Adaptive Urbanism
Shaping Rapid Growth in Nairobi

by

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Submitted to the Department of Architecture
in partial fulfillment of the requirements for the degree of

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ABSTRACT

Within the past half century many African nations regained independence and in the process, imported various development models from the Western World. Joan Clos, Under-Secretary General of the United Nations claims “it is now evident that all these models have failed to achieve the goals that African nations had set themselves”. Considering these past failures along with rapidly increasing urbanization rates, a poor economic outlook and on-going vulnerability to natural disasters, the need for reconsidering urban strategies is more pressing than ever. The relatively nascent state of urbanization on the subcontinent should be see as an opportunity to embrace new paradigms of urban development. No African city is more poised to become a test bed for change than East Africa’s center for innovation and globally connected capital of Kenya - Nairobi.

The thesis proposes a project for the Nairobi metropolitan region. A current population of 8 million people is set to double by 2050. And, by some estimates, up to 60% of these people currently live or work outside of the formal sector. The project unfolds across scales, from global and regional concerns down to housing clusters. Richard Neuwirth’s notion of harnessing the power of the informal plays out here by carefully calibrating how much public participation or indeterminacy is built into the interventions at each scale. Housing types and clusters have endless permutations while the regional plan is centrally instated.

The design project resonates with the New Town movement in scale and ambition, specifically in cases where these ideas were exported to the Global South in the fifties and early sixties. It also embodies a critique of these projects Utopian visions that sought to ‘solve’ the ‘problem’ of the city and the totalizing approach these took.

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INTRODUCTION

Within the past half century many African nations regained independence and in the process, imported various development models from the Western World. Joan Clos, Under-Secretary General of the United Nations claims “it is now evident that all these models have failed to achieve the goals that African nations had set themselves”. Considering these past failures along with rapidly increasing urbanization rates, a poor economic outlook and on-going vulnerability to natural disasters, the need for reconsidering urban strategies is more pressing than ever. The relatively nascent state of urbanization could also be an opportunity to embrace new paradigms of urban development. The next chapter, the Project for the City, builds on these points to insert the intervention in global frame.

A history of planning ideas and practice on the African continent saw major activity in the post-war era where newly independent nations invested in new towns to launch them into the modern world. This continued through the sixties and seventies under the auspice of international development with the help of the United Nations and the World Bank. Development projects were inexorably woven into a global geopolitics. Withdrawing colonial forces sought to cuts deals for

"Be considerate of local climates. Build with local materials. We can recreate village spaces."

"Research shows: Self-build, self-management is the best solution."

"Designer's should focus on that parts that are too difficult for people to do themselves."

"It is fantastic that people can build for themselves but it is onerous that they should have to."

"Expansion is key. The developing world needs to make room for a planet of cities."

We can solve this - with science!

INTERGENERATIONAL CONVERSATION
the continued exploitation of natural resources and while Radical African politics swung toward Russia and the Eastern Bloc the United States sought to extend its influence by exporting a certain culture along with Utopian aspirations. In hindsight, the structural adjustment policies, and per-mature decentralizing of state power that accompanied these projects have been a major hindrance to the industrialization of most African nations.

The spatial remnants and ideological positioning of this historical moment offer up a rich body of study. Otto Konigsberger, Maxwell Fry, Jane Drew and other tropical modernists, espoused a sensitivity to local climate and carefully considered material pallet. While at the same time held slightly problematic views concerning 'respecting local culture' which manifested in a late colonial form of social engineering.

A more refined version of this thinking re-appear in the work of John Turner’s Freedom to Build movement. Turner’s central thesis claimed that housing is best provided and managed by those who are to dwell in it rather than being centrally administered by the state. These ideas are still valid today, and feature extensively in the design project presented here. Insightful criticism is added to the conversation by Justin McGuirk writing from the Strelka Institute who argues that governments in developmental contexts must step-up and play a more central role in territorial scale management. McGuirk claims that Turner's ideas have been hijacked by neoliberalists as an excuse to dial back state support and neglect the urban poor.

The Structure and Infill paradigm championed by John Habraken, played out in many sites and services or service core housing types. This model is famously deployed today by Alejandro Aravena as incremental housing. The third chapter, The Progressive Settlement District, builds on these ideas operating at a district scale. The project embodies the idea that designers should focus on the things that average DIY-builders can't manage. This is particular relevant when considering risk management, and large-scale infrastructure. This sentiment persists in a dematerialized sense with Shlomo Angel, who practices extensively in the developing world, in association with UN-habitat. According to Angel’s, Grid of Dirt Roads method, securing land rights for the future provision of infrastructure is more important than the services themselves. This way, land is developed and taxes can be collected before the government rolls out any expensive equipment. The fourth chapter embraces Angel’s work by designing a mega-block that results from a grid of road reserves. The chapter after that speculates how DIY builders might begin to populate these areas and how innovations in service deliver might offer new ways of guiding the housing process.
"The fact that many of the trends of Modern Western cities can be seen in hyperbolic guises in Lagos suggest that to write about the African city is to write about the terminal condition of Chicago, London or Los Angels"
- Rem Koolhaas

Urban design is perhaps the most conservative of the design fields. In an era when urbanization has exploded across the globe, giving rise to countless cities embedded in a local culture, a specific history etc. it is worth considering how we could re-think approaches to city-making.

Koolhaas’ research in Lagos lead to an obsessive interest in cases of failure – jammed highways, overcrowded markets and garbage piled up interstitial spaces. He offers insight into the functioning of Lagos as an archetypal African mega-city and revels in the complexity of the burgeoning metropolis. But, by describing Lagos as terminal case of a Western City, he implies that the
Kibera is a slum in Nairobi, Kenya, and a neighborhood of the city of Nairobi. It is located near the city center. Kibera is the largest slum in Nairobi, and the largest urban slum in Africa. The 2009 Kenya Population and Housing Census reports Kibera's population as 170,070, contrary to previous estimates of one or two million people. Other sources estimate the population to be between 500,000 and over 1,000,000 depending on which areas are included in defining Kibera.
Dandora is part of the Embakasi division. Surrounding neighborhoods include estates like Kathundu, Kioni District, and the Kibera slum. Dandora was established in 1972. However, the estate was turned into a high-density slum with high unemployment. Nairobi's principal dumping sites are situated in Dandora and the Dandora Crematorium Buses.
URBAN EXPANSION

The Draft Metropolitan Boundary (outer red line) first published in 2014, yet to be legally instated.
The urban footprint is shaded in grey, from 1999-2011.
failures of the city are inherent in the model. They are not ascribed to people, a government nor historical legacy – it is the Modern Western city itself which fails in this context. Sensitivity to how Lagos, or Nairobi, for that matter are situated within a global modern history is crucial. Underlining the mis-match between Western aspirations and Southern realities is not to excuse the failures of Lagos, nor illicit guilt or pity over global inequality or a history of subjugation. Rather, as David Adjaye suggests we are forced to engage with the exciting prospect of new models. Considering an African mega-city in the contemporary global context is to appreciate the how much it’s trajectory will diverge from a global norm.

Compared to Africa, China and East Asian counties have witnessed similar rates of urbanization and similar demographic transitions over the past two decades. These countries have built countless cities and established a healthy middle class of homeowners, now actively purchasing and consuming goods in an emerging economy. While high-rise apartment blocks and towers proliferate across the skyline of Chongqing or Shenzen faster than any other receded history, the underlying engine for growth is industrialization. Africa’s economic reality is different. The share of manufacturing in the economies of most African countries has declined from about 15% in the 1970s to around 10% today. Pushing most African cities into a state of what Edgar Peiterse calls ‘Jobless Growth’. One theory for the decline in manufacturing is that massive, rapid development in smaller East Asian counties within this sector has outpaced global demand and simply beat East African countries out of the market with lower prices and reliable service.

If ruling out a traditional mode of nation building like industrialization seems dire, it may be encouraging to consider how vastly different the technological landscape of 17th Century Sheffield or 18th Detroit is to current day Nairobi.
F03 - UN GIGIRI COMPOUND
The UN Complex at Gigiri contains a 'green' building, a completely energy and carbon-neutral building, housing UNEP and UN-Habitat offices.[3][4] The building is the first of its kind in Africa, recycling water and using natural light to reduce reliance on artificial lighting. In addition, the building is designed to use natural flow of air as a substitute to air conditioning, and it contains solar panels to generate all the energy that the building would consume.[5] It was opened on 31 March 2011 by UN Secretary-General Ban Ki-Moon and Kenya's former president Mwai Kibaki.

G07 - CBD
[central business district] Nairobi grew around immigrants, it has been described as "Little Mogadishu",[1] as well as "a country within a country with its own economy" on account of its robust business sector.

E07 - KIBERA
Kibera is a neighbourhood of the city of Nairobi, 5 kilometres (3.1 mi) from the city centre.[2] Kibera is the largest slum in Nairobi, and the largest urban slum in Africa. The 2009 Kenya Population and Housing Census reports Kibera's population as 170,070, contrary to previous estimates of one or two million people.[3] Other sources suggest the total Kibera population may be 500,000 to well over 1,000,000, depending on which slum is included in defining Kibera.
Jonathan Ledgard, former journalist and founder of Zipline (the world’s first cargo drone company, in Rwanda) recalls the rise of cell phones on the continent. Around 1997 when major cellular distributors began trading in Africa, they had predicted a 9% market penetration, and only needed 7% to break even. That means out of 100 people, if nine of them bought a cellphone, the company would earn a profit. Business strategists in London or New York saw it as an acceptable risk. The phones were to be aimed at the upper middle class and sold as status symbols. What they had overlooked however is the discrepancy in telecommunication infrastructure. While cables for ‘land line’ phones covered every inch of the United States and England, most of Kenya, or Rwanda or Nigeria was unreachable outside of major centers or expensive radio towers. Demand for cell phones was intense. Within five years there were 20 mobile subscribers per 100 Africans. Business pivoted to sell ever cheaper handsets and that number soared. Today it is in the high nineties. Almost every African owns a phone, many own two. And infrastructure for mobile telecoms completely outstripped the roll-out of land-line cables. Cases of technological leap-frogging are instructive in two ways. First its important to notice how unprecedented and unforeseen the phenomenon was. Second, the rapid spread of a decentralized, dematerialized network was enabled by an absence of an earlier infrastructure.

A draft document released in 2014 outlines the government’s plan to define the Greater Nairobi Metropolitan Area. This merges four neighboring counties, pooling funds, opening up vast
"We no longer see the world as a singular modern experiment, but as multiple models, and we need to be sensitive to what their trajectories are about. Architecture should be responding, and of the place."

-David Adjaye

amounts of space to development and adjusting the entire spatial trajectory of the city. The Urban Expansion map presented here shows the city’s urban footprint pushing past the official Nairobi city boundary by the year 2000. Since then suburbs have continued to extend along North-Western and North-Eastern arterial transport routes. In response to this the, I propose a new development district on the South Eastern edge of the city, marked ‘A’ on the map. Low-cost housing in this zone can capitalize on low land prices near the city center, attached to a major transport route – the road to Mombasa.

notes


5. Personal notes following a presentation "Cargo Drones in Africa: The Next Great Leap(frog)?" at Swissnex Boston on (March 10, 2016), facts checked http://www.itu.int/en/ITU-D/Statistics/Pages/ (accessed, 08/05/2016)


A. THE ROAD TO MOMBASA
Speculations on the resulting textured and heterogeneous field of urban fabric that will emerge from the combination of these various types. A key reference for this is Nairobi's own Kibera district. This is the largest slum in Africa characterized by extreme overcrowding and a perennial lack of basic services. But in spite of this, borne out of grassroots movements and a multitude of NGO groups, the district offers schools, clinics and market places along with innovative models for communal organic waste disposal and shared cooking facilities. All of which is organized in a manner that is generally referred to as 'informal'.

B. NORTH EASTLIEGH EXPANSION
Historically, modernization has been associated with centrally planned, well ordered efforts, and reflexively design thinkers tend to associate informality with traditional, or backward societies. I argue against this assumption, with the claim that densely interconnected, distributed networks of power can be more adaptive and dynamic in ways that are inherently better suited to the developmental needs of the urban poor and the neighborhood scale.

C. DIRT ROAD GRID
Sholmo Angle from the Stern Center proposes a simple 1km grid of dirt roads forming an arterial network that can support self-organized settlement. Later, these can serve as conduits for infrastructure and basic services such as electricity and water. This territorial scale expansion project is what he calls the 'making room paradigm'.

D. NAIROBI NATIONAL PARK
Nairobi itself faces many of the same developmental challenges confronting most large African cities - extreme population growth, weak industrial and manufacturing sectors compounded by the limited authority of local government and a complex network of urban actors and power structures borne out of a checked past.

E. BLUE ZONE
The United Nations has four global headquarters based in: New York, Geneva, Vienna and Nairobi. The Gigiri estate in Nairobi is also home to the two UN bodies which deal directly with urban design and the quality of our environment: UN Habitat and UN Environmental Program or UNEP.
STAGES OF PROJECTS

COMMUNITY PARTICIPATION

GRID OF DIRT ROADS

PROGRESSIVE SETTLEMENT DISTRICT
In 1862, the United States established a law which would open up millions of acres of land to its population. In order to qualify for a plot of land, which was in most cases free or nearly so, a citizen had to be committed putting the land to productive use - usually through farming. The Homestead Act, was also a mechanism to encourage the settlement west of the Mississippi, reshaping the country. And since 1862, many different versions of the law were used with various spatial intentions right up until 1976 within the 48 contiguous states and until 1988 in Alaska. The land reform endeavor was inevitably exploited. Families worked together to seize disproportionate swathes of land and built large estates. Conspiracies of Cattle Barons would gain control over key water resources in an area and close out the competition. But on the whole this project, spanning a century highly instrumental in shaping the entire country, housing a population and putting people to work in largely self-determined ways.

The Progressive Settlement District (PSD) represents a regional project that employs similar tactics to the American homesteading movement on a smaller scale and shorter time-span with regular feedback and frequent re-calibration. The district is defined by a combination of form, process and
regulatory controls. Preconditions of the district and parameters for future development secure certain outcomes while allowing for a large degree of indeterminacy.

Mega-blocks in the PSD are made available to settlers in a carefully planned sequence. Shown in the 'Time Triggered Development' drawing – the whitest blocks are opened first. As each of these reaches a minimum density adjacent blocks are opened to the public. Promoting compact growth helps to incubate the privately run operations geared toward service delivery. These are discussed later.

The *Structure and Infill* paradigm championed by John Habraken⁷ and still employed today by Alejandro Aravena is at play here. Aravena, speaking about his incremental housing scheme, claims that the role of the designer is to take care of precisely the things that the general public are not equipped to deal with themselves while leaving room for the rest to be filled in by the end user. In the PSD, the base structure is a grid of dirt roads forming mega-blocks of 1km squared. And within each mega-block, two reserves. One for flood risk mitigation coupled with future civic functions. The other for waste management, small scale manufacturing, trade and local logistics. The infill is housing, defined by group settlement typologies featuring self-built houses and amenities.

The entire district is conceived of, planned and initiated by the central government. In terms of the participatory framework, the structure component is completely out of community control, hence beginning at the top right of the framework diagram. As new residents move into the settlement district and communities are formed, they are able to weigh-in on future development and are de facto authors of the intra-block city-space. Over time, stewardship of the PSD shifts over to the residents.

On 114km2 over a 35 year period the district is big enough to make room for a projected increase of seven million people over the next 35 years. The district is close enough to the city center to be accessible via bus or matatu and potentially a Bus Rapid Transport network in the future. The SDD materplan shows this transport route in orange. One major route forms the backbone of the development. It connects two highways into the city: the A101 (road to Mombasa) at the Southern boundary and Kangundo Road to the North. The land mass is hemmed in by rivers on three sides. The site is immediately adjacent to the Jomo Kenyatta International Airport and a mix or heavy industry and medium size manufacturing enterprises with the Nairobi national park framing the Southern edge. Development within the physical bounds of the site (rivers and highways) has already begun on two counts. These are marked in orange of the masterplan. In the South-Western corner, a low-density housing development 'Syokimau' is underway supplying middle-class residents with dwellings conveniently close to the airport. On the Eastern edge, the 'Mlolongo' informal settlement has formed adjacent to a slew of industrial buildings. Both of these cases suggest that the area is ripe for habitation – with relatively good access to the city, employment and nature.

MEGA-BLOCK

The mega-block is a single, repeated urban element defining the Progressive Settlement District. It results from the grid of dirt roads outlined in the previous section. This section describes how the contents of the mega-blocks and their relationships depart from, or augment Shlomo Angel's work. Angel's 'grid of dirt roads' focuses on securing a minimum standard for accessibility, housing prices and green space in largely technical terms. The design of the mega-block shown here sets the stage for development of civic spaces, productive centers, engines for self-maintenance and environmental safeguards which only come to fruition within a given socio-cultural context. In-line with Angel's conception, these begin as no more than parameters, or infrastructural thoughts. There is no capital investment beyond securing the land in the first stage. Only after settlers have arrived, communities are established and industrious people get to work the reserves are galvanized by activity and hard infrastructure can be invested in. Then these spaces can be built out. First the space is reserved; through inhabitation and use it gains cultural meaning and finally that meaning is crystallized in built form.

Every mega-block begins with two reserves. The reserves dramatically reduce the environmental footprint of
development. Solid waste produced within each block is recycled, reused or stored in perpetuity. Similarly, storm water and urban run-off is dealt with on site. Thus in urban metabolism terms the outflow of the system is dramatically reduced. This principle allows for rapid multiplication of mega-blocks without concern for a greater environmental impact. Communities that maintain either of their facilities particularly well could in fact begin to import waste or other by-products for profit. Each cell tends towards autarky without precluding productive exchanges between cells.

Staking out the reserves serves a ceremonial role. It announces that the mega-block is open for settlement. The two reserves are staked out as a circle and a square.

The circle is a meeting space, a formal reference to a settlement pattern favored by the Rendille people. A central circle called a Nabo, was a place where only elders were permitted to meet. Here they would discuss recent events, hold discussions and make important decisions or hold prayer, all with the expressed intention of shaping the outcome of the tribe at large. It could also be used as a space to receive guests and hold formal ceremonies. Thus the circular reserve is a proto-civic space. A space of collective discussion, a place of democratic protest, public celebration. This civic, administrative program is coupled with an environmental concern. The entire city of Nairobi is affected by multiple occurrences of flash floods every year. Poor drainage and storm water management is directly
linked to numerous fatalities in every instance. The most recent instance of flooding occurred while this project was underway, between April 29 and May 2, more than 16 people died and 75 went missing within the city due to flooding. So the circular reserves double as small retention ponds within each block. This mitigates the risk of flooding by dispersing rainwater rather than allowing it to accumulate over a large surface area. The maps presented below demonstrate how a digital elevation model of the local topography was used to determine slope direction and generate a flow accumulation model for every 1km cell within the entire Progressive Settlement District. From this, the position and size of each reserve is calibrated for each mega-block. The pond is located at the lowest point of each cell. If the area is likely to collect more water, the pond is bigger. Adjoining cells that receive large amounts of water are grouped together forming green corridors.

The square reserve begins as a dump site for solid waste. Tied into a network of private or contract waste collectors. Waste collectors operate with hand-carts, rickshaws or bicycles to perform door-to-door collection for a small fee. The dump site is quickly expanded to accommodate sorting spaces for junk dealers. Material then moves down stream to recycling units or temporary storage, then into small scale manufacturing operations, things like sheet metal and timber go directly into pre-fab home building while plastics are crushed, dyed, dried and resold. A productive urban corridor is formed, sprouting
COMMUNITY ALLOTMENTS

PLANTED EDDIE RETENTION POND

ADMIN BLDG + CIVIC SQUARE

CLAY PIT

SOCCER PITCH

GREEN INFRASTRUCTURE TYPES
from the initial square reserve. In particularly successful cases, the goods (re)produced here might go directly into a market place thus closing the loop of a material’s life-cycle. An economist would be likely to predict that since this is driven by market based competition, each respective reserve would seek to gain an advantage over adjacent cells through specialization. This would lead to a complex web of interdependence across the Progressive Settlement District.

So as the Mega-blocks or ‘cells’ propagate, dramatically different iterations will emerge from cell-to-cell. There are inter-cellular trade offs to be made. For example if an area is prone to less rainwater, the reserved void could become an active a civic space. If faced with widespread delays in municipal infrastructure the most entrepreneurial neighborhood’s will attract more residences with robust, distributed self-organized systems for service provision.
Waste Re-use: Start-up and Development Plan

Value created from waste establishes a private market for door to door collection. Involvement at a municipal level establishes the core recycling units and allows space for private expansion.
Waste Re-use: Building types, Actors and Processes

Waste is collected or off-loaded then sorted and salvaged. Materials re-enter the commodity market, either through immediate re-use or by after various recycling processes.

a. baling & crushing

b. cleaning and dying

c. comprehensive manufacturing

d. crushing

e. pre-fab construction

f. ad-hoc storage

g. rental storage

h. mass-storge

i. sorting for recycle

j. salvaged for re-use

k. co-ordination & logistics
STAGES OF PROJECTS

COMMUNITY PARTICIPATION

INITIATE | PLAN | DESIGN | IMPLEMENT | MAINTAIN

None

Direct

Consultative

Shared Control

Participatory

DISTRIBUTED SERVICES
The housing settlement process is entirely citizen-led. With the gridded super-structure protecting access to trunk infrastructure, the urban fabric within each block it largely unspecified. It is open to emergent organization and natural growth. Research by Laure Criqui on informal settlements in Lima, Peru documents a pioneering approach to the provision of basic urban services. This serves as a precedent for how utilities are supplied to irregular, unplanned neighborhoods. After describing the mechanisms behind the Lima case, this section will discuss how the process can be leveraged by designers and planners to ensure minimum standards are adhered to while allowing for maximum indeterminacy.

Criqui’s research in Lima documents the provision of water pipes, taps and household connections as well as electricity lines and street lamps in a neighborhood that was traditionally unplanned and once considered illegal - a squatter settlement. Lima has a history of progressive approaches to housing design and policy. In the seventies, without a master-planned vision, the state promoted self-build housing as championed by John Turner. This lead to extensive peri-urban growth.

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1. Arrival

2. Settlement

3. Occupancy Certificate

4. Access to Utilities

5. Mortgage; ownership

HOUSING AND TENURE PROCESS
of entirely unplanned, and irregular settlements. Through progressive legislation however, residents are now able to access basic urban services and take steps towards securing tenure. With as many as 60% of some urban centers in Africa housing residents informally, it is a process that these cities will have to take on too.

Two tools Criqui's study places importance on are map generation and road preservation. A group of residents seeking connection to the cities services first solicit a surveyor. The surveyor creates a map of the group's houses, the nearest road and service connection points. This document is then used by the residents to apply for a municipal connection. The municipality pieces these surveys together incrementally. Over time they have accumulated to form a masterplan of the area from the ground up. Upon receiving the survey the municipality grants the residents with a certificate of occupancy. This offers a great deal in terms of security of tenure. Soon after, a utilities firm is dispatched to install pipes, poles etc.

Both the surveyor and utility firm are private actors, probably residents of the same town. The states role here is simply to enact a new policy, collect plans and contract the work out. Once services arrive at a housing group they are metered and paid for by the residents, allowing the city to eventually recoup the initial costs. Like Angel's model, this process starts with settlement and allowing people to arrive in a city and ends with a complete build-out; connection to services and ultimately the collection of taxes.

The Progressive Settlement District invites new arrivals like those in typical informal settlements who are incentivized to build within certain guidelines in order to qualify for connection to the city's utilities network and eventually secure tenure. Here the process resembles Criqui's study with additional guidelines serving either as pre-approved surveys to streamline the process or as a minimum standard, like traditional building codes to ensure a healthy, safe and productive use of space. The each settlement type includes:

- Water connection, or shared tap.
- Run-off canal or stormwater.
- Adjacency to a road
- Waste collection
- Recycled materials
- Toilets
- Communal cooking or commercial space.

As with earlier design moves, these guidelines place an emphasis on codifying space and reserving it for specific uses. Process precedes build form. Any settlement type could has a vast combinatorial possiblity-space. The settlement permutation image shows a small selection of housing cluster layouts possible within a single guideline. Ultimately, this suggests that the variations within each type and adjacencies between types are endless. The resulting urban fabric will be a manifestation of myriad micro-interactions and personal negotiations on the ground. Personal, family and community narratives writ large across the streets of each new tract of self-build housing, capturing and crystallizing the urban-rural migration as a celebration of urbanization phenomenon rather than the de facto criminalization that new arrivals face today. Drawings of the final urban form at the scale of these housing clusters from here on

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is purely speculative. They attempt to capture the tension between the guidelines imposed, based on highly optimized precedents, tending toward orthogonality and repetition and the irregular, organic fabric found in Kibera and most informal settlements in the global south. The Growth Speculation drawings series below show these two extremes within the a single mega-block. These account for settlement over time and internal forces like the Material's Center and Civic-Space reserves. A third iteration considers how desire lines or links to adjacent blocks could influence growth. And how accretive development might adopt new patterns or favor different settlement types over time. These drawings only begin to unpack the complexity that might result from the given constraints of the Progressive Settlement District. Synthetic drawings in the concluding chapter take these speculations a step further showing how the various settlement types might interact over time within the proposed regulatory framework.
IN-SITU UPGRADE: COMMUNITY LEAD RE-BLOCKING
GROUP SETTLEMENT TYPE: MUD & STICK CONSTRUCTION

Mud + Stick construction of eight homes with basic services. Houses 40-50ppi. Net Density: 0.025p/m²
GROUP SETTLEMENT TYPE: METAL / FRAMED CONSTRUCTION

Metal Sheeting + Framed construction of ten to twelve homes. Houses + 36 ppl. Net Density: 0.05p/m²

52m [maximum] 8m [min]

RUNOFF CANAL

S T R E E T

M - Material Drop W - Water Connection
C - Communal Cooking D - Drainage
T - Toilet R - Recycle + Waste
GROUP SETTLEMENT TYPE: CORE HOUSE

Masonry construction of twelve homes. Houses +36ppl. Net Density: 0.038p/m²

M - Material Drop
C - Communal Cooking
T - Toilet
W - Water Connection
D - Drainage
R - Recycle + Waste
GROUP SETTLEMENT TYPE: INCREMENTAL

Masonry construction of sixteen homes. Houses +64 ppl. Net Density: 0.037 p/m²
GROUP SETTLEMENT TYPE: WALK-UP APARTMENT

Concrete framed construction of ten to twelve homes. Houses +30ppi. Net Density: 0.05p/100m²

M - Material Drop
C - Communal Cooking
T - Toilet
W - Water Connection
D - Drainage
R - Recycle + Waste
CONCLUSION

Like a tissue sample from a living organism, the tract of urbanity in the image below is only a small part of a larger whole. One mega-block is shown here. Each block across the entire Progressive Settlement District would be different. Differentiation is built in from the top down, in the Pond sizes and the natural predisposition of each of these – how much rain water they can expect to receive and how they are positioned within a larger green corridor. From the ground-up, once communities move in and begin to compete for business, tenants or cultural cachet a rich tapestry of human dramas is written into the street patterns and social spaces.

As a whole the thesis project has presented a range of interventions across scales, working in concert, to imagine an alternate mode of development in the African context – a mode of development that embraces diversity and radical inclusivity through a tendency toward self-sufficiency and autonomy requiring minimal capital investment with long-term, environmentally sustainable outcomes.
G7 - Nabo Pond

The circular shaped reserve common to each mega-block, in this instance remains a public open space surrounded by housing clusters. This would be where new arrivals would meet with local leaders – official and informal. Houses fronting onto the proto-civic space would most likely be occupied by these community leaders. As the negotiation space and interface with larger governing bodies this would be a space for community meetings or public protests. As an administrative center, some of the surrounding buildings would be occupied by businesses ancillary to the housing process. For example: the surveyors mentioned in the previous chapter. At the Southern edge of the pond a larger building suggests that this might be the site for iconic structures or symbols of collective power and progress.
This instance of the waste and recycling reserve common to all mega-blocks is a substantially developed materials processing center. Several tiers of sorting-salvage, processing, up-cycling and manufacturing extend down the primary access route. Although it does not culminate in a market as shown in earlier iterations. Here we see un-certified housing which one could assume is occupied by some of the poorest members of the community working somewhere along the production line; seeking out a meager living while they strive to gain a foothold in the city.
H0 - Incremental Housing Clusters

Sites along arterial roads are most likely to be settled first. The neighborhood shown here with the darkest shade is in a late stage stage of development. Re-blocking efforts, in partnership with a private investor are most like behind these incremental housing clusters.
A1- Core housing and Early Incremental Model

A public-private-partnership project using pre-approved Core Housing settlement type. It is the most optimal use of space for single story buildings on a flat site. Here over 400 units are provided by a government funded initiative. These larger scale projects are negotiated with the existing community and typically involve additional benefits like reserved open land [see. A1.] or publicly funded schools.
D1 - Uncertain Outcome

If the informal has come to represent a certain failure of the current system, it is essential to imagine how a new system might fail, or how those living outside that paradigm end up. The right of this frame we see housing clusters with certified occupancy (shaded); to the left, less organized overcrowded groups of houses that still exist without secure tenure or legal recognition.
Blue water tanks store water drawn from underground aquifers and distribute it to nearby buildings. This form of service provision operates autonomously from the central system of fresh water piped in from distant lakes. Each node of this distributed system operates like a small business. Detailed description of how this might work is described in the appendix. They are most likely run by somebody (or a communal group) who has already gained occupancy in the area. Group Settlement Types that are shaded-in on the map indicate that these people have received occupancy certificates. At the Southern extreme of the map a building shaded in red indicates a public latrine and bio-gas/composting facility. There is precedent for this too in the case studies. Houses in this general area are mostly without formal recognition or legal tenure. As such they are yet to receive formal infrastructure.
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APPENDIX: CASE STUDIES IN URBAN AUTONOMY

“What will be remembered about the twenty first century, more than anything else . . . is the great and final shift of human populations out of rural, agricultural life and into cities. We will end this century as a wholly urban species . . .

The last time humans made such a dramatic migration, in Europe and the New World between the late eighteenth and early twentieth centuries, the direct effect was complete reinvention of human though, governance, technology, and welfare. Mass urbanization produced the French Revolution, the Industrial Revolution and, with them, the enormous social and political changes of the previous two centuries. Yet this narrative of human change was not to be found in the newspapers of the 1840s or the parliamentary debates of the early twentieth century; the city-bound migration and the rise of new transitional urban enclaves was a story largely unknown to the people directly affected by it. And the catastrophes of mismanaged urbanization –the human miseries and revolutionary uprising and wars- were often a direct result of this blindness: We failed to account for this influx of people, and in the process created urban communities of recent arrivals who became trapped, excluded, resentful. Much of the history of this age was the history of deracinated people, deprived of franchise, making urgent and sometimes violent attempts to gain a standing in the urban order." (Saunders, 2010: 2)

Transitional urban enclaves, as Douglas Saunders calls them, have been around for as long as there have been cities. Squatters and informal entrepreneurs are most concretely characterized by those that fall outside of the formal, legal system – they don’t own or rent the land they occupy nor pay rates or taxes. Unrecognized by the law, these people are often criminalized and forcefully removed. Without secure legal tenure, people in this situation are left without basic human rights.

Ad hoc dwellings, self-organized to accommodate rural-urban migrants offer new arrivals a chance to set foot on the economic ladder and hoist themselves upwards. In this sense, one could argue that slums serve a vital role in incorporating millions of people into cities who would otherwise have no way in. Industries benefit, somewhat cynically, by having a large, mobile pool of labor to draw from. Camps usually take hold in unwanted land – steep embankments, wet-lands, road reserves and administrative fringes. They expand accretively, densify and compound building efforts. Communities can dig drainage trenches and pirate electricity. But access to other services is haphazard or absent.

Fresh water, sanitation, waste management, energy and transport all constitute basic urban services. Without these urban landscapes become treacherous environments – clogged up, starving and desperately unhealthy. Traditionally, central governments consider these services the utmost highest priority when planning cities. The goal is to establish a safe, healthy environment for humans to trade, learn, reproduce and flourish. In recent decades however, as urban centers of the Global South have often failed to realize this.

Slums existed in first major migration into cities Sanders describes above. This is estimated to have effected roughly 15 million people in the global north moving over a two hundred year period, from the 1750's to the 1950's. The 'second wave' of urbanization, currently underway in the Global South will involve over 300 million in half the amount of time. By 2030, Edgar Pieterse estimates that a population of 3.9 billion people would have moved into urban agglomerations in the Global South. The numbers are so staggering that it is easy to comprehend why demand for urban services has outstripped conventional state mechanisms for urban development. The world is faced with a wholly new problem that will not be solved with tools and techniques from the eighteenth century. In a bid to examine new modes of urban development, and the provision of basic urban services, this paper considers three cases where citizen groups have taken charge of the task.

In 2011 while an organized Egyptian populace ejected their president, Hosni Mubarak, another grassroots movement was just beginning. This one was reshaping city's built form rather than a political landscape. In the three months directly after Hosni's resignation the residents of Al-Mu'tamidiya constructed four off-ramps connecting their local road network to Cairo's ring-road. The ring-road circles Cairo and provides road access to the entire city. Unplanned and cut off from the city at large, Al-Mu'tamidiya had been neglected by central government for years. Poor connection to the city means residents can't commute to better jobs in surrounding areas, thus suffer financially. Moreover it limits shared resources like police presence and fire-fighter response time effectively absolving the city if its responsibility. Deprived of their rights, the residents felt as though they had no choice but to see to their own needs. Here spatial agency and political resistance conflate in a way that would make David Harvey proud. These residents have claimed their 'Right to the City' by forcefully including themselves. One could argue however,(and Justin McGuirk does) that they

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2 "Edgar Pieterse: How can we transcend slum urbanism in Africa?", 2014, video recording, UN-Habitat worldwide.
shouldn’t have to.

Amid the tech explosion of the internet age, phenomena like peer-to-peer sharing, distributed systems or decentralized networks have been the subject of much excitement in the Global North (Napster, Uber, AirBnB, Twitter). Similarly talk of citizen agency or DIY-city making has become a staple of Architecture exhibitions and urbanism conferences. Sadly, these radical notions tend to manifest in merge community gardens, temporary ‘urban farm’ allotments or flimsy pop-up kiosks. They fail to make an impact on a larger scale.

The paper examines three cases of self-organized service provision in a context of rapid urbanization. Critical consideration in each case will be given to how the projects are able to reproduce, what sort of a public results out of these collaborative efforts and the nebulous legislative pre-conditions for intervention. Before returning to Al-Mu’tamidiya’s community work, I will describe a water provision network in Bubeneshwar, India then a public toilet and sanitation system in Tema, Ghana. While matters of land occupation or local sovereignties are inherently political, I will avoid of discussing the movements as acts of resistance. Similarly, framing poor living conditions as crises or human tragedies is beyond the scope of this study. The intention is is unpack the working relationships underpinning each scenario with an eye on how they might be folded back into the standard approaches to urban development.

**Bhubaneswar**

Bhubaneswar, the capital city of India’s poorest state, Odisha, with the largest percentage of rural inhabitants is industrializing. The state will soon be home the world’s largest Steel plant⁵. Growth in Bhubaneswar has outpaced administrative capacities and spread far beyond the humble city plan from 1946. Along with Jamshedpur⁶ and Chandigarh⁷, Bhubaneswar was one of India’s first planned modern cities. The ‘New Capital’ was designed by German architect Otto Konigsberger to celebrate India’s independence and serve as a model city. It took the form of a rational curvilinear grid that kept growth tightly regulated up to the 1970’s⁸. Explosive growth lead by the economic liberalization of the 1990’s saw over 300 slums emerge across the city. The largest, Saliasahi, houses an itinerant population of over 150, 000⁹ which equates to roughly 40,000 families. Figures from Bhubaneswar's

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5 TATA steel at Kainganagar.
6 TATA steel headquarters and flagship steel city named after the corporations founder, Jamsetji Tata.
7 Celebrated modernist new-town project by le Corbusier.
9 Ibid.
Public Health Engineering Dept. (BPHE) show that only 59% of residents within the metro area are covered by the formal system. That leaves a large part of the population to fend for themselves. Unlike other Indian cities, water-tankers are rare here. So those who fall outside of the BPHE network source their water predominantly through bore-wells. In Saliasahi alone, there are an estimated 4,000 bore-wells. That's one for every ten families. Since some are built into single homes the number of homes relying on any one well varies from ten to fifty.

Drilling is relatively easy. Ground water can be found 10-15m. That water is then pumped into a raised storage tank and gravity-fed to nearby houses connected via above-ground pipes. After the initial cost of the bore hole the other major expenses are electricity to run the pump's motor and typically one person to man the pump. Since no permit is required to drill bore holes there are few limitation on the spread of this method. But at the same time, there are few government records accounting for the operation. It is entirely legal yet remains informal in the sense that it is invisible to the law.

There are three business models: The few that can afford it create their own wells and use them for personal ends. Then there are entrepreneurs who invest in a well and sell off water in bucket-loads or charge neighbors a monthly fee to connect. Third, residents cooperatively finance and manage a community well. In the latter two cases the wells are centrally located in shared open spaces. While this may seem purely practical, or a matter of happenstance, it is important to note that the tanks are also the tallest structures in most parts of Saliasahi lending an iconic presence to the environs.

Although the system is effective and organized, it is entirely heterogeneous. Monthly tariffs, subject to bargaining and negotiations, range from INR 50 to 300. The number of connections per well varies

10 These also present a wide array of complex social and business interactions.
as members move in and out of the community. Relationships are not purely business orientated since many of the newcomers are family members or from the same original rural community. One can imagine that a household might be switch to another provider if the rates are too high or unfavorable for other reasons. The system self-orders, re-articulates and reproduces itself governed by both social relations and market forces.

**Tema**

Shortly after Bhubaneswar, Otto Konigsberger began another World Bank funded project with fellow tropical modernists, Maxwell Fry and later Jane Drew. Together they drafted the first plan for a new town in Ghana in the early 1950s. This iteration of the *Tropicalist* ideals drew from the garden cities movement in Britain at the time and repeated the same curvilinear street patterns and healthy allocation of green spaces. In reaction to the alienating early modern town plans Koenigsberger, Fry and Drew earnestly hoped that a sensitivity towards native practices and local climates could incubate enthocultural diversity.

The port city was part of a the Volta river project setup by the UK in 1951 during Ghana's transition towards self-governance. Like Bhubaneswar, it was intended to trumpet a newfound independence and lead the nation into the modern, global world but, caught in a complex geopolitical struggle, the project was fraught with missteps and setbacks. Various stakeholders included: the World Bank under the auspice of aiding industrial growth; Ghana's first president and pan-African leader Kwame Nkruma; the UK government hoping to exploit natural bauxite deposits as it withdrew its colonial rule; local villagers and fishing community; the Tema Development Corporation; the architects Fry, Drew, Konigsberger and later Constantinos Doxiados. Michelle Provost posits a that Tema and a slew of new towns in the developing world were influenced by an undercurrent of cold war tensions at this time. Rosemary Wakeman sketches out a field of political uncertainties where Doxiados' pseudo-scientific, apolitical approach became the most palatable for all parties which ultimately put him at the helm of the mater plan. His *Ekistics* framework was soon deployed along with a reckless assumptions about of social engineering which carefully calculated and conceived of the extravagant

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11 Note – from a field work in the Kalinganagar area, I observed a similar pattern of shared well + tank in many small villages.
dynapolis. A new town for 100,000 people replete with luxury hotels, theaters, superhighways and all the trappings of a global city. As with all modernist efforts, the new world necessarily marginalized and displaced an existing population. In this case the 10,000 odd villagers that had lived in Tema were to be resettled across the lagoon, a short way away. Here Fry and Drew reappeared to design the 'Tema New Village'. The rhetoric was “to allow the villagers to keep their own identity while improving living conditions.” which translated into gender segregated dormitories and housing clusters of building shells without electricity and shared toilet facilities. Ad hoc building extensions driven by endemic overcrowding has completely changed the appearance of the village known today as Tema Manhean. Yet the public latrine as an urban element has survived.

Chaflin's "Public Things, Excremental Politics and the Infrastructure of Bare Life in Ghana's city of Tema" tracks this element's role in public life as the relationship between user, manager and profiteer metamorphs into a familiar neo-liberal format. While the Tema Development Corporation managed the city-proper as an lucrative enterprise, Tema Manhean was administered and readily neglected by the local municipality. This state of neglect continued through the 60's and 70's until a populist revolution in the early 80's galvanized communities and neighborhoods. While the People's Militias and Community Defense Community took up arms, neighborhood samaritans lifted hoses and mops to rehabilitate the latrines. In this arrangement the buildings were cooperatively managed and maintained by the residents. In most cases they were organized into the neighborhoods or housing clusters that Drew and Fry had originally allocated. This was sustained until 2004 when the New Patriotic Party (NPP) rose to power under John Kufuor eschewing state populism in favor of the free market and no-liberal ideals. In this configuration the latrines are rented out, prices are fixed and operators are contracted to manage the business. Entrepreneurs compete for contracts and oversight is by the same Tema Municipal Assembly. Here the labor associated with service provision is shifted onto private actors while the state retains ownership and collects profits from the entire toilet stock.

Back towards Doxiados' carefully planned vision in the present day, a squatter settlement has taken hold in a juristical interstice – a wetland dubbed Wastelandia. A mutation of the public latrine is repeated here in an absence of the state. 'M', a self-styled benefactor builds a larger-than-usual latrine

complex which he runs as part-business part-community hub. His complex later expands with a boarding house cum-homeschool for impromptu lessons for local children taught by 'M' himself and later a bio-gas system that converts human waste into compost and gas for cooking.

Chaflin characterizes the Tema Manhean latrines as a domesticated public space; they were centrally planned and built yet used for intimate practices. While here the space is social it has disengaged from the national or the civic. In that sense, not wholly public. Unless we consider Wastelandia as an autonomous micro-nation. A far more plausible is the reading of M simply as an entrepreneur. He has invested in infrastructure and charges a fee for a service. He is kind to the clientele and recycles to maximize profits, which he doesn't speak of. By the Tema Manhean model, the venture is lucrative but requires a connection to a sanitation network. M, skirts this issue with the bio-gas digester and discharging minimally into the wetland.17

If the latrines are taken as public spaces as Chalfin clearly paints them18. The skeleton of this public was imagined by Fry and Drew under the auspice of levelheaded sanitation provision. It existed first as a state creation, then self-organized social movement, later as clientele with state as service provider until M's creation where jurisprudence, market logics and social network are supplanted by a fluid set of asymmetric interpersonal power relations within a wholly discrete system. Radical autonomy comes to members of this social group with insecurity and risk of exploitation. This iteration shows the most promise in terms of being able to repeat itself, autonomously. Although a problematic model for creating a larger society, it does not preclude the possibility of being regulated, and reeled back into the rule of law.

Cario

Over sixty percent of Cairo's 16.7 million residents live informally.19. This population of 'shadow citizens' amounts to a mega-city in its own right.20. When thinking about informality in Cairo, it is instructive to leave behind visions of tin roofs and pirate electrical wiring. The dominant housing type here is a four-to-five story walk-up apartment block built with exposed bricks and structural concrete frame. These propagate across vast tracts of the city's outskirts, many under construction or half built, making palpable the breakneck rates of urbanization defining Cairo today.

17 Note: wetlands are naturally capable of filtering human waste and waste water, extracting nutrients and returning them to the ecosystem.
18 Ibid. 15.
20 Megacities are defined by a population over ten million.
The 72km stretch of six-lane beltway circumscribing Greater Cairo was conceived in 1970. Most of the construction took place in the mid-80’s under Mubarak’s rule but is yet to be completed to this day. The infrastructural mega-project was intended, like all ring-roads, to contain city sprawl while simultaneously providing access to those at the outer-limits. A recent study by Cairo Laboratory for Urban Studies, Training and Environmental Research (CLUSTER), maps out ad hoc interventions along this highway. They note numerous piles of tires indicating auto repair shops, minibus stops and tea stands in proximity pedestrian sitars. Some of these stairs are community built foreshadowing the Al-Mu’tamidiya off-ramps. CLUSTER’s online publication describes how the temporary evacuation of state presence and law enforcement gave rise to a various new modes of informal urban intervention. And how the gradual return of power has come with negotiations over how space is used.

In an interview with al-Mu’tamidiya community leader Mr. Abdel Nasser Abu MusaN claimed that the entire community was mobilized to complete the project. Folks pitched in with cash, labor, expertise or the loan of equipment as they were able to. Coming in at an estimated one million Egyptian pounds (roughly 100,000 USD).

While the construction took place in a time of popular protest and political upheaval, it is not so much an act of resistance as much as an effort of remedy the disenfranchisement that produced social unrest. Ideation for the project began well before the 2011 protests but the window of instability


23 Ibid. (Interview conducted by Omar Nagati and Beth Stryker)

24 Ibid, 18.
offered an opportune opening. Post-construction negotiations between Mu-tamidiya’s leaders and concluded with the Governor of Giza inaugurating the project thereby incorporating into the city as an official piece of infrastructure. It is unlikely that reimbursements were made, but to underscore the district’s inclusion into the city’s jurisdiction, a police kiosk was setup in the cleared area below the highway. In case of Bhubaneswar, waster supply was taken care of in a similar type of spontaneous self-organization and also offered clear steps toward being incorporated by the state: ledgers kept by the pump attendant could serve as meter's for managing a water usage and costs. The work can be contracted to the individual water suppliers by the municipality. In one of the many iterations of the latrines in Tema Manhean, this was the case. Services are run by private operators under contract from the state – but in this case the contractor was only incentived to cover from areas that were able to pay the most. Perhaps the most pertinent similarity in successful efforts was the social bonds that galvanized action – from a community of 10 0000 people, building with concrete and power tools or a handful of families digging a well.

References


APPENDIX: PARTICIPATORY PLANNING
FRAMEWORK DIAGRAMS

Action Planning is a set of ideas around participatory planning developed by Nabeel Hamdi and Reinhard Geothert. Together, they developed a notation for describing the level of participation at each stage of a project. This is best understood through archetypal modes of engagement described in the diagrams below. These diagrams were re-drawn after Hamdi and Goethert’s. These are used throughout the thesis to record the amount of public participation at each scale of intervention and work towards making an argument in favor of participation used strategically to empower people on the ground.

see:
STAGES OF PROJECTS

A MODEL FOR PARTICIPATION¹ (N.HAMDI + R.GOETHERT, 1997)
STAGES OF PROJECTS

INITIATE  PLAN  DESIGN  IMPLEMENT  MAINTAIN

COMMUNITY PARTICIPATION

COMMON PERCEPTION OF PARTICIPATORY PROJECTS
STAGES OF PROJECTS

INITIATE  PLAN  DESIGN  IMPLEMENT  MAINTAIN

COMMUNITY PARTICIPATION

PARTICIPATION IN A TYPICAL PROJECT
STAGES OF PROJECTS

INITIATE  PLAN  DESIGN  IMPLEMENT  MAINTAIN

COMMUNITY PARTICIPATION

EMERGENCY RAPID RESPONSE
STAGES OF PROJECTS

COMMUNITY PARTICIPATION

PRO FORMA DEFERENCE TO PARTICIPATION