I was interested in exploring its potential to address questions of architecture in a rigorous manner. How can digital culture help shape architectural development at a deeper level than the two commonly seen paths of either the “organic”, or the parametric screen?
Fractal Grid; from Patrick, Francis, Duncan Studio, GSD

Pattern Studies - Size, Porosity, Density, Surface, by Yong Ju Lee
A - 03

Appendix

Parametric Design Exploration
Appendix

Parametric Design Exploration

α- Parameterizing The Project
These geometric studies aim to start testing different organizational methods, along with their strengths and weaknesses. While some of these patterns begin to suggest certain attributes, they nonetheless each have their own shortcomings. More importantly, these patterns are still not addressing the full 3-dimensions. While some are purely 2-D, others get to 2.5-D.

The success of a mat system relies on the potential to address the full 3 dimensions, and perhaps we can even call the social atmosphere of the space the 4th dimension. The relationship and interaction between the different spaces is imperative in the project.

The formal question does not become about beauty, but rather about functionality. If a simple orthogonal grid allows for simple division and structural systems, while an “organic” object would allow only for the interaction between spaces (some more successfully than others), how can we create a system that allows for three-dimensional flexibility and interaction, while maintaining a structural and methodological system?

“The flexible linkage web between individual and collective presents a non-standard and open-ended system. It is rather a 4-D network (3-D+ time dimension) than the 2-D connection. [...] In understanding of Neo-Mat-building, it is not only the entity of building, but rather the new lifestyle and social reality. Our activities, which mostly take place in terms of different places and time, make this a necessity. It should be more applicable, lively, joyful, hybrid and “real” than sculptural, serious, rhetorical and isomorphic building in mechanical age.” - Yuan Zhu [Neo-Mat-Building]
Parameterizing The Urban Fabric

The Doxiadis urban megablock in the city of Riyadh stands as a 2km square. If we cut a section through this urban environment, we can see a sprawling, low-rise environment, populated by block separation walls. There is no hierarchy between different parts of the city, despite the noticeable systematic layout of the roads.

If one were to reconsider this strategy sectionally, an argument can be made for building a side of the urban block higher as it encroaches upon a larger street, while getting lower in the centers of the neighborhoods.

Taking this a step further, one can begin to set out with an agenda in regards to the access from the different sizes of roads, as can be seen in the next page. These distinctive patterns can start to propagate within the megablock, either with one repetition, or with several different typologies, as a way of creating a larger mat.

As these patterns start to get refined, they begin to pull their information from the existing neighborhood street network; while some keep parts of the existing street network, others use the moments of intersection as a way of generating new connections.
Sectional Qualities - Urban Qualities

Primary Edge: Noisy, fast traffic - build higher, fewer openings
Secondary Edge: Main neighborhood road, medium speed traffic
Tertiary Edge: Slow traffic, more pedestrian - build lower, allow for openness between existing plazas and new rooftop

Creating Hierarchy
Propagating A System
Utilizing The Existing Grid
Appendix

Parametric Design Exploration

b- Previous Work In Organizational Parametrics
Different Islamic Patterns originate from the same base grid; using that, one is able to create a set of patterns by taking advantage of scripting tools - in this case, python. From this, a new typology is created: the evolving Islamic Pattern, then transformed and applied in a three-dimensional setting.

This study attempts to understand the different parameters that go into variation within the same system: how can we have one system adapt to a series of catalysts? What do we develop as inputs?

Pattern Evolution: Adapting The Grid/Module

Project Done In Collaboration With Iman Fayyad, January 2010

Different Islamic Patterns originate from the same base grid; using that, one is able to create a set of patterns by taking advantage of scripting tools - in this case, python. From this, a new typology is created: the evolving Islamic Pattern, then transformed and applied in a three-dimensional setting.

This study attempts to understand the different parameters that go into variation within the same system: how can we have one system adapt to a series of catalysts? What do we develop as inputs?
This study attempts to identify different factors that influence the outcome of a parametric model, and how to take advantage of that. The different studies study different types of pattern generation, from the module to the grid. These are then tested against a set of external influences that adapt the system, from attractors, to groupings, to rebuilding.

The ultimate goal of the study was to try and understand how these systems, when broken down, can start to accomplish different things in plan and section. How flexible can they be? How systematic do they need to be for the outcome to be predictable? What is the benefit of using a grid vs a modular system?
Considering the different daylighting needs of different spaces, this study uses field and figure to create a governing roof with a daylighting strategy that also incorporates a spacial organizational system. This allows for a datum under which different program has the opportunity to shift in section as needed. This mat typology allows for the creation of a system into which the program figures can plug in and adapt, depending on the needs.

While in the case of this particular study, sectional variability is determined and not flexible, this type of system allows for the exploration of variability in plan and in section, after the implementation of a systematic roof.


Yuan Zhu Neo-Mat-Building. The 4 International Conference of the International Forum on Urbanism (IFoU)


Greta Hansen Turning the Black Box into a Great Gizmo. Thresholds 38, MIT.


<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Publisher/Year</th>
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<tbody>
<tr>
<td>Craig S. Kaplan</td>
<td>Islamic Star Patterns from Polygons in Contact.</td>
<td>University of Waterloo, 2005.</td>
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<td></td>
<td>Rewriting the Mediterranean City: Geography of Transformation.</td>
<td>New Geographies 5 - The Mediterranean.</td>
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