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Quiet Encroachment and Spatial Morphologies in Jallah Town, Monrovia, Liberia

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Quiet Encroachment and Spatial Morphologies in Jallah Town, Monrovia, Liberia

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Abstract

Quiet Encroachment and Spatial Morphologies in Jallah Town, Monrovia, Liberia

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Abstract: This paper will build upon the idea that informal settlements communities develop characteristic spatial morphologies as a response to outside forces. By understanding those forces and the resulting use of space, in particular public spaces, we can develop more appropriate urban design and planning interventions based in local realities. I begin by presenting the urban theories of Christopher Alexander and Bill Hillier, which provide analytical tools for understanding public space morphologies and the uses of public space. I then introduce Asef Bayat's concept of *quiet encroachment* to more fully theorize the characteristics of public space as a response to the outside forces, in particular as an informal means of claiming space and rights to the city. Finally, I draw on this analytical and theoretical framework to analyze public space in the informal settlement of Jallah Town, in Monrovia, Liberia. I conclude by outlining how these analytical and theoretical tools can be used to further urban theory and international development and planning practice in informal settlements.

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Chapter 1: Introduction

Jallah Town is a small informal settlement with between 5,000-7,000 residents in the heart of Monrovia, the capital of Liberia (Figure 1-2). Like most such communities in Monrovia, residents have settled on what is technically public land in an effort to gain access to the city center, local markets, and public services. Most of the residents have no legal standing regarding the property they have claimed. However, because they have settled in such large numbers in the undeveloped and somewhat hazardous areas of the city, the government has been unable to enforce local building and zoning regulations against them (Williams, 2011).

When Jallah Town was first settled in the 1960s, the people built their homes on a small strip of land to the northeast of downtown, wedged between the base of a cliff and the mangrove swamp, which the city wraps around. This narrow plot was prone to develop and difficult to develop through formal processes. While it would have been risky for a business or government building to be built in such an area, the residents, with their desire to access the city, proved willing to take the risk. As the city grew from roughly 600,000 people in the 1990s to nearly 1.2 million people today (Williams, 2011), Jallah Town grew as well. With the influx of new settlers, most of the solid ground in the narrow strip of land was soon occupied. Desperate for more land, residents chose the only option they felt they had left and began to claim land from the swamp. As they say, they "pushed the water", bringing in gravel, sand, left-over construction material, and anything else they could find to infill the swamp and create their own, new "land."

Figure 1: African continent, with Liberia highlighted in orange.

St. Paul River

Port

West Point

Central Business District

Legislature

Capitol Hill

Jallah Town

UN - Mission in Libera (UNMIL) Headquarters

City Hall

Old Sprigg's Airport

Presidential Mansion

Swamp

Somalia Drive

To International Airport

Monrovia, Liberia
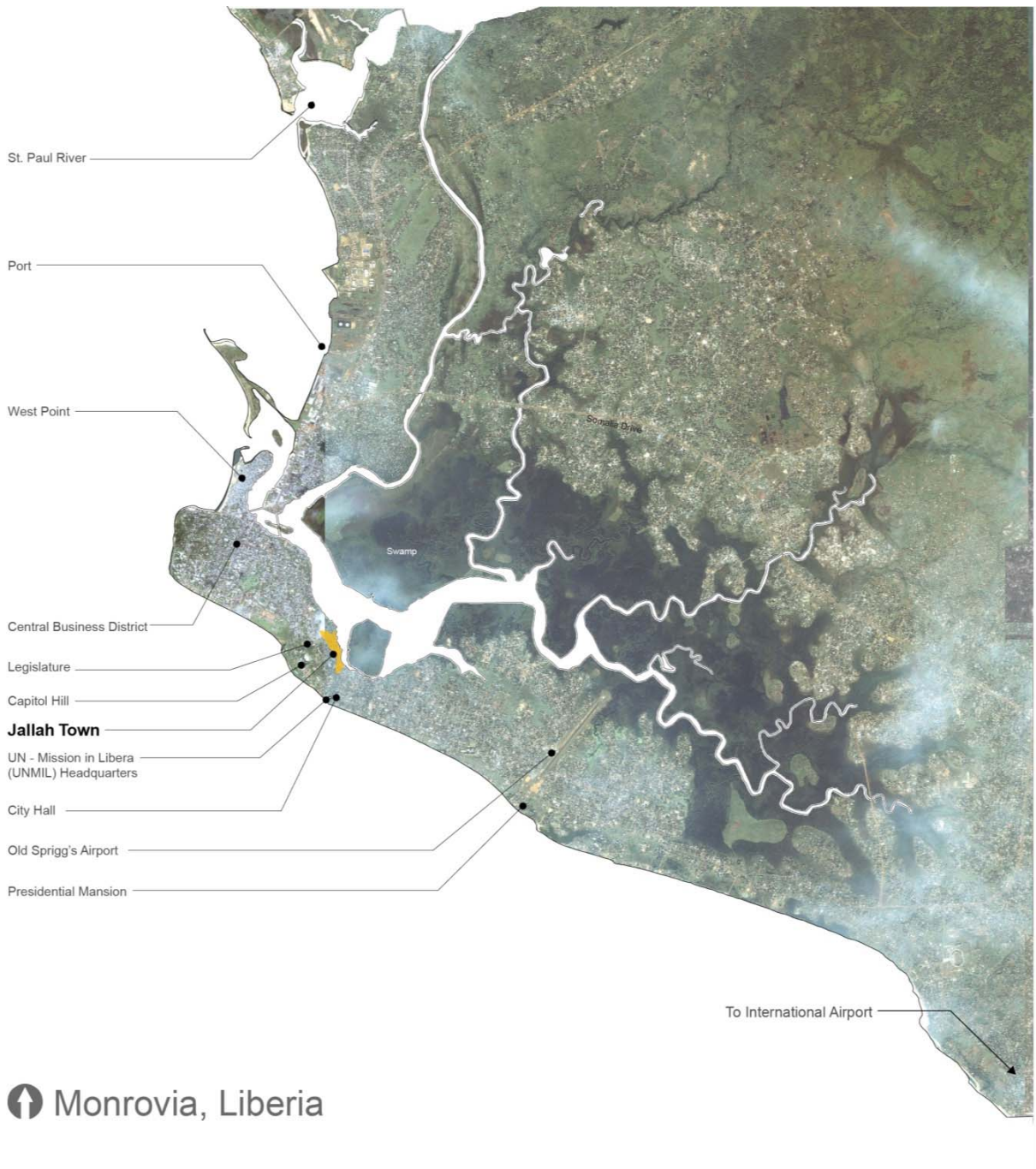
Figure 2: Monrovia, with selected areas noted.

Today, the only reminder of where the edge of the swamp once was is the paved road that runs through Jallah Town: Jallah Town Road. The road serves as a badge of honor to many of the residents, representing their accomplishments and their work to develop their community. To others, the road is a social dividing line. On the older, southern side of the road, the inhabitants live on solid ground and are thought to be better off, as they are more established. On the north and east side of the road, where the residents live on what was once the swamp, the residents often feel as though they are "less than" the more established side.

The community has, for most of its history, existed apart from official rules and norms. Jallah Town has been forced to establish itself in the cracks left vacant by public authorities. The residents have worked hard, in a difficult environment with no state assistance, to carve out their place in the city (Williams, 2011). The government views the informal occupation of public land as tantamount to theft, and most of the residents have no title to the land and are under constant threat of forced eviction (Williams, 2011). The residents are allowed to stay only as long as the state does not need the land. If the land is ever needed, the government may evict residents with little warning or remuneration (Williams, 2011).

Since Liberia is still in recovery from the civil war from 1989-2002, Jallah Town has had to rely, for the most part, on private facilities or on creating their own infrastructure. The community has only one private medical clinic, which is only open part of the day. There are three primary schools in the community, but they are all private and do not conform to the Millennium Development Goals (MDG) of free primary education for all (United Nations, 2013). Fresh water and sanitation services are limited, especially in the areas closest to the swamp. Water from wells that are dug in land

recovered from the swamp is brackish and non-potable. Drinking water can only be purchased at one location, near the service station at the north end of the community, or in small plastic bags. Several water tanks that were built by UNICEF sit empty and unused, just like the community center that was built next to the tanks (Figure 3).

Despite all of these infrastructure challenges, the community elders say that one of their biggest problems is a lack of leadership. A recent community leader was found to

Figure 3: Jallah Town Community center.

have pocketed a small donation of two bags of rice and $200USD from the government donations intended to for the community. The donation would not have been enough to make a great impact, but the theft is an example of how the community has been fragmented rather than united around common goals. In addition, it is hard for me to

understand why such a relatively small gift was given to community of several thousand. It is enough to placate an individual or a small group, but is of little use to even a small segment of the community.

Instead, such gifts to community leaders hurt the ability of the community to advocate for itself. According to the local representative for SLUMDAL (Slum Dwellers Association of Liberia), a subsidiary of Slum Dwellers International (SDI), use such gifting strategies to co-opt rising leaders in the community. SLUMDAL has done its best to provide leadership and to act as a conduit to the government and international organizations. Unfortunately, they have no funding to directly support projects, nor have they received the training to properly organize the community or the necessary authority to serve as spokespersons for the communities. While other international groups provide limited services in Jallah Town, such as the community center built by UNICEF, city authorities have yet to develop an urban policy and very little has been done for these informal communities.

In *Life as Politics* (2009), Bayat writes that scholars tend to incorrectly assume that slums are the "breeding ground for violence, crime, anomie, [and] extremism" (p.13). The daily struggles that shape life within the settlements and create "new life and communities" are overlooked (Bayat, 2009: p.13). This view has led many international agencies to emphasize land tenure and microfinance programs, instead of considering the importance of everyday life and coping strategies in such communities, in particular the informal designs and uses of public spaces. As Bayat (2009) goes on to say, "[t]he outdoor spaces (back alleys, public parks, squares, and the main streets) serve as indispensable assets in the economic livelihood and social/cultural reproduction of a vast segment of the urban population" (p. 20). If public spaces are, in fact, indispensable

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assets, it would stand to reason that the development of these spaces should be assigned a position of the utmost importance. Not only would the creation of equitable public space combat instability and the effects of concentrated poverty, but that space may also provide an opportunity to better understand the forces that exacerbate poverty and to better focus resources to public space so as to mitigate the effects of those forces (Lagman, 2010).

Much of life in informal settlements is played out in public spaces, and it is by studying those spaces that we can best develop an understanding of how the communities adapt in the face of external threats. We know that there are gradients between public and private space (Alexander, 1977), and we know that the spatial morphologies can affect those gradients (Hall, 1966). Much urban design and international development research has posited that public space is an integral part of communities (PPS, 2012), that public space aids in the creation of social networks, and that public space strengthens community resilience. Those social networks have been shown to have the ability to increase property value and decrease crime in areas of poverty (Poethig, 2011). But, less is known about the ways in which such networks and structures of resilience are, in fact, shaped by the morphologies and uses of public space. Thus if we want to affect poverty, we need to better understand how social networks function within public spaces.

From this perspective, informal development and uses of public space should not be considered as an overtly political strategy. Rather, they are the result of small, incremental actions necessary to live in spite of external pressures and lack of resources. The opportunistic actions involved in forming such public spaces are taken in the absence of direct enforcement by state authorities, not as acts against authority. In the case of Jallah Town, residents created and settled land into the swamp simply because no one

was stopping them, not because they wanted to highlight the absence of urban policy or secure land tenure. The development of places like Jallah Town is not the deliberate political act of a Tahrir Square, but rather the quiet, everyday act of survival.

However, not all public spaces are created equal and simply labeling a space "public" will not always encourage the creation of productive social networks. A beautifully designed park may look nice and serve to encourage markets or outside investment, but it may not facilitate community networks. Community networks are built upon an empathetic understanding that members of the network are all in the same situation (Bayat, 2009). When seeing someone else in the same situation, individuals are more likely to respond to help each other. Also, community members in places like Jallah Town tend to spend much of their time in tight networks based upon family ties or close geographic relationships. These types of social interactions are not primarily created or maintained in public space. Understanding this, it would be detrimental for certain communities to build a large urban plaza in the U.S. or European style. Unfortunately, that may well be the first response of a planner or architect when hearing that public space is beneficial to a community. Public space must be designed on a community-by-community basis, not based naively on Western understandings.

As a basis for analyzing, quantifying, and qualifying the spatial morphologies that currently exist in Jallah Town and assess their relationships with community networks, I will draw upon the research of three well-known theorists: Christopher Alexander, Edward Hall, and Bill Hillier. Christopher Alexander's book, *A Pattern Language* (1977), is the foundation of much urban theory and his concepts of activity pockets, the intimacy gradient, and common area are especially applicable to my research. Secondly, I draw on the work of Edward Hall, also known as the father of proxemics. Proxemics, or

the comfortability of people in relation to one another and the spaces they inhabit, will serve to ground some of the assumptions of Alexander and to bring in spatial concepts in preparation for my subsequent space syntax analysis, which was developed by Bill Hillier (1989) as a tool to measure the connectivity of space. I use space syntax analysis to quantify and model the morphologies of public spaces in Jallah Town, and Geographic Information Systems (GIS) to develop cartographic representations of the city, the community, and its public spaces. As Liberia is still recovering from a series of civil wars, the GIS information available was limited but efforts were made to find any pertinent data or to use multiple sources for the creation of data. For the greater municipality and the relationship of Jallah Town to Monrovia, I relied on GIS data gathered from Liberian Institute of Statistics and Geo-Information Services (LISGIS), the clearinghouse for GIS data in Liberia, while I used Open Street Map data for street networks and environmental perimeters. Where there were still gaps in information I digitized satellite maps and used direct observations and photographs to infill the needed information.

The GIS data, in combination with a spatial syntax analysis, can provide information about the spatial characteristics of the city, the settlement, and even identify areas of activity within the settlement. However, in order to understand how people use space and to test the theories of Hall and Alexander, it was also necessary that I conduct visual observations on public activity in public spaces in Jallah Town. Through a visual survey methodology, I mapped the paths, actions and demographic information of each visible person within the public space. The vector information (location and movement) of each person was mapped along with an estimated age, the gender, and type of action (washing, playing, cooking, etc.) being performed.

Finally, to provide a background of the conditions facing the informal settlements, it was important to talk with the organizations that most commonly interact with the settlements. I spoke informally with representatives from various government agencies, several non-government organizations (NGOs), donor organizations, and community leadership, who described the conditions of the informal settlements from the perspective of their organization. These representatives also provided the specific mandates of their organizations, their organizational capacities, and any past or current actions planned for implementation. Conversely, community representatives readily discussed the relationships between Jallah Town and outside institutions and the principal needs facing the community. This information provided necessary context for my observations and analysis of spatial morphologies and the actions of residents as they continue develop their community.

Through my research, I hope to make several contributions to the fields of urban design theory and practice. First, by closely documenting uses of public space within informal settlements, I will expand on urban theory by incorporating a more nuanced understanding of the benefits of public space in mitigating the effects of poverty. Public space theory should acknowledge that the models of European urban designs are not always applicable or beneficial in completely different cultures. Secondly, in terms of urban design practice, this thesis introduces the theories of Asef Bayat and suggests that public spaces in informal communities can be viewed as the incremental response of people seeking to survive. However, this understanding can lead to a reframing of the methods in which we work in areas of deprivation. Although the development and uses of public spaces represent a quiet response to solving small problems within the community,

spatial analysis of urban morphologies can serve as means to develop strategic responses for engaging with the world.

In the next chapter, Chapter 2, I will review and discuss the theoretical foundations of my research before I introduce my selected research site. Realizing that every city and culture have their own history that contribute to the existing conditions, Chapter 3 will outline a brief history of Liberia and the current conditions affecting informal settlements in the country. In Chapter 3, I also explain my methods in more detail, including how field observations were quantified and represented in maps. In Chapter 4, I focus on the historical development and institutional structures in Monrovia and the development of informal settlements in the city. In Chapter 5, I describe the findings derived from my field mapping in public spaces in Jallah Town and my expanded space syntax analysis. Finally, in Chapter 6, I discuss the potential future applications of these spatial analysis models for work in informal settlements.

Chapter 2: Theoretical Framework

Violence is not an unfamiliar term for Liberians. In the U.S., we tend to think of "violence" as an aggressive, physical act with hands or weapons. In Liberia, even though they have had their fair share of physical violence, they are acutely aware that violence can exist separate from physical manifestations. Violence, to Liberians, also can convey the violation of rights of a group or individual. When one group violates the rights of another, they are committing an act of violence that, while maybe not physically harmful, can be just as catastrophic and demoralizing to the affected. In Liberia, there is even a term that has been coined to describe the violation of rights through a specific use of money and or influence: "cash violence."

The first time I heard the term cash violence was at a community meeting with the elders of Clara Town, an informal settlement of approximately 70,000 people, just north of downtown Monrovia. Elders in the meeting used the term cash violence as they described events that they felt were violating their community. The Methodist church, adjacent to Clara Town, had recently made claim to an area of nearly 75 acres of land where hundreds of families were currently living. The Methodist church, supported with U.S. money and with ties to the Liberian government, claimed that their rights to the land predated the establishment of this informal settlement. The residents, conversely, claimed that they had lived in the community for several generations, and that there were community members who remembered the time before the Methodist church had come into the area. The Methodist church has been able to provide proof of ownership for other land holdings in Liberia, but has thus far been unable to provide any evidence of ownership for the land they are claiming in Clara Town. The residents do not have proof

of ownership either, but they believe they have a stronger right to the land than the church due to the years they have been in the area. Currently, neither side has any legal right to the land, but the church has money and political influence that the people do not. For the elders, the ability of the church to use resources that are unavailable to them to potentially remove them from their homes was the epitome of cash violence: they were being violated through the use of money and influence, and there was little they felt they could do to resist it.

In using this story as a core for defining cash violence, one can pull out several important qualities that set cash violence apart from some other modern interpretations of violence. Slavoj Zizek, in his book *Violence* (2008), describes violence, or violating acts, as broadly being either structural or subjective. For Zizek, structural violence is the systemic inequality that perpetuates violence against groups of people. By simply being part of the system, we violate others. An example of structural violence would be the clothing industry, which uses slave labor to produce t-shirts for big name brands in the U.S., which is supported by our want of cheap clothing. We do not directly violate someone through buying cheap clothing, but through the system we effectively take advantage of people. Subjective violence, on the other hand, is the act of one against another: a subject profits from the violence, while an object is disaffected by it. Cash violence resides somewhere in between the categories of violence described by Zizek. Like structural violence, cash violence is part of an in-egalitarian system that profits from inequality built into the system and, like subjective violence, it is propagated most typically by an individual with full and direct knowledge of the violation they are committing against a group of people.

"Cash violence" is useful for this thesis as a concept that links actions taken on an institutional level, the conditions of poverty, and spatial relationships. Since the social maps of London by Charles Booth, urban theorists have observed correlations between spatial conditions and urban poverty (Vaughan and Geddes, 1999). Even more recently, researchers using space syntax analysis have found that "urban form in its own right can be a significant factor influencing the spatial distribution of poverty" (Vaughan, 2005). However, in addition to spatial causes, structural and social forces are also at work, and the concept of cash violence helps illuminate the reciprocal relationships between poverty and spatial morphologies in formal settlements.

A PATTERN LANGUAGE

In his book, *A Pattern Language*, Christopher Alexander developed spatial concepts of the city that form the bedrock of a much of urban theory. Through his concepts of "common areas at the heart", "activity pockets", and "intimacy gradients", he touched on three aspects of urban form and use that are relevant to this research.

Alexander describes "common areas at the heart" as the need for common spaces that enable the constant informal contact of a group with its members. The common areas are along main routes, but off to the side and away from traffic. The common areas allow people to perceive the space and, if they want to stop, remove themselves from the common path of travel (Figure 4). The "activity pockets" are the niches of public spaces where people tend to gather. In Alexander's research, he did not see people gathering in the center of the space, but instead picking corners or alcoves that are protected from the main space but also provide ready access to it (Figure 5). Lastly, "the intimacy gradient" refers to the way in which people have constructed transitions of intimacy from public to private and vice versa. For example, in a home one would not want to walk past a

bedroom, typically a very private space, before entering the living spaces. The first room that one enters is very public and one must proceed through spaces that progressively become more private (Figure 6) (Alexander, 1977).

These ideas will form the theoretical grounding needed to translate the observed use of space by residents of Jallah Town (see Chapter 4 Methods). As much of *A Pattern Language* was written based on observations of European and U.S. cities, there are instances when these concepts do not accurately describe the spatial variations in Liberia, which is a completely different culture. However, it is these moments, when the patterns observed in the informal settlement do not match the assumptions of *A Pattern Language,* that are be most exciting. It is the places where the patterns break down that have the potential to teach us the most.
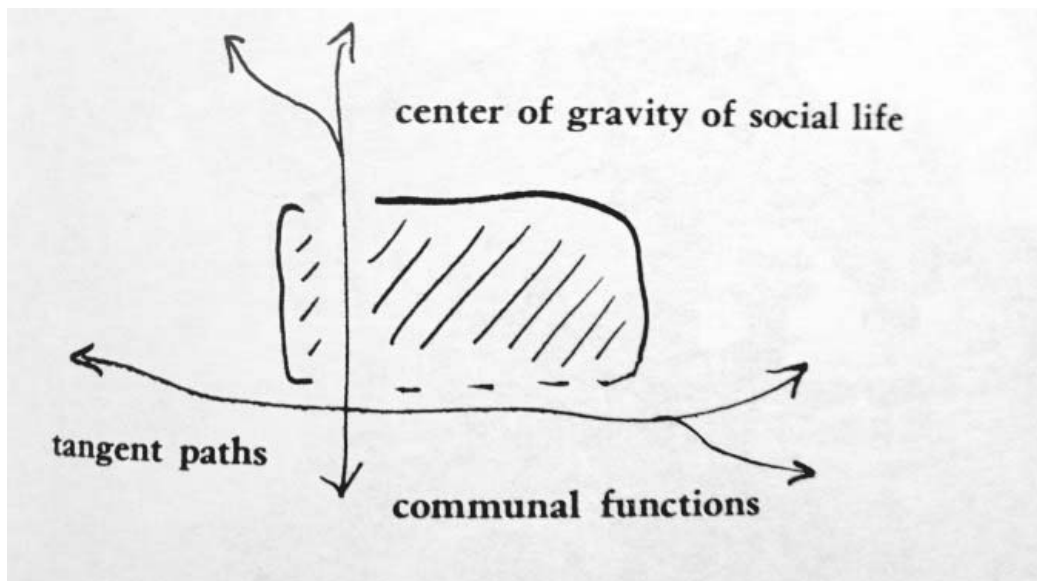
Figure 4: A Pattern Language: Pockets of activity.
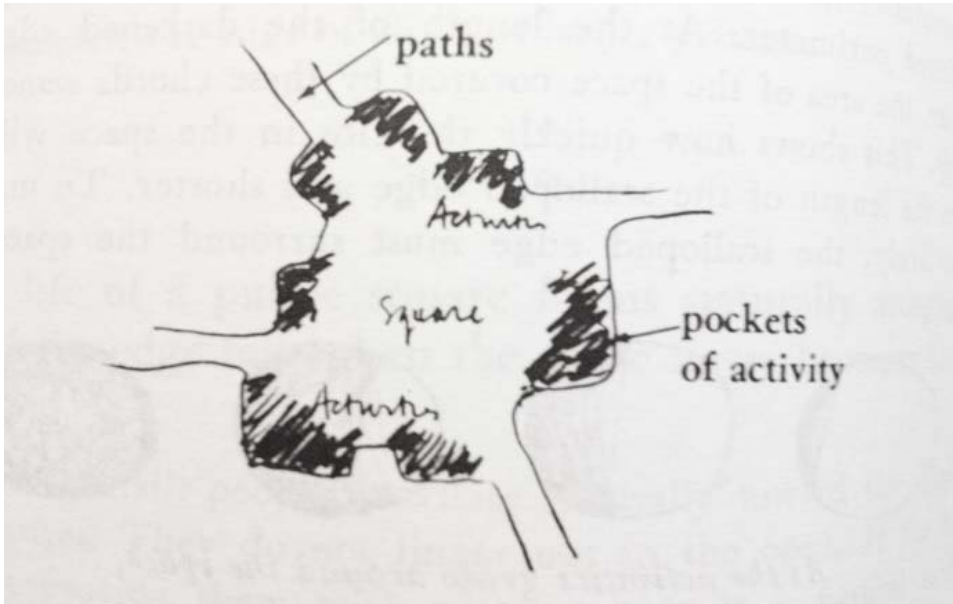
Figure 5: A Pattern Language: Common areas at the heart.
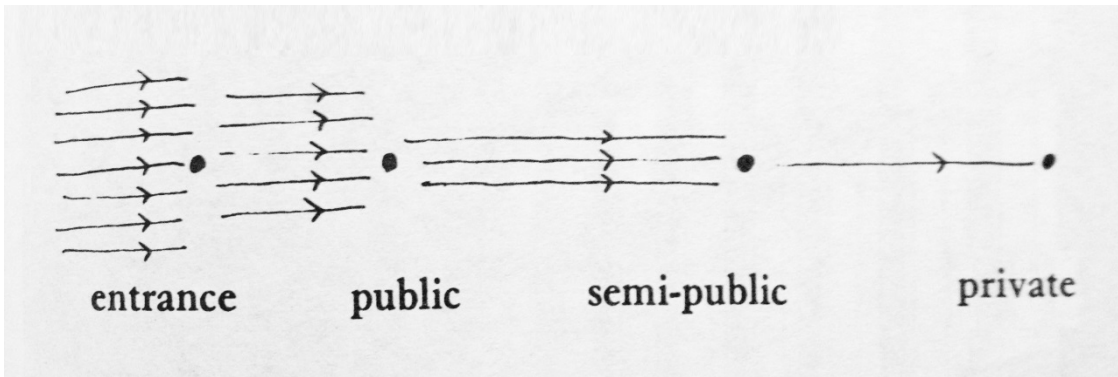
Figure 6: A Pattern Language: Intimacy gradient.

PROXEMICS

The next theoretical framework comes from Edward Hall (1966), who is known as the father of "proxemics." Proxemics is based on the premise that there are "bubbles" or zones surrounding each individual, which correlate with the level of intimacy that each person is willing to allow. We have all experienced these zones, though we become most aware of them when people "invade our space". The erratic behavior of a stranger may be acceptable when they are six meters away, but the same behavior when the person is within arm's reach may be very disconcerting. In addition to the bubbles around each of us, Hall also theorized that there were corollary levels of geographic territory that people make claim to. The territories correspond to the feelings of ownership that we associate with specific locations. For example, sitting adjacent to a stranger in a public park may feel completely natural, but if one were sitting the same distance from each other in the home, both people would feel uncomfortable. In this instance it is the location, in addition to the distance from one another, that determines the level of comfort.

As one would imagine, the sense of comfort is highly important when considering the development of social networks in public space. However, proxemics, while a valuable framework, cannot be considered an unbending law of social behavior. Hall himself was aware that there was a lot of variability in zones of intimacy and territory that were heavily influenced by culture (Hall, 1966). In using proxemics in this thesis, I will avoid any faulty cultural assumptions by only using the personal zones and territories as an initial framework, not as a rigid guide. The *concept* of zones may remain valid independently of culture, but since the distances and level of comfort have the potential to vary dramatically I will not use the distance measure in this research.

The four zones of "personal space" in proxemics as theorized by Hall include the Intimate (0"-1'-6"), the Personal (1'-6"-4'-0"), the Social (4'-0" - 12'-0"), and the Public (12'-0"-25'-0"). (Figure 7). The "intimate" space refers to the space within arms' reach that is generally reserved for people who are very well known and for confidential communication. "Personal" space is just outside the "intimate" and is the area that is comfortable for communicating with close friends and family. When people talk in this zone, they can hear each other in a low voice, maintaining a private conversation that can't be overheard by other people in the area. The "social" space is the sphere where meetings with new people and business transactions typically occur. The distance is acceptable for communication, but keeps the new people at a reasonable distance. The last zone, "public" space, is the minimum distance beyond which we feel comfortable with complete strangers. (Hall, 1966)

Figure 7: Proxemics: personal zones.

The four zones of "territory" theorized by Hall include the body, the home, the interactional, and the public. "The body" could be understood as the area immediately surrounding a person while "the home" refers to the places that one can be said to have

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continuous control over, including the home and the private garden. The "interactional territory" includes those spaces where people may congregate informally, such as a front porch, which people may enter at any time and where a discussion with an unknown person can take place. It is not a public space, but it has the ability to mitigate between the public and private. Finally, the public zone is where all type of interaction may take place. While an individual or group may on occasion try to claim space within the public zone, most often it is not claimed by anyone.

SPACE SYNTAX

Space syntax was first developed in the 1970s as a way to understand the connection between two cities: the physical and the social (Vaughan and Hillier, 2007). Then, as today, urban designers, architects, and city planners have generally had a difficult time bringing these two aspects of the city into alignment. While there are many ideas and theories about the relationships between the two, it has been difficult to empirically verify any causal relationships. As Laura Vaughan puts it:

> Urban practice and theory must connect one to the other. But the reflective disciplines which support and nourish both—roughly the morphological disciplines on one side and the social sciences on the other—take an asymmetrical view, foregrounding one city and backgrounding the 'other' city *through* the foregrounded one, and so at best are a shadowy set of patterns and forces. It is no surprise then that, at the start of the 21st century, we have many partial theories *about* the city, but no theory *of* the city as both of the things that it seems to be.

One of the difficult problems in bridging these "two cities" has been the challenge involved in rationally analyzing space. Urban areas can be classified into typologies of space, but these classifications tend to be either ambiguous or unnecessarily specific, and therefore difficult to correlate to other parts of a city. Public spaces cannot be wholly defined by any particular architectural style, the shape and size of the open area, or a

particular function that may occur. Each of these methods of classification tells us something about the space, but none of them alone can predict the quality and use of public space.

Due to some of the failures of the past, architects and planners often disparage new urban developments for being out of touch or detrimental to the social life of the city. When asked to support their arguments or to postulate alternatives, designers, lacking rules that lead to "good" public space, instead rely on intuitive design processes. Intuition may work at times, but there are also cases when intuition has created harsh, unused public spaces. Without evidence or method quantifying the impact on a city, the planner is left to rely on hypotheses that may be hard to leverage against the accounting of a developer or the motives of the policy maker. It becomes even more difficult when one considers that many theories 'of' the city have changed dramatically since the early twentieth century. The shifting positions of established thought have gone through many iterations, each claiming (sometimes with good evidence) that the preceding was detrimental to the fabric of the city.

Given the challenges of bridging Vaughan's (2007) "two cities", i.e. the physical and the social, Bill Hillier in the 1970s introduced the theory of space syntax as an effort to analyze the effects of urban space (Vaughan and Hillier, 2007), thus bringing rationality and empiricism into the conversation surrounding urban planning and design. Hiller developed syntax analysis as a tool to understand patterns of circulation in the city by atomizing spaces of a city into very small segments, which together describe much of the morphologies and social implications of public space (discussed in further detail in section in Chapter 3: Methods). Hillier classified the spatial morphologies of the city into three distinct types: the moving "through space", the convex space, and the *isovist,* a

spiky shape that represents one's view of the environment (Figure 8) (Hillier, 1989).

These forms represent the way people see and interact with the city, i.e. the way they see

space and move through it. Through this simple method of categorization, the city could

then be broken down into bits of space and analyzed based on the relationships between

them (e.g. the number of convex spaces that could be joined by a straight line). Most

importantly, these typologies and the circulation of a city could be quantified simply

through analysis of the figure-ground of the city.

people move in lines   interact in convex spaces   see changing visual fields as they
                                                      move around built environments
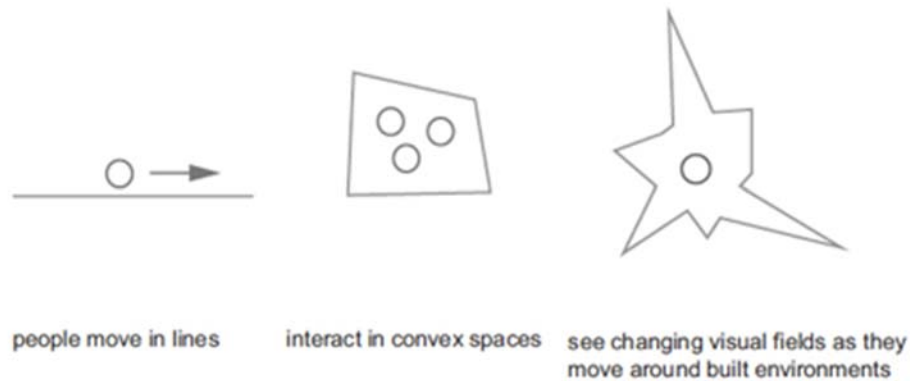
Figure 8: Space Syntax typologies.

Drawing on this method for assessing public spaces, researchers began to test

space syntax models against actual circulation patterns of city. In their comparisons,

researchers found strong correlations between the circulation patterns that were modeled

by space syntax and what was observed. In addition to circulation patterns, researchers

noticed that their analysis began to locate areas the city that were more spatially

integrated, and others that were more *segregated* based on how connected the spaces

were with the principal circulation patterns of the city. In her research, Laura Vaughan

compared these areas of segregation/integration against poverty maps of London in 1889

and 1899 developed by Booth. (Vaughan and Geddes, 1999). The overlay of the poverty

maps and segregation maps, produced through syntax analysis, was striking in that it

strongly correlated spatial morphologies with areas of deprivation. In her analysis, she proposed that the *segregated* areas of London were more difficult to access from markets and city services than the more affluent portions of the city, but they were also more highly integrated with their surrounding neighborhoods. This allowed poorer residents to easily access their community and support networks, but kept them separate from the major city networks. These segregated zones were perpetuating areas of deprivation by both keeping them from services available to the affluent, but also allowing them to consolidate their resources in the absence of the government services.

The social effects of spatial morphology are further explained by Penn (2003), who states that ''one of the primary effects of the built morphology and its use by people'' is to enable movement: smaller blocks enable speedier journeys across the grid, and the ''morphology of the environment defines a local visual field and so defines the area from which one can derive visual information and within which one can potentially be considered visually co-present with others.'' (Penn, 2003). In being spatially segregated from the rest of the city, the areas of deprivation are visually separated from the majority of the city, but the simultaneous, visual co-presence of residents helps create the mutual sympathetic acknowledgement of similar life experience that solidifies bonds within the community. These findings help explain how segregated areas, like both Soho and the East End of London in the Vaughan studies, emerged over time as more impoverished areas. It also helps explain how these types of areas have long been the loci of sub-cultures, whether of specific economic activities and alternate social groups. (Vaughan and Hillier, 2007).

The ability of space syntax analysis to identify a preference for certain social conditions based upon the physical aspects of the city is profound. With this strong

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correlation, one cannot but admit that there is a relationship between spatial segregation and the factors leading to deprivation in the city. This relationship cannot yet tell us if poverty creates the shape of the city, if the shape of the city leads to areas of poverty, or if there is a feedback loop where they both feed off one another. As spatial syntax theory tells us that segregation deprives some areas of access to the city, we can presume that the urban fabric exacerbate conditions of impoverishment. We cannot also forget that poverty occurs in geographic clusters of the city and "can also lead to unequal access to jobs and thus high rates of unemployment in a particular area." (Spicker, 2004; Green and Owen, 2006). We have not yet fully understood the relationship between poverty and the spatial characteristics of the city, but spatial syntax has been invaluable by empirically linking the two.

QUIET ENCROACHMENT

Earlier I discussed "cash violence" as a theoretical concept to better understand the threats faced by people in informal settlements. Drawing on the theories of Alexander, Hall, and Hillier, I introduced tools to analyze the city and categorize its spatial morphologies. In the following, I will discuss the concept of "quiet encroachment" (Bayat, 2000), which will serve as a bridge between the notion of cash violence and spatial analysis help us understand how community members create and use space as a response to the threats against them.

Quiet encroachment represents a view of agency that is quite different from the organized action seen within the political system in Western countries. In the West, people are aware of laws and do not break them en mass except as a political gesture. In the West, people see themselves as political actors, but in informal settlements, Bayat argues, community members typically do not see their actions as political. They act

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through small, incremental actions which they take simply out of necessity for survival. These actions are typically reflective of personal decisions based on what is best for the individual or their close social network, and are not understood to constitute parts of a larger political movement. However, even if these actions do not constitute a conscious, larger movement, the incremental actions of many individuals, when taken together, can have serious political implications.

Bayat also notes that people in such communities come together to help each other in crisis, seeing in their community a set of "sympathetic struggles." They recognize that other residents must deal with the same issues and threats as they do. When crisis does occur, it is that recognition of shared hardship that creates a bond, which in turn enables collective action. Working together in a crisis can be a tremendous benefit to people in a poor community, and mutual understanding may aid the community in extreme situations. However, as my analysis in subsequent chapters will show, it is important to not romanticize the role of public space in facilitating community cohesion and agency. As my observations and mapping suggest, people generally cluster based on familial and ethnic ties, with generally loose relationships outside of their small cluster. The only individuals who could be said to break this trend are the young who, through play and other activities, actively move through a wider area as they live their daily lives in the informal settlements of Monrovia.

Chapter 3: Liberia, Monrovia, and Jallah Town

In this chapter, I will provide a brief history of the specific issues pertaining to informal settlements in Liberia. This history, while presented with the best effort to present objective understanding, will undoubtedly be subjective in its telling. The narrative history laid out cannot, in the space of this thesis, contain a comprehensive telling of every aspect of informal settlements and, as such, what is written has been boiled down to what has been deemed most relevant to the narrative of the thesis. It is not my intent to omit or censure opposing points of view, but to incorporate a truthful telling of some of the history to enlighten the reader and serve as reference for the links between cash violence and space syntax in the following chapters.

INFORMAL SETTLEMENTS

Over the past several decades, Africa has experienced rapid urban growth. The total population of urban dwellers in Africa in 2009 was approximately 395 million, or nearly 40 percent of the one billion Africans. "Whereas it took 27 years for the continent to double from 500 million to one billion people, the next 500 million [are expected to] only take 17 years." (UN-HABITAT, 2010). In many sub-Saharan Africa cities, upwards of 60 to 70 per cent of the population live in informal settlements today. By 2050, it is expected that half the population of the continent will live in urban areas. Unless there is a dramatic change in the development of African cities, much of the urban growth will take place in informal settlements.

While many agencies and governments are aware of the issues of urban population growth facing Africa, many countries have done little more than acknowledge the problem. As UN-HABITAT puts it:

Since cities are the future habitat for the majority of Africans, *now* is the time for spending on basic infrastructure, social services (health and education) and affordable housing, in the process stimulating urban economies and generating much needed jobs. Deferring these investments to the [future] simply will not do. Not a single African government can afford to ignore the ongoing rapid urban transition (2010: p.11).

Though the immediacy of the urban growth and informal settlements cannot be ignored, there is much that we can learn from informal settlements. Unlike in Western countries, the informal structures and knowledge systems in these settlements have the potential to tell us more about the needs of the people and culture than any top-down policy designed from afar. Through its organic growth, informal settlements have developed patterns of relationships, social structures, and space that are unlike anything that emerges from a planning department (Figure 9-11). In fact, informal settlements could be considered an effect of an urban policy that has failed or has been unenforceable. As many times the best places to understand the effects of policy are in the areas where the system breaks down, informal settlements may provide lessons for improving our urban policies.

WHY LIBERIA?

Liberia was chosen foremost because of my history with the country. I had the opportunity to live in Liberia for several years and developed a great love for the people, and desperately wish to see life for the average Liberian improve. I began my sojourn in Liberia constructing schools in the rural areas of the country. Over time, I saw not only how a school could improve a community, but also how the same building, if it were not properly placed, would not have the same potential. This inspired me to pursue this research on informal settlements.
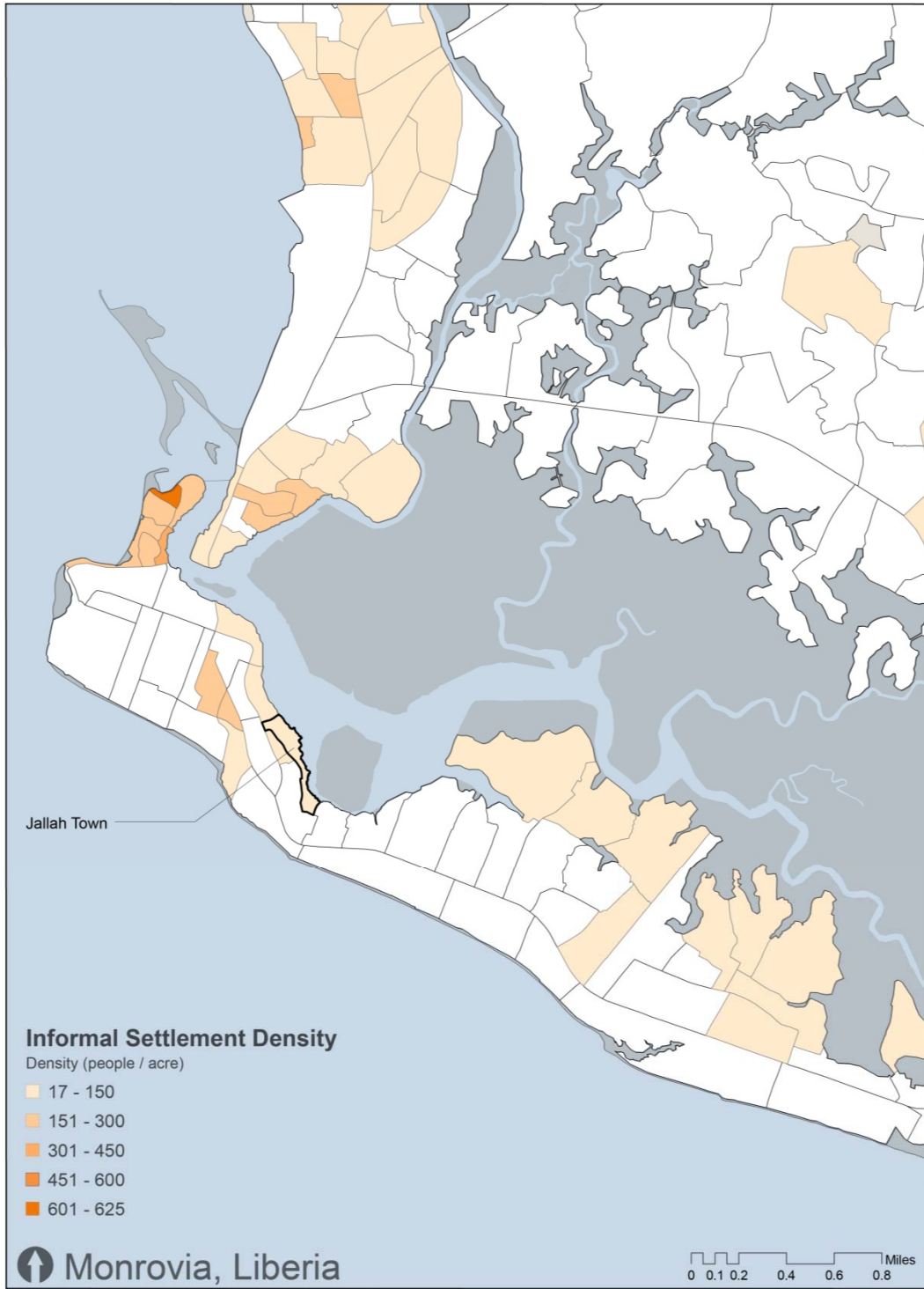
Figure 9: Location and density of officially recognized informal settlements in Monrovia.
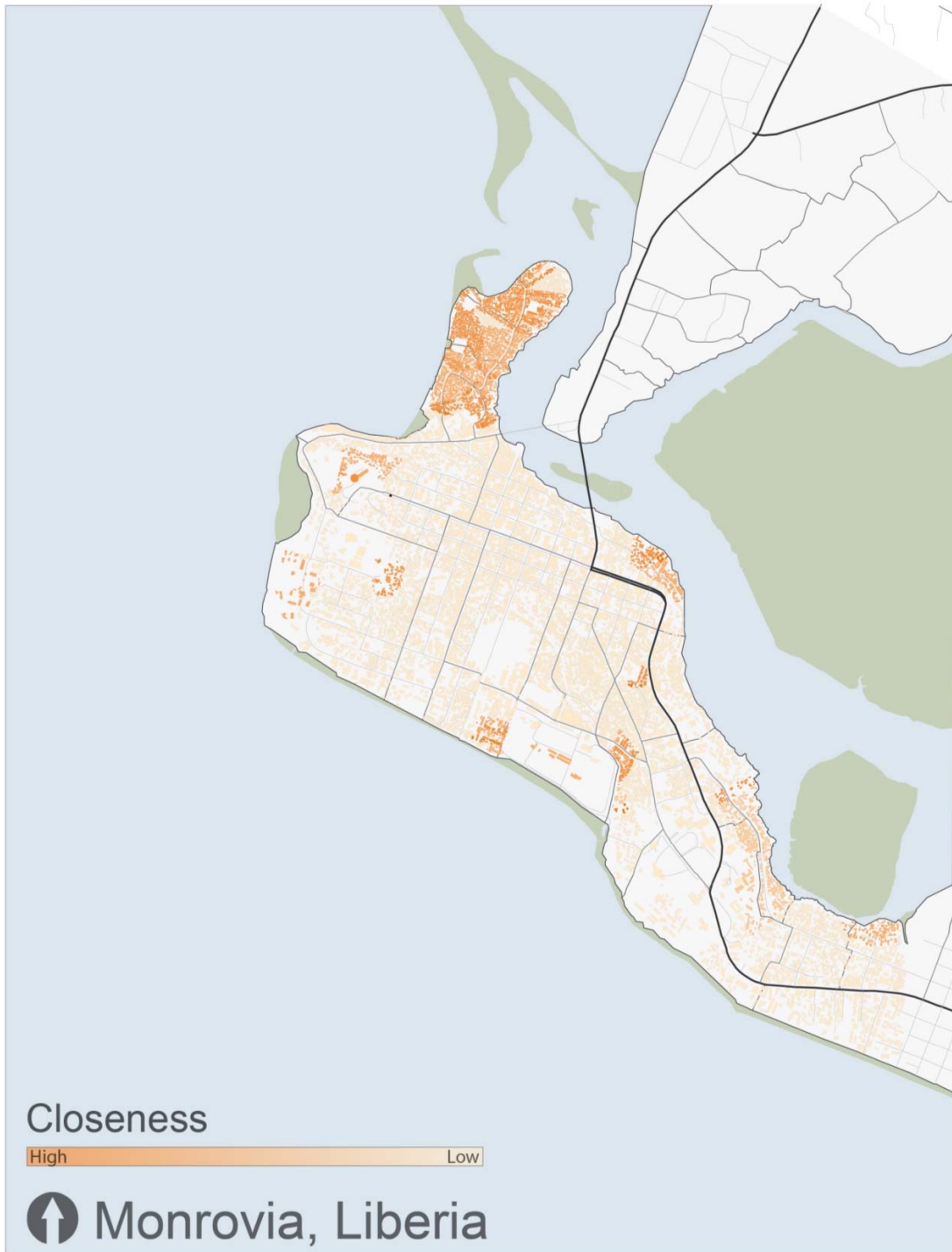
Figure 10: Closeness Analysis: darker areas are farther from other buildings on the street grid. The darker areas are all zones of informal settlements.

Gravity

High ——————————————————————— Low
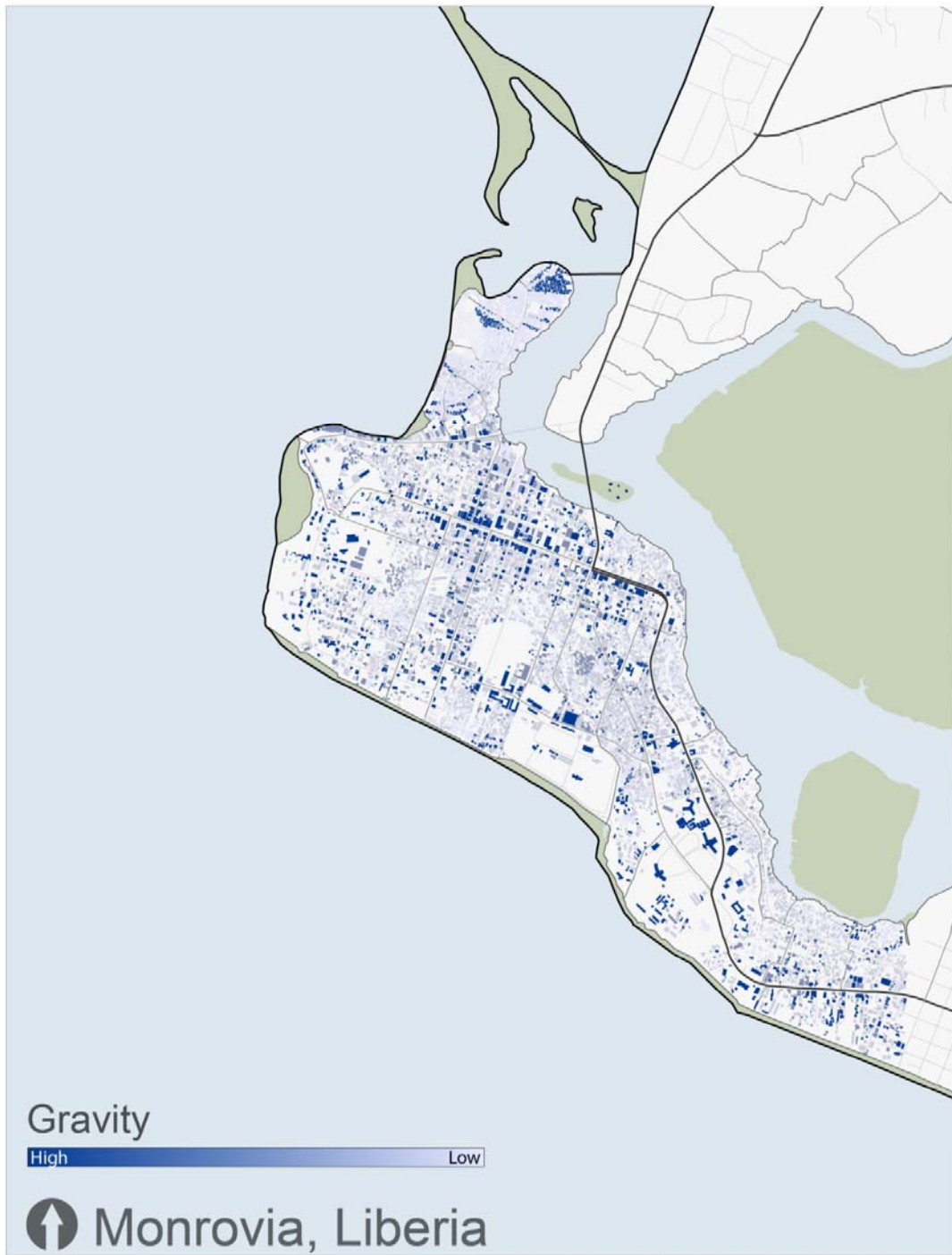
⬆ Monrovia, Liberia

Figure 11: Gravity analysis: Darker areas are natural magnets of activity. The analysis found the high intensity civic and central business districts.

Liberia has a population of a little more than three million people, with over one million living in the urbanized area of the capital, Monrovia. Of that urban population, it is estimated that roughly 70 percent currently live in informal settlements (UN-HABITAT, 2009). Informality thus has become a systemic problem that the country has been trying to overcome, and both the problem and attempted solution involves many sectors of the government. However, due to the country's history, which will be discussed later, there is currently no comprehensive urban policy for informal settlements to guide the separate government ministries. For instance, four ministries are currently developing their own maps of Monrovia. Without an urban policy to coordinate the work of the ministries, it is difficult to know whether some things are being mapped multiple times, or if some things are being omitted entirely. As revealed through my conversations with government representatives, they knew little of what was, or was not, being mapped by other ministries.

HISTORICAL CONTEXT OF LIBERIA

Liberia traces its origins to the American Colonization Society, which was formed in the 1820s as a method of 'returning' U.S. slaves to Africa. Some were coerced, but many were offered the prospect of land and opportunity. The first ships of colonizers landed on the west coast of Africa at the mouth of a river that was in many ways similar to the land they were accustomed to in the southern states of the U.S. The settlement they created was named Monrovia after President James Monroe. Although they were U.S. expatriates, the settlers in the new land always retained a strong connection to their former country. In 1847, a constitution, flag, and government were created in the new colony using the U.S. as a model. (Ellis, 2006)

At the time of the signing of the Liberian constitution, the Liberian government, made up of Americo-Liberians (descendants of U.S. slaves are still called today), assumed control of a wide swath of land beyond the capital. Much of the interior of the country was then extremely difficult to access and was populated by loosely affiliated tribes who had very little voice in the new government. To control these interior areas, the government set up district managers that were to be liaisons between tribal leaders and the government. This structure of government was very distinct from the system of leadership that the indigenous people were accustomed to. The district managers, removed from the oversight of the central government, sometimes set up their own fiefdoms and undercut the social structure that had underpinned the tribal societies for generations. (Ellis, 2006)

Many of the tribal[1] societies had had a dualistic form of social structure that kept order and mitigated the abuse of power. There were the tribal leaders or elders who would help manage day-to-day problems in the community, but also 'secret' societies with an entirely different leadership structure that could counterbalance the formal leadership. Though these groups are generally called 'secret,' this is somewhat of a misnomer. The societies were inclusive of everyone in the community and typically were the conduit for the right of passage for children into adulthood, teaching them what it meant to be an adult in the society. When the district managers were sent to the interior by the Liberian government of the day, they stood outside of this social structure. The district managers were not part of the 'secret society' that helped to stabilize the community, and so they had to work through the tribal leadership. With the backing of

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[1] The term "tribal" or "tribe" does not always represent distinct enclaves of people. It was many times the colonizers or in this case the district managers that decided who was of which "tribe". Some even view the tribal distinctions as forms of oppression used by the ruling class. (Ellis, 2003).

the district managers, the tribal leaders gained extraordinary leverage and power over the community. The imbalance of power in favor of the tribal leaders caused serious damage to the system of checks and balances that had maintained order previously in the villages. With the influence of the district manager behind the tribal leader, it became difficult for the village to restrain leaders that did not have the best interest of the community at heart. (Ellis, 2006)

Since these early days of new nation, the balance of power and what it means to be a Liberian have been dominated by the Americo-Liberians. The motto of the country - "The love of liberty that brought us here" - is a prominent example of the ingrained exclusionary concept of citizenship in Liberia. Implicit in the motto is the idea that we, the real citizens of Liberia, were *brought here*. People who were here all along are, by implication, omitted from being Liberian. This is very important because those without power or influence, many of whom live in informal settlements, are open about their feelings of being second-class citizens in their own country.

Only once in the history of Liberia has there been a president of indigenous descent. In 1980, Samuel K. Doe along with other members of the military took President William Tolbert and his cabinet out of the executive mansion to nearby Redemption Beach, killed them, and claimed the right to lead the country. Doe's reign lasted nearly ten years, but like his ascension, Doe's demise was a bloody affair. The incursion of Charles Taylor, the regional interests of France, and the rising power of Nigeria, who had recently discovered oil within their borders, fueled a war that lasted nearly fourteen years. (Ellis, 2006) By the end of the war in 2003, an estimated 250,000 people had been killed and the infrastructure of Liberia had been ruined (Ellis, 2006). The hydroelectric dam that once supplied electricity to the country had been destroyed, and the education system,

health care, and government were left in complete disarray. Hurting the country even further was the flight of the many educated Liberians, who became refugees in the U.S. and abroad (NRC, 2011). This "brain drain" has had a prolonged effect on the recovery of the country.

During the war, Monrovia swelled from around 600,000 to over 1 million people (NRC, 2011), most of whom came to the capital in search of safety and subsistence. Since the government was barely functioning at the conclusion of the war, many of the new residents had no ability to buy land, even if they had had the money, and so they squatted on vacant land left by refugees or the deceased. As the city became inundated with people, residents even began to create homes and a community in the national cemetery of central Monrovia.

Today, ten years after the end of the hostilities, the country is still feeling the impact of the war. The average age in the country is 17 years old (UNICEF, 2011), and most residents have enjoyed limited or no access to quality education as the country rebuilds its institutions. Many of the educated refugees are only just now returning. Overall, this lack of education has severely hindered the ability of state institutions to find capable persons to manage the country. Despite a number of capacity building workshops by aid agencies, the need for skilled people still hampers the work of many of the ministries.

Lastly, the lack of clear mandates and communication between government ministries has been exacerbated by the international community. Individual government ministries are offered aid based on the interests of foreign donors rather than the needs of the government, which undercuts the ability of the government to formulate coordinated policy and, at times, creates the attitude within the ministries that it is only through

international assistance that new policy can be formed. All of this can be clearly seen in the lack of a comprehensive urban policy, as I will discuss below.

Figure 12: View of Jallah Town from cliff edge, behind University of Liberia.

JALLAH TOWN

With upwards of 70 percent of the population of Monrovia living in informal settlements, there are more than a few settlements that could have been selected as the primary focus of this thesis. In the end, the selection of the Jallah Town settlement came down to several important factors. The first factor was that Jallah Town is the location of the country office for Slum Dwellers Association of Liberia (SLUMDAL). Upon visiting the representatives at SLUMDAL, they took me on a tour of the community and helped

introduce me to community members. Having the SLUMDAL representatives introduce me to the community made it much easier to engage with residents. The local representation helped assuage any fears associated with an outsider in the community and conferred legitimacy to my research.

The next factor that led to the selection of Jallah Town was both the geographic qualities and population of the community. Located adjacent to central Monrovia and just north of the University of Liberia in downtown Monrovia, the community is readily accessible (Figure 13). As the community extends the length of a well-traveled road in Monrovia, it was very easy to access any portion of the settlement. The accessibility to the community, as an outsider, made the engagement process much smoother as I could find easy transportation to the area throughout the day. Also, the community of Jallah Town, covering only a few square miles and with approximately 7,000 residents is much more manageable for short-term research than other settlements, such as West Point, which covers a large peninsula at the edge of the city and has between 50,000 and 70,000 inhabitants. (LISGIS, 2013)

In Jallah Town, one can see cash violence has been at work in the formation and continuation of the community. The community has had to adapt as more affluent areas of the city have been prioritized for government services. Jallah Town Road has been paved, but only because it is one of the two east-west routes through a narrow section of Monrovia, not as an investment in the community. Due to the heavy traffic and the presence of small children who are constantly walking along or crossing the road, the community has built speed bumps for their protection. The cement and rock used by the community to protect themselves and their children was not a small endeavor for a

community of little means. However, it was important to the community to adjust their physical environment to meet a clear need that was not being met for them.

The Jallah Town community, like many of the informal settlements, has been a difficult puzzle and relatively low priority for the government. During one conversation with a local government official, I asked why, 10 years after the war, there was still no comprehensive urban policy. The official made it clear that they desired to create an

Figure 13: Monrovia figure-ground with Jallah Town.

urban policy, but they needed additional external funding: in order to create an urban policy, he said, they required at least $2 million USD. More than a little confused at the large sum of money needed, I asked what steps they needed to take going forward. He said that the first step would be a one-week urban policy forum that he estimated would cost $500,000USD. Without that money, he assumed that the forum would be postponed
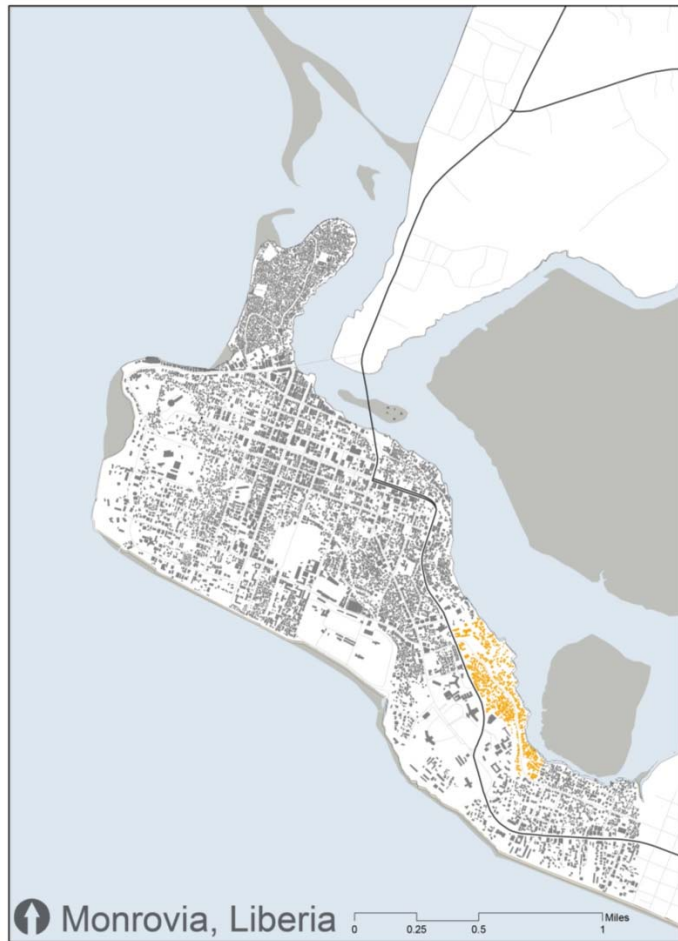
until an international donor agency[2] could be convinced to support the meeting. In a country where the average person lives on $1.25 per day (NRC, 2011), it is difficult to fathom why such a large sum of money would be necessary for a one-week conference.

It took a while and some discussions with other international agencies before a possible, yet unfortunate explanation could be made for the cost of an urban policy[3]. The consensus was that there are members of government who see the development of urban policy as an opportunity to enrich themselves. By claiming the need for such a large sum to initiate an urban policy, the government official was, in a sense, holding the development of urban policy hostage. In doing so, the representative was committing cash violence against the people of the informal settlements and Jallah Town. The action of holding the urban policy hostage is both willful and part of the systematic violations faced by the informal settlers. Thus the very lack of urban policy may, perhaps, be the greatest act of cash violence perpetuated on the people. In the following chapters, I will take a closer look at more specific instances of cash violence and its effect on the spatial characteristics of Jallah Town (Figure 14-Figure 18).

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[2] The representative said that they were currently waiting for the assistance of UN-HABITAT to supply the funding for the urban forum. In discussions with UN-HABITAT, while they were aware of the desire for funding for an urban forum, they were not in Liberia as a donor, but as a support and capacity building organization. For the appearance of planning that the representative had put into the urban forum, there appeared to be a great deal of miscommunication and misguided mandates.

[3] The corruption here is an assumption. There is no evidence, as that would take a great deal of investigation, but the people of Liberia are not unfamiliar with corruption. It has been a constant struggle. I, myself, have been forced to pay bribes to customs officials in Liberia in order to leave the country and not directly to one individual. One official told me exactly who and how to bribe another.

Figure 14: Jallah Town Road, looking west at the "established" section of
the community.

Figure 15: Stairs on West side of Jallah Town Road leading up into the
community.

Figure 16: Jallah Town local marketplace.

Figure 17: Swamp edge bordering the Eastern extent of Jallah Town.

Figure 18: Sand being delivered to a Jallah Town Resident in order to build up more land from the swamp - "pushing the water."

Figure 19: Rock being delivered to a resident in order to build up more land from the swamp - "pushing the water."

Chapter 4: Methods

The following chapter contains a complete description of the methods that were used to collect and analyze data. The chapter has been broken into sections based upon the methods that were employed.

CONVERSATIONS

Informal conversations were an important part of the preliminary research process. It was during the course of informal conversations that I came to understand the approaches of organizations working in informal settlements, and the conditions and threats facing the informal settlements. These conversations also helped me better understand the workings of the organization or institution. Whenever possible during these informal meetings, I collected official documents and reports outlining working procedures, mandates, and goals of the various institutions discussed here.

ENTERING THE COMMUNITIES

I conducted my public space observations in two phases. The first phase was to locate a public space that would be feasible for conducting a mapping study of the use of the space. The second was to photograph the settlements visited. Photographs were an important part of the survey of the settlements, as they would contain vital information about the regularity and the typology of each settlement. Photography was thus used to document all of the locations visited and also to provide background documentation of the chosen site, especially the site context and surroundings.

As an outsider, it was necessary to hire both a guide and a driver to survey some of the informal communities in Monrovia. The guide was able to locate the communities, to provide security, and to navigate the implicit protocol within each of the settlements. It

would not have been terribly difficult to locate many of the communities without the help of a guide, but navigating the local political structure within the settlements would have been extremely difficult. Residents expect that visitors speak with the community chairperson or commissioner prior to visiting the area as a respectful gesture and to clarify the purpose of the visit. (Figure 20)

Figure 20: Walking with guide in West Point, Monrovia.

There are as many as 26 recognized informal settlements in Monrovia (UN-HABITAT, 2013), and each has an elected commissioner or elder who acts as their representative. The representatives are typically unpaid, without any sort of office. In order to find the representative, it was necessary to walk through the community, conversing with the locals to find out who the representative is and where he/she lives. In each community, my guide took the lead to find the representative, as people deep within

the settlement would have been wary of a lone interloper asking questions of them. It would also have been dangerous had I followed unknown individuals to unknown locations. Once we found the representative, we would ask for access to the community as a show of respect. Also, the representative would usually find a guide or personally guide us through the community, identifying important locations, steering us clear of areas that could potentially be unsafe, and indicating when it was appropriate to take pictures.

The use of photography can be touchy to many Liberians, but especially in areas of deprivation. Liberians have had their pictures taken by many journalists who were reporting on the wars and poverty, and to them, photojournalists became wealthy selling images of poor and abused Liberians while they received nothing. The photographs were taken *from* them, not *of* them. This history put some limits on the ability to capture much of the settlements and the site. When the people were told that I was not a photojournalist but an architect, which I am in addition to being a graduate student, they were much more compliant, but they still preferred that pictures were taken of structures rather than of people. (Figure 21- 23).

Figure 21: Buzzi Ouarter.

Figure 22: West Point beach.

Figure 23: Wroto Town street.

FIELD MAPPING AND PUBLIC SPACE OBSERVATIONS

Mapping of the spatial morphologies and uses of public spaces was always meant to be an integral piece of the research. As much of the research and theory of urban space stems from a Western-centric point of view, I needed to obtain observational data on the types and uses of space in this divergent environment in order to test the usefulness of these theories. Where the foundational urban theories and spatial mapping of the settlement aligned, the survey would help to ground theory in the local culture. Where

theory and mapping were in conflict, it would point to modifications of theory or an alternate lens with which to view it.

Before beginning the mapping survey, a proper site that met the conditions set forth by the research was needed. The site needed to be unequivocally public, with no restrictions of accessibility for people to come and go. A public site with people was not enough; due to the mapping method chosen (explained in greater detail later in the chapter) it was important that there was steady movement—but not so much that it would have been difficult to accurately record the movements. In addition to moderate pedestrian traffic, I was looking for a site that was not secluded or distant from common paths of travel. I was also looking for a mixture of uses and people—i.e. residences nearby, places where children played and places where people performed typical chores such as cleaning and cooking. I also needed a site with variation in the movement of people, including spots where people would rest. Lastly, safe and reasonable access for me, the outsider surveyor, was necessary in order to conduct a thorough, safe study of the community. As it would have been very time consuming to have conducted a full survey of each criterion for each potential site, the site had to be chosen through a quick assessment made while walking through each community. After a tour of several communities, I decided to focus my mapping on a cluster of spaces adjoined by a primary public space in Jallah Town.

The mapping would involve recording the movement patterns of people within the site at regular intervals. A figure-ground map, demarcating the buildings from open space, would form the backdrop on which the movement and use patterns were to be recorded. To identify patterns it was important that I documented where people moved, but also demographic characteristics that would help *explain* the patterns of movement.

Therefore in each instance where I recorded a person either moving or stationary in the space, I also included their approximate age, gender, and the type action or purpose of the moment. The interval between recordings was a bit of a balancing act amongst the constant movement in the public space, the ability to record each accurately, and desire to gather a significant dataset. After several tests, it was found that a 10-minute interval was sufficient to record the movement and corollary information.

Before any mapping was conducted, a survey book was created for consistency and accuracy of recorded data. The background map (Figure 24) was derived initially from satellite imagery and traced onto graph paper. This background map was then adjusted through observations of the site, locating key barriers, doors, porches, and other spatial markers. I left room on each map to record the date, time, and weather, and the age, gender, and action of each individual (Figure 25).
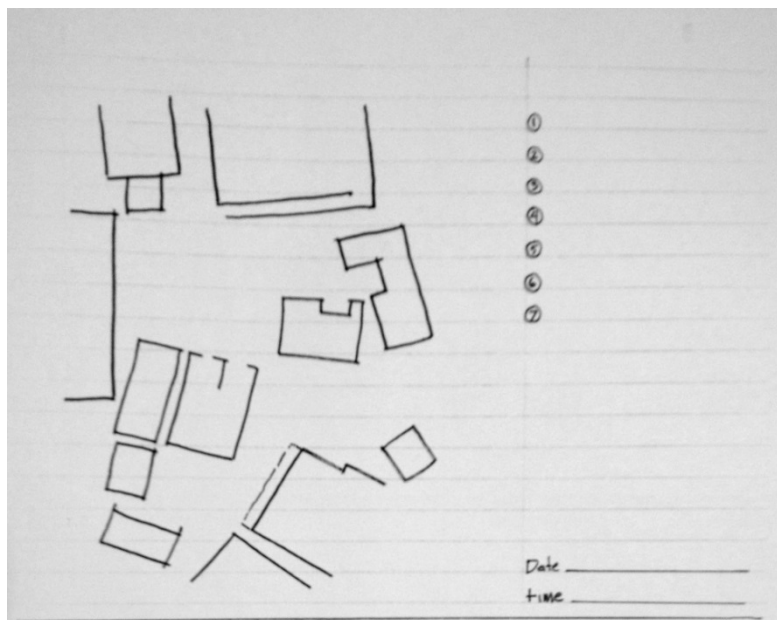

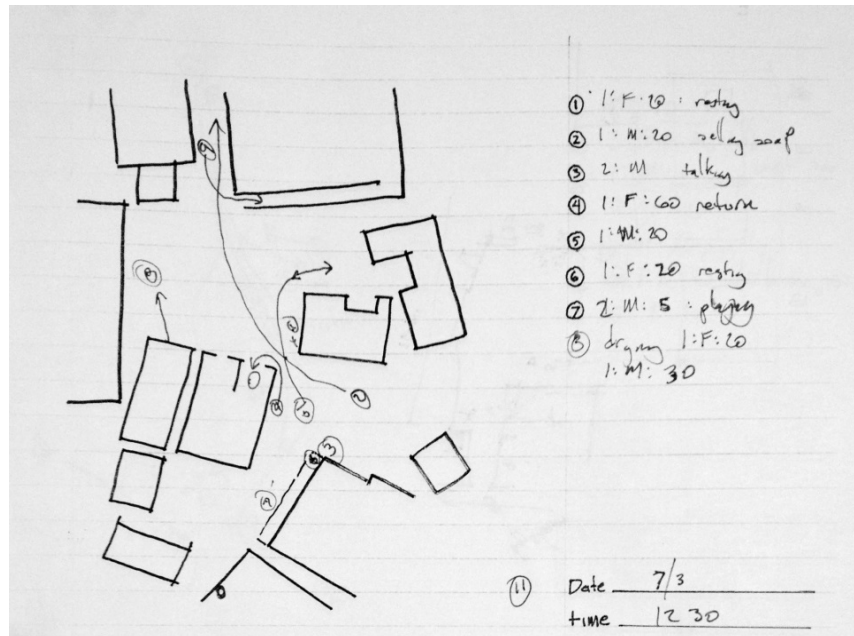Figure 24: Base survey map for recording pedestrian movements.

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Figure 25: Field recordings of pedestrian movements.

While it would have been beneficial to spend all of my time on the site recording the movements and uses of the public space, nearly half of my time was spent in informal conversations with the people of the community. In dedicating some time to the community, explaining to them who I was and what I was doing, it helped allay any apprehensions they may have had and allowed me to focus more fully on mapping when I was free to do so. Some of the best places to watch the site would have also been some of the most socially awkward to sit for hours at a time, such as directly adjacent to the main paths of circulation. To maintain consistency, I conducted my mapping only in locations where it was possible to view the full use of the primary public space.

The mapping of movements in the space was recorded to best represent the general path of travel and the area of space that was inhabited or traversed. Complete accuracy of movement would have been nice, but unnecessary for the scale of this research, and would have been impractical with the tools and time available. The purpose

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was to identify larger patterns within the site and to generalize the use of space. Any greater detail could have been intriguing, but may have added additional and unnecessary complexity to the later analysis.

The categories of actions recorded for each individual was an iterative process that sought to capture the variation and similarities of actions carried out. Ideally, the categories were as few as possible while staying truthful to the original actions. Some of the main categories used most often included: washing, playing, resting/sleeping, selling, and cooking. These categories describe a genre that best fit a group of related actions. For instance, "play" included both the playing of a board game by adults, *lapa,* a game full of running and lots of movement, and more sedated playing with small toys or objects by children in a small group. Similarly, "cooking" and "cleaning" included all actions related to food preparation and the washing and drying of clothes, respectively.

The categories of age and gender are, obviously, more restrained, but also required some categorization. Gender was fairly easy, though for very small infants this distinction was made with a best guess. Age was slightly more difficult. In lieu of asking each individual his/her age, a best estimate was given with a ten (10) year span for everyone. Children age 0-10 and 10-20 was seen as too broad as there is so much potential variation that can occur in the actions and movements the first twenty (20) years of life. The age brackets used were a baby (0-2), a toddler or young kid (around 5), prepubescent (10-12), and teenager (around 15). In cases where there were older teenagers they were graduated to the category of 20s, as the responsibilities and independence level of an upper teenager more closely aligns to a young adult in Liberia[4].

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[4] The differences in age between late teens and early twenties was a difficult distinction for me to make out in the field and so most often older teenagers were classified as being in their twenties.

Once the mapping was complete, it was digitized in ArcGIS in order for me to later interpret and analyze the information geographically. Before inputting the data into the GIS software, I created a more accurate base map of the footprint of the surrounding buildings was created in Autocad. The building footprints were traced using satellite imagery and then modified based on field measurements and photos taken of the site. While the initial, hand-drawn maps were rough approximations of the space used to locate the movements of the people, the digitized background map was created with a much higher level of accuracy and detail. In addition to the building outlines, the location of significant ground objects such as streams, piles of debris, and old building foundations were recorded. (Figure 26)

Figure 26: Initial CAD map of Jallah Town public space.

When inputting the data into the GIS software, it was important to include the data that was relevant to each recorded movement (age, gender, weather, time, and use). When inputting the data it was not known how the data would later be used for analysis. The GIS software has the capability to store data according to categories of points, lines, and polygons. Even though people were understood to not "move" when they were stationary and so a point may have been a more typical interpretation, the software would have split a line layer from a point layer. I decided that for the purposes of this research, using a short line, less than one-half meter, to represent a stationary person would still be easy to identify, while maintaining a single table that was representative of all instances.

GIS ANALYSIS OF OTHER ACQUIRED DATA

Since GIS was to be central for my urban analysis, it was necessary to acquire quality GIS data while in Monrovia. I obtained the bulk of the GIS data from the Liberian Institute of Statistics and Geo-Information Services (LISGIS), the Liberian agency responsible for maintaining all GIS mapping data; Open Street Maps (OSM), an open-source GIS database; and Landsat maps. LISGIS provided census data pertaining to population of communities along with the geographic boundaries of each community. The GIS data pertaining to the roads, waterways, and natural land features that were available from LISGIS was sparse and so OSM was used to fill in this data. The OSM website had much of the information, including a network dataset of the streets and general land features with much greater detail than LISGIS[5]. The Landsat information, though only having a resolution of approximately 30 meters, was used to look for growth

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[5] There is sometimes a concern about the veracity of crowd-sourced information, so the data from OSM was used only when it closely matched what was available, from LISGIS or satellite information. Additionally, the only dataset used for analysis during the research that was taken from OSM was the network dataset, as it this was the only location available for this information.

patterns of the informal settlements over time. Jallah Town was known to have pushed into the adjacent swamp over the years, and it was hoped that the satellite imagery could better detail the rate or patterns of expansion.

SPACE SYNTAX ANALYSIS

Before beginning the syntax analysis, a set of environmental and community boundaries were selected as the extents of the study area (Figure 28). The boundaries of the study area contained all of Jallah Town and portions of adjacent communities, but left out zones that were governmental or institutional. In the North, the boundary was created by the Ministry of Health, while the swamp forms the study boundary in the east. In the south, the boundaries were extended into the neighboring communities of Sinkor and MCC, as circulation among the three communities overlap and cutting the boundaries at the codified boundary would affect the syntax analysis of the edges of the community. To the west, a cliff located at the edge of the University of Liberia forms the boundary up until the grade lessens and the community climbs up the hill. Where the community moves up the hill, the boundary selected was the road running north parallel to Jallah Town Road (Figure 27).

Once the boundaries of the greater site were identified, the work of creating the convex spaces and axial lines for spatial analysis began. Using the figure-ground map of the community created earlier, a grid of convex spaces were drawn that best articulated the negative spaces between the building footprints. The resolution of the convex spaces was kept at the level of the figure-ground that was created using satellite imagery of Jallah Town, which was approximately one-meter resolution. This resolution was enough to capture general building shapes, but not every porch or minor building variation. Additionally the satellite based figure-ground was not able to capture spaces that were

underneath roof overhangs, so for the purposes of the syntax map, roof overhangs were considered part of the building space.
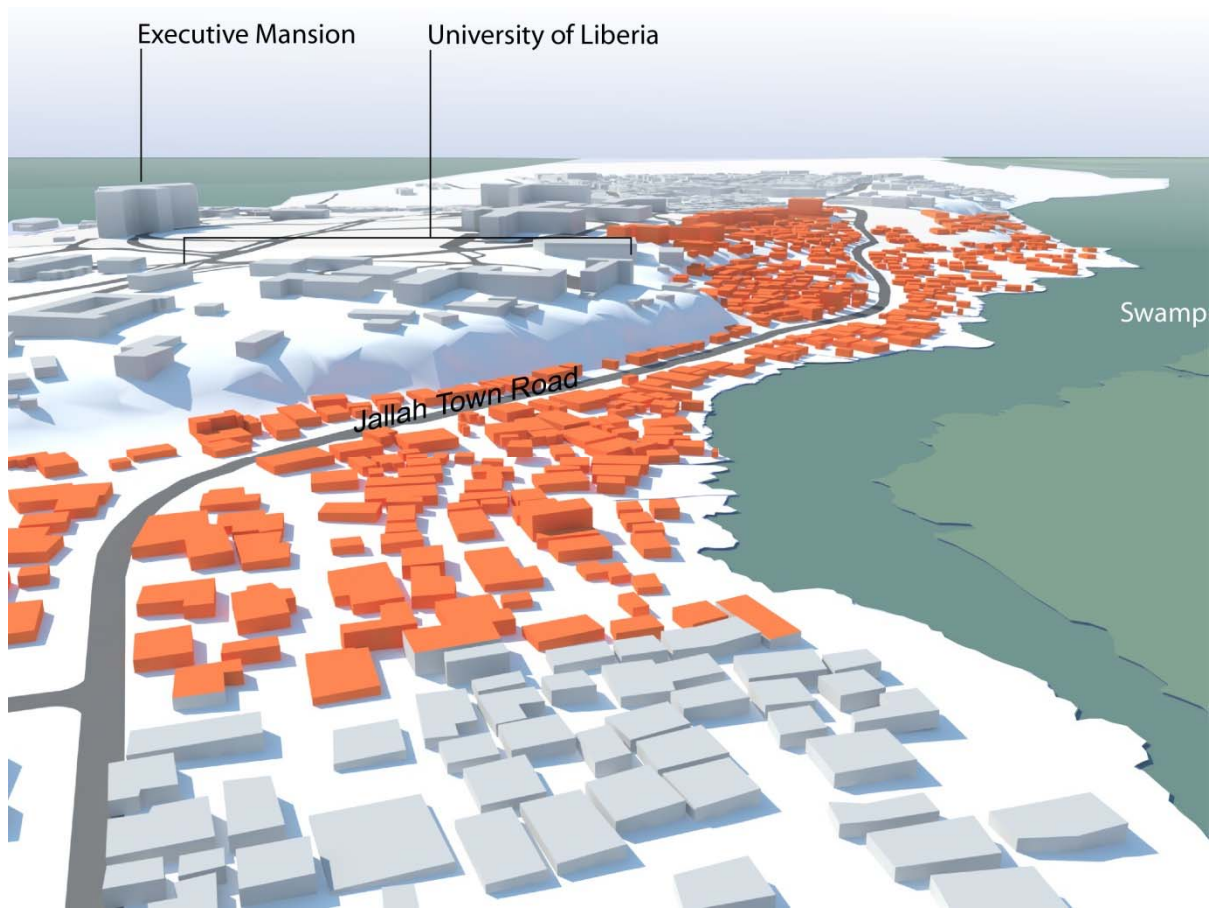

Figure 27: Perspective of Jallah Town. Community has been highlighted orange.

Figure 28: Jallah Town boundaries.

Near the edge of the community the open space would more often form a very large single space, but I noticed that there were in fact many small barriers that made it impractical for someone to walk along the water's edge. These large spaces were split at locations where there were streams and run-off gutters that ran through the site to the swamp. These streams were more often than not significant barriers to movement, as they were not always maintained and were typically full of all manner of waste. The axial lines, which connect the convex spaces, were created according to the methods set out by Hillier in *The Logic of Public Space* (1989). The lines with the greatest length were drawn until each space had been connected to all adjacent spaces.

With the lines and convex spaces created, GIS was used to spatially join and then count the intersections of the spaces and lines. There were three spatial joins that were used in GIS for the spatial syntax analysis:

1. **Axial Index** - For each axial line, a count was created representing the number of convex spaces that were connected by that line. This represents the connectivity spaces along a single path.

2. **Axial Connectivity** - For each axial line, a count was created representing the number of other axial lines that intersect that line. This represents the connectivity of the convex spaces to connect to other spaces.

3. **Convex Summary** - A summary was created for each convex space that counted the number of axial lines that were overlapped, a summation of axial index, and a summation of the axial connectivity. The sum of the axial index quantifies the number of spaces that directly linked to each space through a single line. The sum

of the axial connectivity quantifies the ability of each space to connect to other spaces.

A high axial index and connectivity score represent a very well connected space that would be expected to receive a lot of traffic in many directions. A high axial index, but a low connectivity score represents a space where people pass through, but that may be more constricted and not an open public space. Conversely, a low axial index and high connectivity score represents a location that is not as open to the rest of the community, but may form a local node of interaction.

INTEGRATION ANALYSIS

By normalizing the spatial index and connectivity quantifications from the space syntax analysis, I developed a map to analyze the ease of travel from any one space to another. This map of space integration was created by counting the number of turns needed to access any space from the main roads, assuming that the roads act as the primary path of accessibility between most spaces. Starting with the axial lines that represented the roads (enumerated as "0"), each axial line that crossed the roads was enumerated as "1", as it was one level away from the primary path. Each axial line that crossed the first iteration of lines that was two levels from the primary path was label "2" and so on. This method of counting turns was continued until the twelfth level when the entirety of the site, with the exception of the choke point along at the North end of the community, had been counted. (Figure 29).
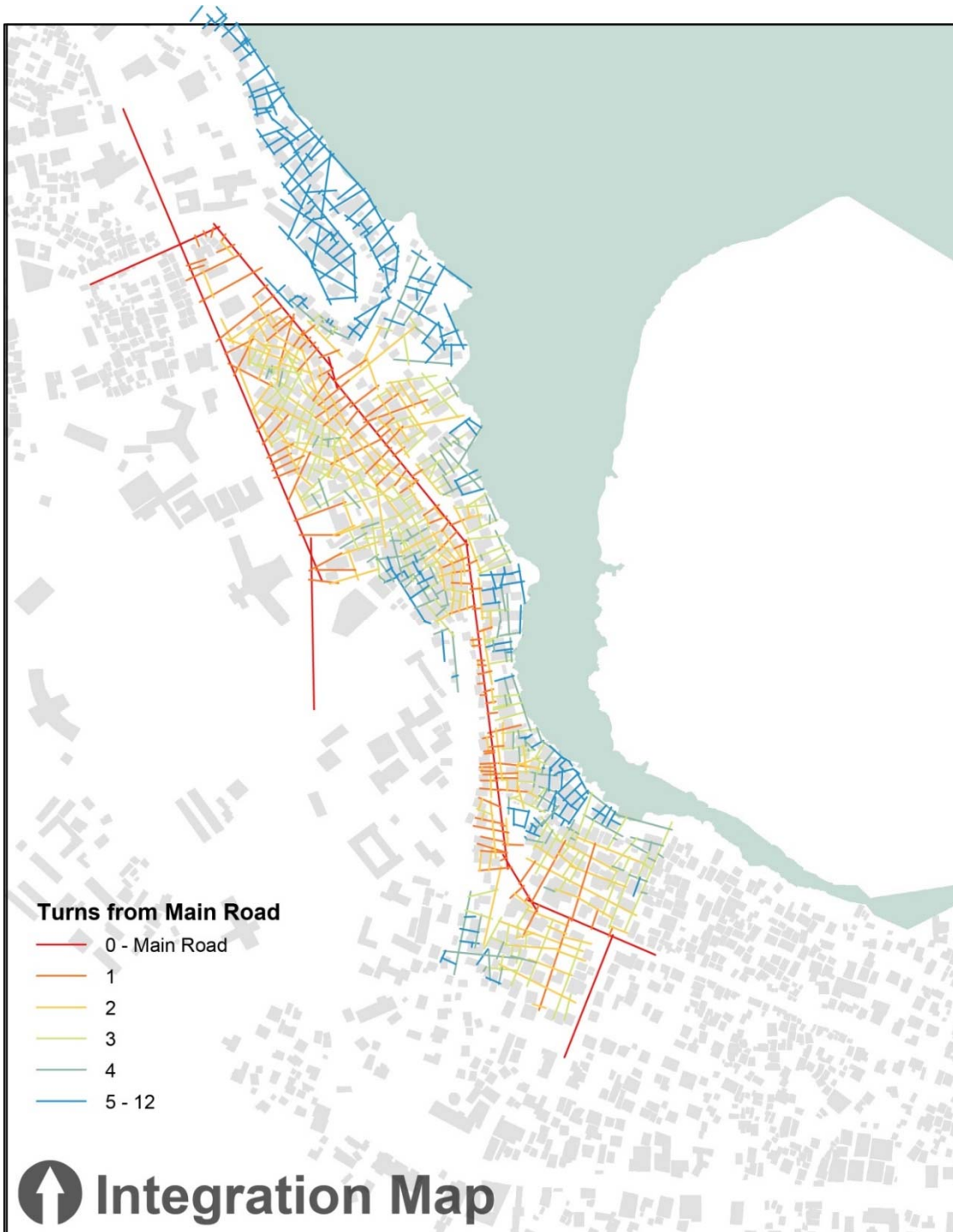
Figure 29: Integration from Main Road.

Chapter 5: Jallah Town Public Space - Findings

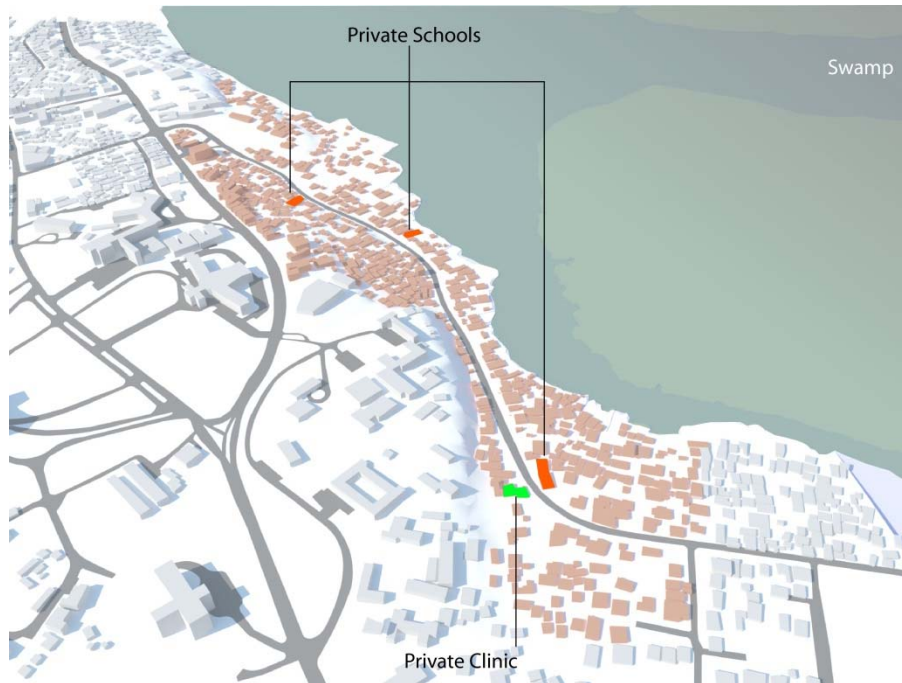**THE SPATIAL MORPHOLOGY OF JALLAH TOWN AS AN ACT OF THE COMMUNITY**

Figure 30: Location of private schools and clinics.

Over time, the inhabitants of Jallah Town, once limited to the narrow space between the road and the cliff, have created firm land in the adjoining swamp and formed their own community structure without any guiding government regulations. Residents have developed a busy commercial area along the main road with informal markets, bars, and stores. Interspersed with the markets are a few private elementary schools (three in total) and a clinic that provide services not made available by public agencies (Figure 30). Behind the public market and civic areas along the main road, community members have constructed the majority of the residences. In the homes located along that road,

many residents have erected small stands to sell commodities such as small bags of drinking water, candy, and cooking ingredients[6] (Figure 31).

Figure 31: Small stand for selling within settlement.

The spatial morphology of Jallah Town does not form the typical patterns that are associated with suburban or urban environments in the U.S. Instead, the building patterns have evolved based on topography and explicit (and sometimes implicit) social contracts between members of the community. The pattern can be most easily seen in the regularity of density between buildings within clearly identifiable zones. The westernmost, and more established, side of the main road has a relatively high density of buildings and movement patterns, while directly across the street there is a dramatic shift (Figure 32-Figure 33). On the eastern, swamp side of the road the building pattern is more open and sparse. This is most likely the result of the ways in which community members moved

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[6]Typically this would be seen as the amazing entrepreneurial spirit of the informal settlements, but in Poor Economics, they have found that generally these markets are a product of necessity not a desire to form a business (Banerjee and Duflo, 2011). If, given the opportunity the individuals would typically chose a steady job with the government or business rather than the inconsistency and stress of the informal market.

into and reclaimed the swamp. As they expanded the settlement, new residents would need to agree on the extent of territory one could claim without infringing on the rights of someone else.

One is reminded of the ideas of Ed Hall in that people make claim to a certain territory as a function of space and distance. Encroaching on this space of comfortable might have been perceived as a slight and would have required some type of negotiation between residents. The lack of density may also be attributable to the relative "newness" of the swamp side. The residents who created the land established preferred comfort zones and they have not yet been squeezed, so to speak, by an influx of new residents. It would be interesting to go back to Jallah Town in 10-20 years to see if the density has increased in the area as a function of time, assuming the community has not been forced to resettle.

The negative space between the buildings has formed a fairly consistent pattern of circulation spaces (see Syntax Analysis Findings, below). Also, as in some of the dense areas of West Point[7], residents have not only left open space for circulation, but also created public spaces with what appears to be uniform regularity (Figure 32-33). Why does this happen? How does a community decide where to create a node of public space and what size this space should be? It is unclear how this pattern of public space was incrementally developed over time, but my research has found that these spaces occur with great regularity in the community and that residents must be assumed to both desire and act on the need for open space.

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[7] West Point is commonly understood to be one of the worst informal settlements of Liberia. There is reportedly a lot of crime, drugs, and destitution within the community. The area is also under constant threat from flooding, as it is located on a small beachhead out into the Atlantic Ocean.

Figure 32: Spaces of high axial and spatial intensity as derived from the space syntax analysis.

Figure 33: Connections from high intensity spaces to remainder of Jallah Town.

What is clear is that the residents of Jallah Town have a desire for public land, as they have made it a priority to reserve a large plot of land for the construction of a community center. This is not the most desirable parcel, since it is located in the narrowest area between the road and the swamp, but the community has made their desires clear by reserving it for the public good. It must be assumed that residents have actively enforced this communal land claim, since otherwise someone would most likely have squatted on this land already.

Figure 34: Water mitigation.

The community has also actively created other public services in lieu of state service provision. The community left space between homes for water run-off culverts to protect against flooding in the low-lying areas of the community (Figure 34). Many of the residents along the edge of the swamp have also built latrines that one can see dotting the edge of the swamp (Figure 35). The latrines, though built directly behind some residences, are not reserved for anyone in particular but are open to the general public[8]. The latrines may have been originally built for a specific family or grouping of people, but at this point they did not appear to be "claimed" by anyone; i.e. no one was kept out, although it would take further research to establish this

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[8] Most use may be by those with easy access to the latrines at the swamp edge or the residences adjacent to the swamp. On several occasions people were seen to walk through the public spaces to the latrines. A survey of the use and catchment area of the latrines would be an interesting addition to this research.

for certain. The flood mitigation strategies on the other hand, while serving to protect individuals, are beneficial to the whole community. The upkeep and clearing of debris are chores that must be accomplished by the collective and responsibilities of maintenance must be negotiated among the residents.

Figure 35: Makeshift toilet at swamp edge.

Community members also make use of the spatial form of the settlement to protect themselves from vandalism and crime. In several conversations with the residents of Jallah Town, they expressed little worry about criminal activity within the area and suggested that the spatial attributes of the community keep them safe. Since the community is long and narrow with environmental barriers to the east and west (the cliff and swamp, respectively), any person taking part in criminal activity would be forced to flee along the long axis of the community. That person would then, more than likely, be

forced onto the main road where it would be easy for the criminal to be seen and captured by residents. Thus the urban morphology of the community was forefront in the minds of the inhabitants as a means of ensuring their own security. However, in addition to jointly providing public services, open space, flood protection, and security, residents have also established spatial patterns at the micro-scale of individual homes as a means of adaptation to cash violence.

THE SPATIAL MORPHOLOGY OF CLUSTERS AS AN ACT OF SMALL GROUPS

Cluster Map

Figure 36: High use, semi-private cluster.

One, distinct spatial morphology of Jallah Town can be characterized as the clustering of homes by family groups or residents with tribal connections (Figure 36). Although not every residence was part of a cluster, this pattern is common in the community. Clusters of homes often center on a central path or space, sometimes no

wider than a hallway in a typical home in the U.S. These spaces would be used for a multitude of activities and functions for the group: for informal meetings, to care for children, to cook, and to eat. The spaces were most often set back from the principal paths of travel, with the surrounding cluster of buildings opening up directly onto the space.

Figure 37: Common claiming of territory by youth.

The central spaces between the clusters were most often claimed by the residents in the cluster, but they were not, in the terminology of Hall, territories that could be described as neither intimate, nor home or public. There was never an instance when it felt uncomfortable entering these spaces as an outsider, although it was rare to see other individuals who were not native to this family or tribal cluster spend time in the space. The exception was children,[9] who would play with children from other families and roam

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[9] For this research understood as between five (5) and fifteen (15) years of age. Children under that age were not typically mobile and were most often in the care of an individual. Children as young as five (5) did were not given much supervision, though they were typically kept within certain zones.

between clusters; still, they did not appear to stray too far from the home without the supervision of a family member or friend of the family[10](Figure 37).

SYNTAX ANALYSIS AND OBSERVATION FINDINGS

The following are key findings focusing on the integration and connectivity of public space, derived from the spatial syntax analysis of the community and survey site. As noted above, a regular pattern of highly integrated open spaces has developed throughout the community (Figure 38-57). The major exception to this regularity of integration was the narrow section of Jallah Town, where residents were constricted by the proximity of the cliff to the nearby swamp. The site chosen for the mapping analysis is one of first open spaces of integration that occurs on the southern end of this "integration desert" (Figure 29). To the south and west of the site, moving into the neighboring community of Sinkor, the regularity of integrated public space picks back up rather quickly. On the northern end of the site, most of the high intensity, public spaces are in the old section of Jallah Town located on the west side of the main road.

In the analysis of the network of spaces, determined by counting the turns (i.e. numbers of paths necessary to reach any other space), several characteristics became immediately apparent. The first was that most of the community could be reached in as little as three to four turns (Figure 29). The most segregated area was the choke point at the north end of the site, which, because of the topography and the location of the Ministry of Health, is much less accessible than the rest of Jallah Town. In addition, even though there is a high density of buildings and paths in the western side of Jallah Town, it is extremely well integrated. It is possible to reach even the furthest section of the main

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[10] Refer to the Mapping Findings sections for further analysis of the spaces where children would tend to use.

road from almost any point in the area in 4 or fewer turns. Considering the complex morphology of the neighborhood, this was a surprising and illuminating finding[11].

A limitation of the syntax analysis that should immediately be addressed was that it does not account for the stationary residents. Since the syntax score attempts to capture the movement through spaces on the way to other places, its intent is not to describe where people would rest. The syntax analysis did not predict the pockets of semi-private spaces, those just off of the highly traveled spaces, which are often used for cooking, resting, and conversing. The claiming of these edge spaces, while consistent with some of the observations of Christopher Alexander (1977), are not reflected very well by spatial syntax analysis. Another limitation of syntax analysis was that the methods of convex space and axial lines did not describe the gradation of traffic within the public space[12].

During field work, I noted all movement data on individual maps, where each map recorded a single instance of time. Once this information was digitized and the individual time instances were overlaid on top each other, it became possible to observe patterns that developed in movements of individuals (Figure 42). Along with the classification of movement by age, gender, and action, further patterns began to emerge (Figure 55-57).

For the most part, the majority of movement was directly through the site as people travelled to and from the main road. When the movement to and from the main road was removed, there was comparatively little movement on the site (Figure 44). Even though (as shown in the syntax analysis) the space had high levels of connectivity and

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[11] This measure has been made only using a flat analysis of the site. A more "complete" assessment would incorporate the changes of elevation, minor obstructions, and unseen barriers to accessibility that were not apparent at the resolution of the satellite imagery.
[12] There are some methods spelled in the *Social Logic of Space*, by Bill Hillier, typically used for understanding movement within the interior of a building that could be used for this purpose. The analysis is more intensive than was feasible for this thesis, but would be the next step in any further analysis.

integration, most of the movement could be attributable to the close proximity to the main road and the space's function as a path. With this movement to the road removed from the analysis, the main public space begins to appear rather deserted and most intra-site circulation is performed by children (Figure 54). The "public space" here is not being used for gathering or networking, but simply as a wider portion of the main circulation through the site.

With the movement reduced to those within the site, recordings are mostly of people who were stationary (cooking, cleaning, resting, et cetera) in four to five (4-5) locations. The spaces where people tended to remain stationary most often shared several characteristics: there was good visibility to the main paths of travel; they were in a cluster and near (within 2 meters) an entrance to a private residence; they were at least one level removed from the main path of travel; and they were protected from the rain. There were exceptions to each of these general characteristics, but, more often than not, they each met three out of four (3/4) of them. These spaces do not conform easily to the model of territories of Hall, but for now I will refer to these as "semi-private" spaces.

For the most part, it was primarily women who were making use of these spaces. In all but one location, the majority of inhabitants were always women[13] (Figure 44-45). The women appeared to use the space for cooking and cleaning and so had greater claim to the space. When the men were present in semi-private space, it was more often to rest, not to perform chores with the women[14].

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13 In the other, there was only one older gentleman that typically used the space, unless some children (his grandchildren) decided to sit with him. The wife appeared to use the side of the house, where there was an outdoor kitchen.

[14] This may be partly the gender roles, but also may be an aspect of the timing of the survey. The time of day that the surveys were conducted were typically in the middle of the day on the weekdays, when many of the men went to a job that was remote from the site. Some of the men worked at local restaurants or went to a market and so were either not present, were preparing for work, or coming home from work during the survey times.

People would also use the main public space, or the space between the public space and the semi-private, to wash clothes. During almost any hot and sunny day, women would be busy washing and hanging clothes out to dry[15]. Both because it is helpful to use the heat of the sun and because the space within most of the semi-private spaces is too small for the washing of clothes, functions typically found within the home would thus be expanded into the public space. The temporary claiming of space and the growth of semi-private space can been seen in Figure 41 and Figure 55. Another interesting finding is the spaces where children tend to reside. The main public space, though located off of the road and relatively protected, appeared to be too public for the children to play in. The children almost never used the central space, unless they, like the adults, were accessing the main road. Otherwise the children were kept at least one turn or step farther into the settlement[16] (Figure 48, 49, 55). It could be that the relative visibility of the children to passersby on the main road was seen as a potential threat.

Through the analysis of movement in the public space of the community the use and function of different space typologies were apparent. People spent most of their time and developed the most highly integrated networks in very small clusters or units. The small level of networking was relatively privatized to these local groups who had much looser connection with the surrounding neighbors.

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[15] Even though most instances in the survey were of women performing these duties, there were times when men were helping with the washing on other areas of the site, that were not being mapped. The predominance of washing did seem to be performed by the women, though again this may be similar to the observations noted in the previous footnote.

[16] The fact that the children do not play in this wide-open space, and were explicitly told on several occasions to stay out of the central space, is interesting for several reasons. The first is that there are children of all ages on the main road. If the main road were considered dangerous, culturally, why would so many adults be comfortable with their children playing in view and easy access of it? Perhaps this may also be due to the relative placement of the home and adults responsible for the children. For an adult who either works or lives along the main road it would make sense to keep an eye on them, even along the main road.

The people made little use of the primary public space for political action. This reinforces my suggestion in previous chapters that much of the agency of the community is taken in incremental steps by individuals and small groups through quiet encroachment, rather than as collective action for political agency. The clusters are where the tightest knit groups continuously reinforce themselves through use of territory that they have claimed, apart from the greater community.
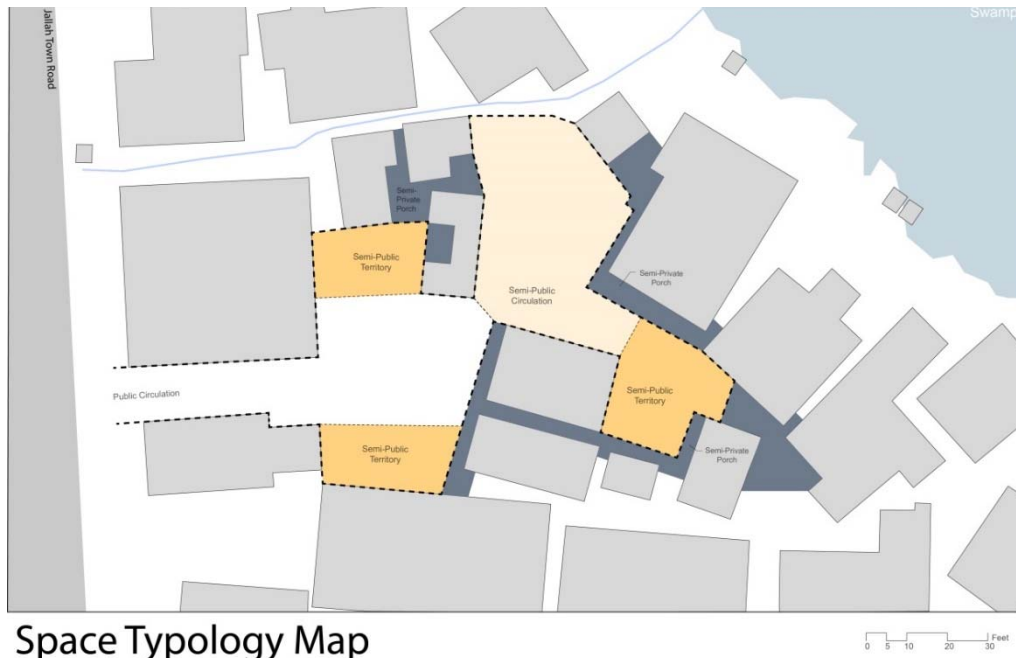

Figure 38: Panorama of primary public space observation.

Figure 39: Base map of surveyed site showing the location of the toilets (WC), garbage pile in the primary space, and run-off stream north of site.

Figure 40: View of Jallah Town and location of mapping survey.

Space Typology Map

Figure 41: Observed typologies of space. Orange spaces, within the dashed line, are
public spaces. Outside of the dashed line the private and semi-private
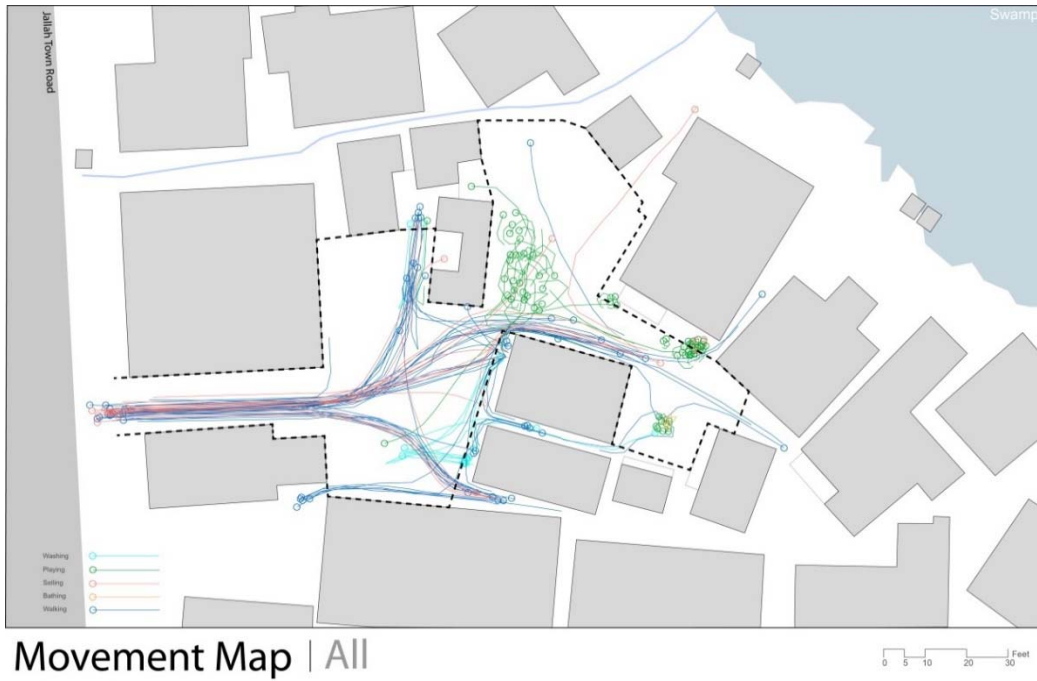spaces are shown in blue.

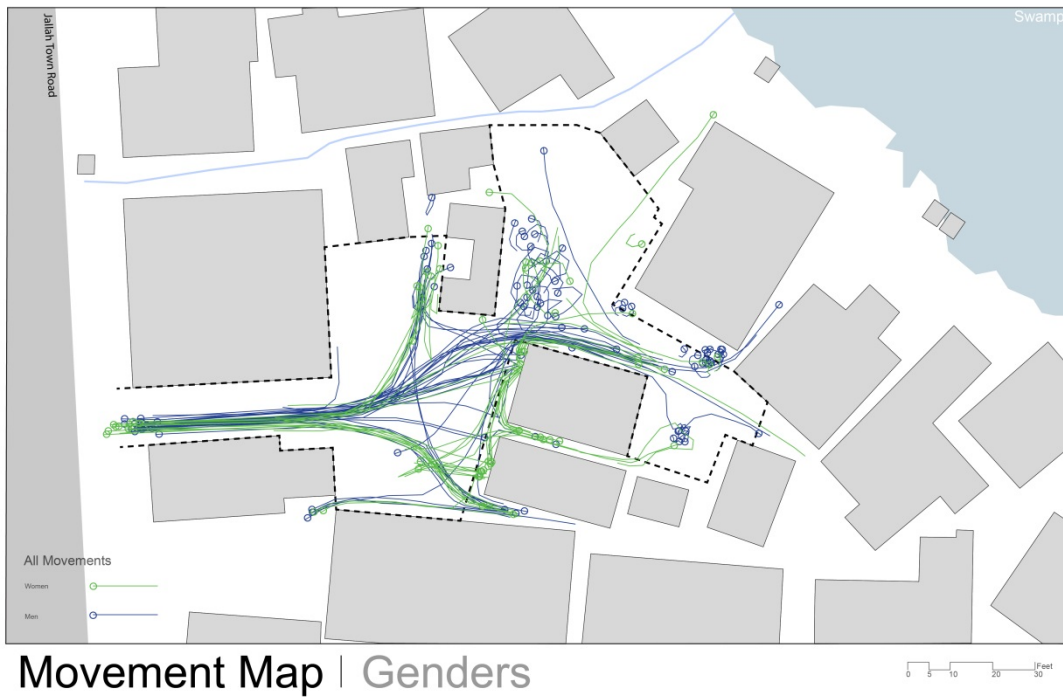Figure 42: All recorded movement categorized by function.

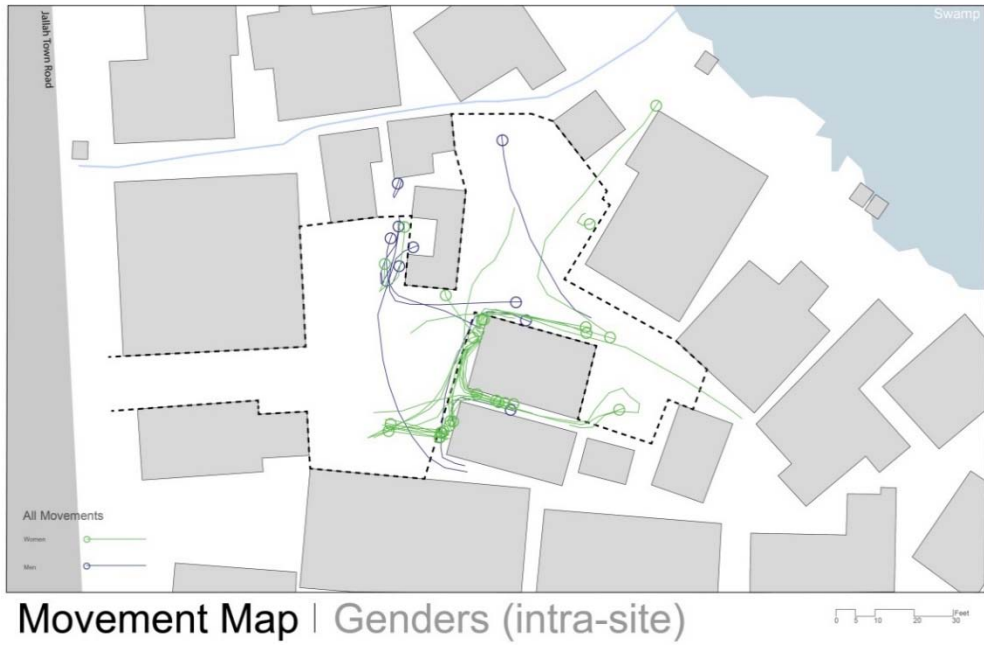Figure 43: Recorded movement categorized by gender.

Figure 44: Recorded movement categorized by gender.(Only showing the
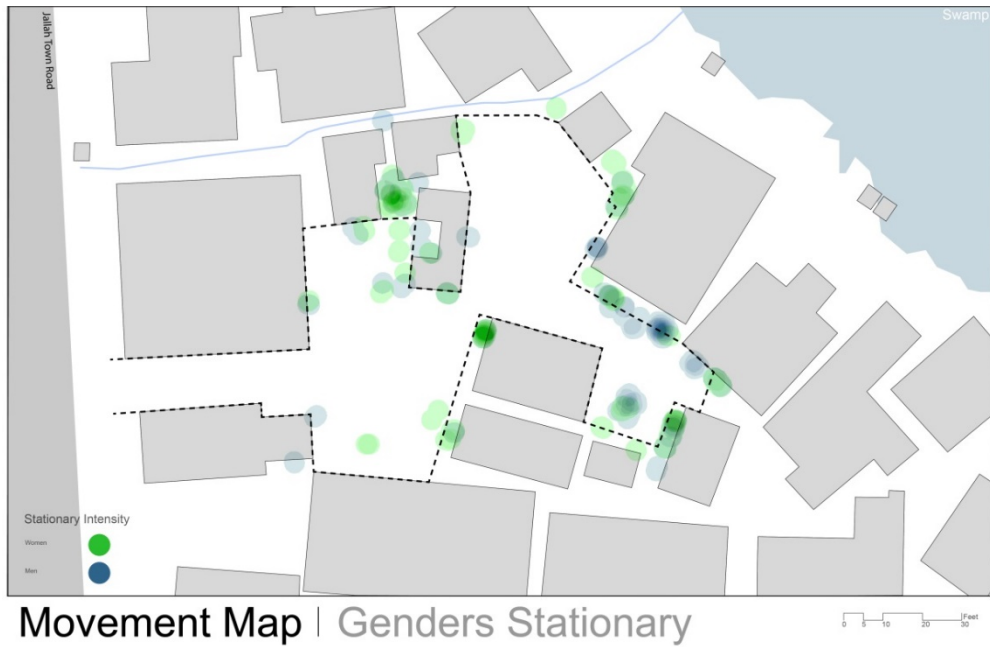movements interior to the site that did not come from or to the
main road.)

Figure 45: Locations where individuals were at rest, categorized by gender.
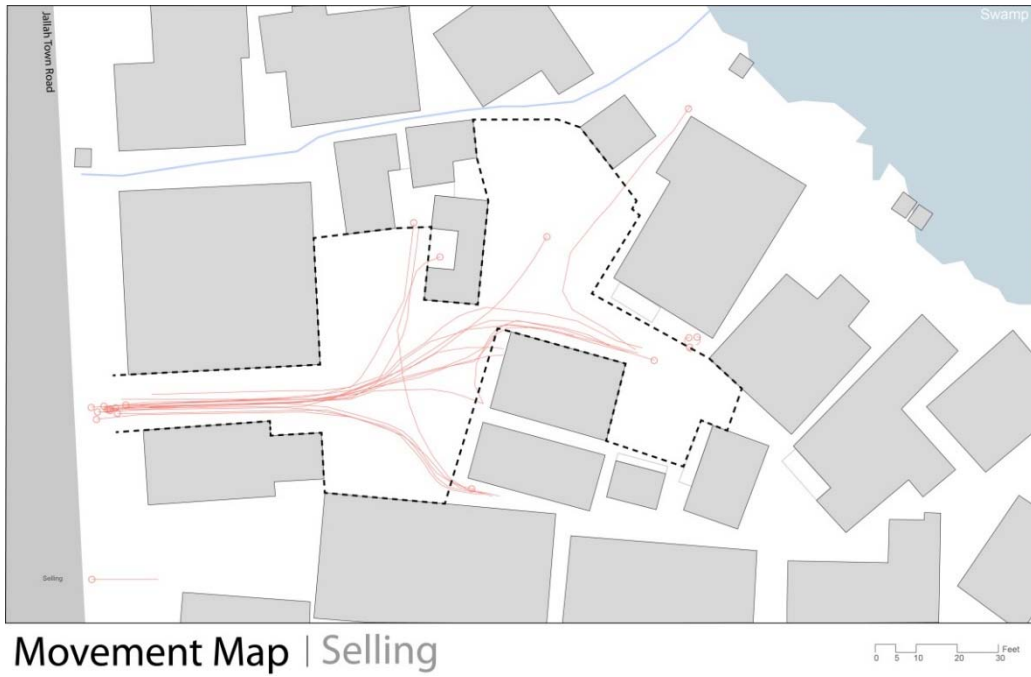
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Figure 46: Recorded movement of individuals that were selling goods.
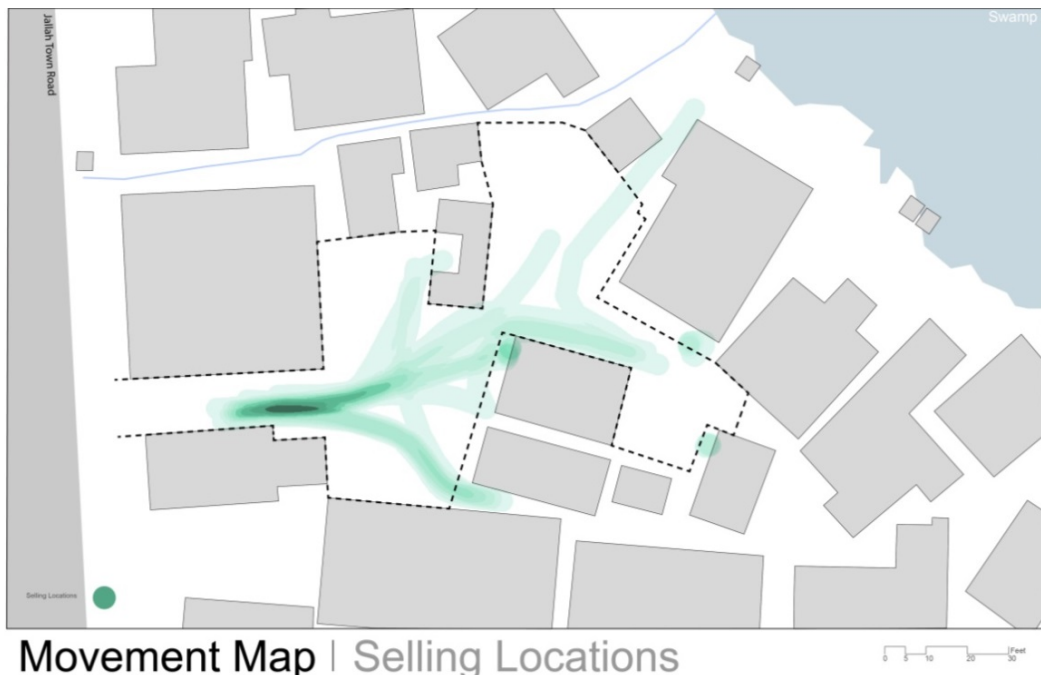

Figure 47: Density analysis of selling movement and static locations.

Figure 48: Recorded movement that was categorized as "play."

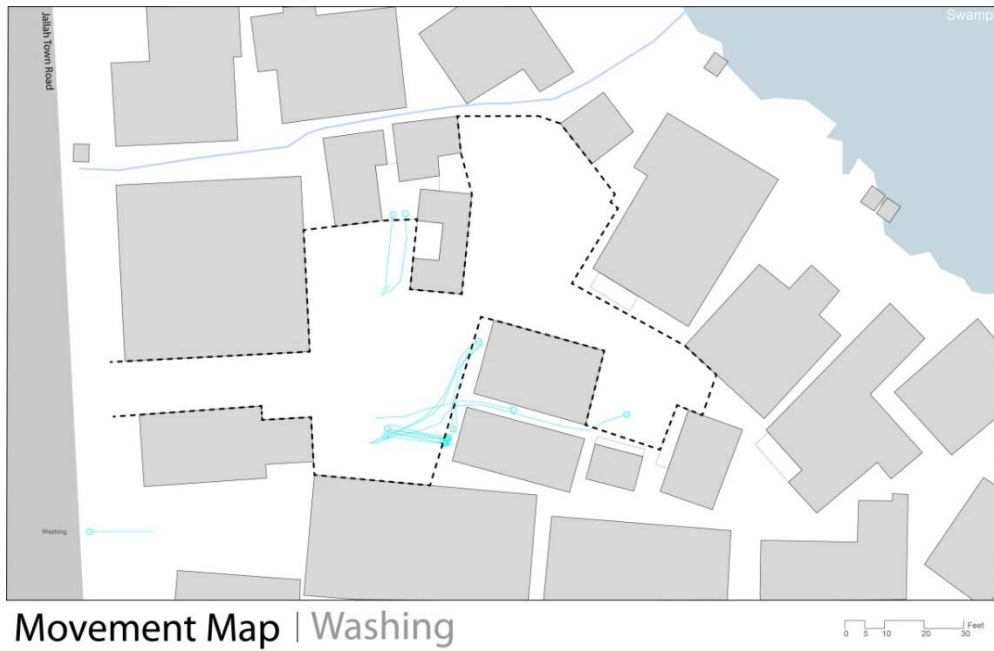Figure 49: Density analysis of play on the site.
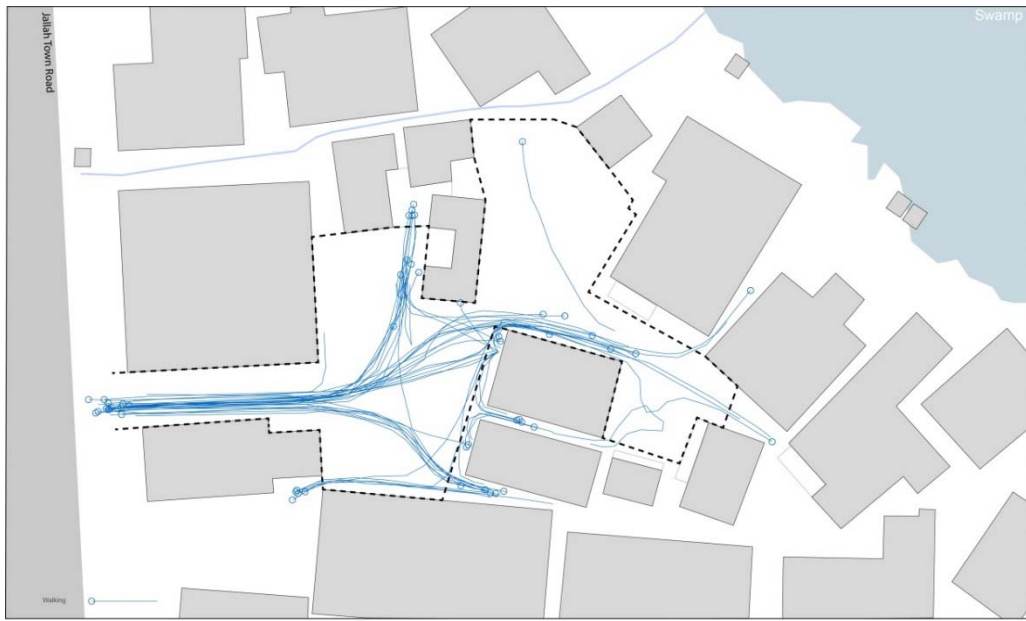
Figure 50: Recorded movement that involved the washing and drying of clothes.

Figure 51: Density analysis of static locations where there was the washing of clothes.

Movement Map | Walking

Figure 52: All recorded general walking throughout the site.

Movement Map | Cooking Locations

Figure 53: Density analysis of static locations that were used for cooking and the prepping of food.

Movement Map | All Ages

Figure 54: All recorded movement categorized by age groups.

Movement Map | Ages 5-15

Figure 55: Movement of all individuals approximately between the ages of 5-15.
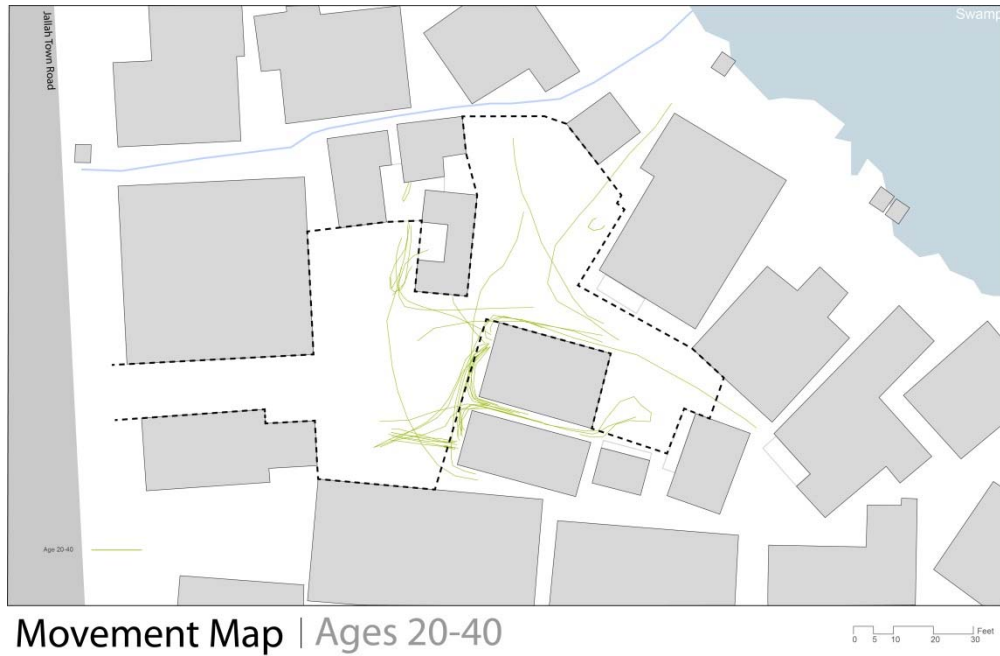
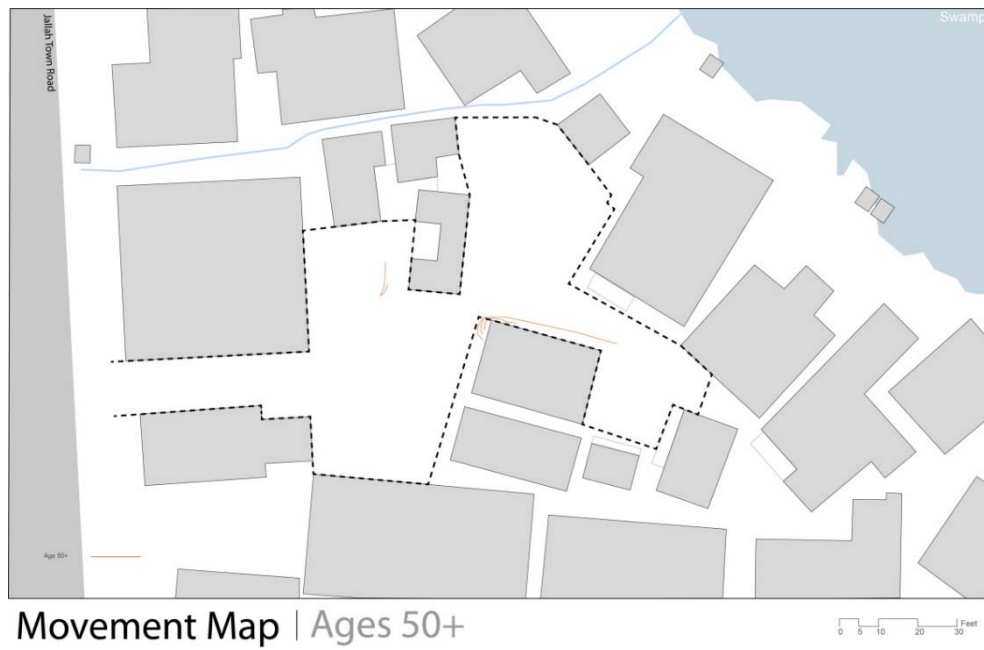Figure 56: Movement of all individuals approximately between the ages of 20-40.

Figure 57: Movement of all individuals that can be estimated to be over 50.

Chapter 6: Analysis and Discussion

By interpreting theories on public urban space in the context of observations and spatial analysis of the informal settlement of Jallah Town, I have described a series of strategies of "quiet encroachment" deployed by residents as they adapt to the conditions of the political-economic environment. In small steps and without top-down guidance or enforcement, the individual actions of people have created spatial patterns within the community. The government, stressed by the influx of people coming into the city, has had a difficult time keeping up with the rate of urbanization. It is within these gaps in power and governance that the individuals and the community have acted, not as an act against the government, but rather in spite of it. Residents do not typically view themselves as political actors. They are instead taking advantage of ambiguous rules because these present opportunities, not to challenge authorities.

As people have had little ability to acquire land near services and jobs in the formal city, they have gone to great lengths to create new land where there once was only swamp. The creation of land is a highly visible result of the quiet encroachment of the community to adapt to the lack of access to land tenure and the inability of the government to establish a comprehensive urban policy and planning regime. With the pull of services, local markets, and employment in the city, there are many benefits to be located close to the central business district of Monrovia. The creation of land is therefore a prime example of the informal, quiet method of "encroaching" on the city and claiming land as well as services.

However, although they benefit from being located near the urban center, there are many gaps in the availability of services that must be solved at a local level. The

community has therefore had to establish informal methods of zoning and an understanding of property that is not based on the holding of title or deed with the backing of the state. They have created a normative, informal legal environment with agreed-upon "easements" around residences for purposes of flood mitigation, circulation, and informal gathering. These are also spaces where children can play, and where one can cook or hang clothes to dry. This creation of public and semi-public spaces that mitigate the lack of state services has formed patterns that are not random or coincidental. The community has, without any sort of government regulatory mechanisms, established communal understandings of rights and access that have informed both the density of buildings and the patterns of public spaces. The community has also developed an intrinsic understanding of the ability of space to reduce the risk of crime.

The clustering and use of semi-private spaces around small familial or geographical units[17] is also an example of residents' adaptation to the climatic and economic environment. The clusters allow for a minimum amount of construction while providing for a maximum potential for usage. The use of these spaces is also interesting in that it is reminiscent of the homes in Europe and the U.S. prior to the 18th century, where individual rooms within the home were not claimed for specific functions like they are today. (Hall,1966). The interior rooms are reserved for many of the functions associated with the bedroom in the West, including sleeping and procreation, but the semi-private space at the heart of each cluster serves as a general space that can be adapted to the needs of the group.

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[17] The distinction of geographical unit is that the group is within close proximity to each other. The group, though not made up of a single-family unit, makes use of the same semi-private space at the heart of the cluster. The group may contain similar ethnicities, languages, or tribal relations, but it did not appear that it was necessary for the generation of the group.

The edges of public spaces in Jallah Town are claimed most typically for private use, but they also allow for informal meetings, which has implications for the understanding of networking within the settlement. It is generally understood that one of the benefits that the informal settlements brings to inhabitants are networks that can mitigate the effects of poverty. (HUD, 2011) However, my observations and mapping suggest that these networks do not focus on the collective capacity of the community, as much as the familial or geographical unit. Instead, it is in response to threats from outside the greater community that the smaller units will consolidate to help one another. The groups do not need to have strong ties to others in the community in order to respond to these threats. They see that they have similar lifestyles and are under similar threats and so form a sympathetic response. (Bayat, 2009).

IMPLICATIONS FOR PLANNING AND URBAN DESIGN PRACTICE AND THEORY

My findings have implications both for the theory and practice of urban design and planning. I have expanded on the theoretical frameworks of Alexander (1977), Hall (1966), and Hillier (1989) to incorporate the insights of Bayat (2009) and Zizek (2008) in order to deepen our understanding of the creation of public spaces in areas of extreme deprivation. Despite the blurring of lines between developed and developing countries today, there are still many areas of the world that are struggling to cope with poverty, and the distinct conditions of informal settlements do not fit easily into any single model. In each condition, people are adapting to very discreet factors of climate, culture, markets, history, language, and nascent government institutions. Theory must be grounded in particular, local factors and culture instead of Western conditions and assumptions.

Previous research tells us that space syntax can tell us which areas of a city are more integrated and which are more segregated and therefore more likely to

impoverished, but translating this understanding into a template for advocacy or policy is still a rather abstract proposition. It will take more research to clarify how institutions affect poverty and how people in poverty can effectively better their situation through their own agency. Furthermore, space syntax analysis conducted in a decontextualized manner without understanding of local institutions or culture could serve to reproduce failed planning and design strategies of the past. A simplistic understanding of the relationship between poverty and syntax analysis could lead to the idea that a solution for an area of deprivation would be to reorder the circulation patterns of the city infrastructure, relocating existing residents, damaging community networks, and opening up an area to unmitigated speculation and gentrification. Altering the urban fabric to change the syntax score would be extremely short sighted if the issues that created the poverty and context of people and place were left out of consideration. Conversely, policy makers may, with the best intentions, try to solve a 'poverty problem' without understanding the impact of spatial conditions that may limit the efficacy of their initiatives. Even the best ideas may be hampered because the initiatives did not consider how people relate to space around them, and, most importantly, how they use that space to create social bonds.

The goal of this research has been to understand the particularities of a discreet location by focusing primarily on the adaptation of people who are forced to deal with the lack of state support. In Liberia and other countries dealing with issues of rapid urbanization and informality, the theoretical models used to understand European or U.S. cities are inadequate. Although Liberia has a working government and many institutions and NGOs work in informal settlements, the citizenry, not formal planning institutions, developed the spatial morphology, the informal rules of tenure, and the regularity of

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public space in these informal settlements. These social contracts, informal services, and ad hoc infrastructure have emerged to solve many of the problems faced by the community.

Unfortunately, the challenges faced by these communities are beyond their collective capacity. Residents need the guidance and assistance of the government to provide sufficient services to properly serve the needs of their communities. These two processes—the incremental, quiet encroachment of the community and the top-down strategies of the government—have been very difficult to harmonize. Theory will need to be developed to first understand the relations between these divergent models, and then to find ways to integrate both. Theory must respond by researching and testing the effect of cultural and regional disparities, not by assuming that one can overlay Western ideas of urbanity onto these countries. Such a conception of urban theory that integrates local strategies with Western knowledge will have dramatic implications for urban design and planning, as these fields struggle with the rapid urbanization that is facing Monrovia and other developing cities in the Global South.

Appendix A - Mapping

Data Source Details:

Data: Census Track (Polygon)
Produced by: Liberian Institute of Statistics and Geo-Information Services, 2013

Data: Street Network (Network/Polyline); Natural Features (Polygon); Coast (Polyline)
Produced by: Open Street Maps (http://osm.org).

Metadata Summary:

Projection: WGS_1984_UTM_Zone_29N (meters)
Building outlines produced through satellite digitization in CAD program and projected into GIS software for analysis. MIT Urban Network Analysis tools were used for city network and building integration analysis (http://cityform.mit.edu/projects/urban-network-analysis.html).

Analysis Details:

General:
1. To digitize building footprints for Monrovia, satellite imagery was downloaded to CAD software. The rooflines of buildings were used to demarcate the building footprints.
2. GIS spatial analysis "erase" tool used to limit LISGIS census track boundaries to buildable area. Area erased that overlapped "natural.shp" OSM file designating swampland.

Syntax:
1. Using CAD software and following the Spatial Syntax methods described in *The Social Logic of Space*, convex spaces drawn throughout Jallah Town community.
2. Continuing with Spatial Syntax methodology axial lines were drawn connecting all convex spaces.
3. **"Convex Spaces"** layer and **"Axial Lines"** layer imported to GIS software.
4. **"Axial Lines"** *spatially joined* to **"Convex Spaces"** to produce **"Axial Index",** counting the number of spaces that each axial line overlaps.
5. **"Axial Index"** *spatially joined* to **"Axial Lines"** to produce **"Axial Connectivity"**, counting the number of axial lines that cross other axial lines.
6. **"Convex Spaces"** *spatially joined* to **"Axial Connectivity"** to produce **"Con_Connectivity"**, to summarize the axial index (linkages to other spaces) and axial connectivity (linkages to other paths) within the convex spaces.

7. **"Con_Connectivity"** classified manually into three categories using the Sum of Axial connectivity:
   a. 0-24 – White;
   b. 25-59 – Bright Orange – High Intensity Spaces;
   c. 60-159 – Dark Orange – Highest Intensity Spaces.
8. New layer, **"Convex Intensity,"** created from convex spaces of **"Con_Connectivity"** with sum axial connectivity greater than 24.
9. Selected by location **"Axial Lines"** that overlap spaces of **"Convex Intensity";** then deselected by location "**Axial Lines**" that overlap **"Streets",** to find paths that lead to high intensity syntax spaces other than those along the main roads. New layer, "**Axial Intensity**" created.
10. Selected by location **"Axial Lines"** that overlap with **"Axial Intensity"** to find path just one turn from connections to high intensity convex spaces. New layer, **"Axial Intensity2"** created.

Urban Network Analysis:
1. MIT network analysis using downloaded toolset, Street Network from OSM, and digitized building footprints.
2. Four urban network analyses run:
   a. Betweenness
   b. Closeness
   c. Reach
   d. Gravity
3. Classification of each category:
   a. Betweenness: 6 equal intervals between 0 and 12,809,212.
   b. Closeness: 5 geometric intervals between 0 and 0.054106:
      i. 0-0.000005
      ii. 0.000006-0.000055
      iii. 0.000056-0.000550
      iv. 0.000551-0.005459
      v. 0.005460-0.054106
   c. Reach: 5 natural breaks (jenks) between 0 and 7010:
      i. 0-60
      ii. 60.1-134
      iii. 134.1-225
      iv. 225.1-442
      v. 442.1-7010
   d. Gravity: 5 geometric intervals between 0 and 268.28:
      i. 0-0.0043
      ii. 0.0044-0.0712
      iii. 0.0713-1.1108
      iv. 1.1109-17.265

Survey of Pedestrian Movement:
1. Digitization of pedestrian movements: **"Movement"** dataset created. Columns for the following created: No., Date, Time of Day, Weather, Age, Number of People, Function, Comment, and Length.
2. Selected by location "**Movement**" attributes with "length" greater than 1m. These instances saved to new data "**Move**". Instances with "length" less than 1m saved as "**Movement_sa**".
3. "**Move**" and "**Movement_sa**" broken into separate layers based on gender:
   a. "Male"
   b. "Female"
4. "**Move**" and "**Movement_sa**" broken into separate layers based on function:
   a. "Bathing": bathing, cutting hair, urinating;
   b. "Watching": w/ baby, breastfeeding, watching, cussing out kids;
   c. "Stationary": chatting, resting, sleeping;
   d. "Cooking": cleaning dishes, cooking, eating, prepping food, drinking;
   e. "Washing": working, washing;
   f. "Selling": buying, selling;
   g. "Playing": playing, dice.
5. "**Move**" and "**Movement_sa**" broken into separate layers based on age:
   a. "Age 5-15": older than 2, younger teenagers;
   b. "Age 20-40": older teenagers to 40;
   c. "Age 50": 50 and over.
6. Line Density analysis of "**Move**" and "**Movement_sa**" :
   a. Output cell size: .05
   b. Search radius: 1m
   c. Process extent: Same as Display
   d. XY resolution: .1m
   e. All results of "0" exempted from display and classification.

Caveats

Building Footprints: The digitization of the building footprints was done using satellite imagery which is map not be accurate or up to date. In using the rooflines in lieu of the building footprint it is possible that the spatial syntax could have been affected as many times the roof may not conform to the extent of the buildings.

Survey of Pedestrian Movement: There are several caveats that should be mentioned in conjunction with the mapping of pedestrian movements. First, is that the movements were only recorded for one site, for a two-week period, typically around the same time of day (between 9am and 6pm). It is possible that the movement could patterns could be

very different at different times of the year and during the evening as the environment and population may fluctuate. Also, the location in which the movements were mapped *from* was not consistent. This most certainly affected the visibility of areas of the site and ability to equally track areas of the primary and back public spaces.

LISGIS data: The LISGIS data, produced by the Liberian government through census information should be accurate, but it was noticed that these numbers did not always conform to what the normal estimates of population were for some communities. Additionally, the polygons representing communities overlapped areas of the swamp or natural obstruction which made the density of the communities, included in the dataset suspect.

OSM data: As the Open Street Map data was created through crowd sourcing it is difficult to verify the information. The data may have been produced by individuals with the best intentions, but lacking thoroughness. Without testing the data it would be difficult to know for certain how easily the crowd sourced data could be used for critical analysis.
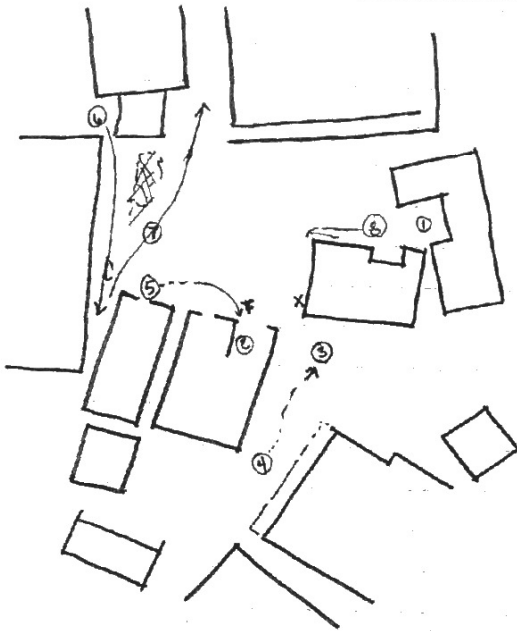
Appendix B – Field Maps
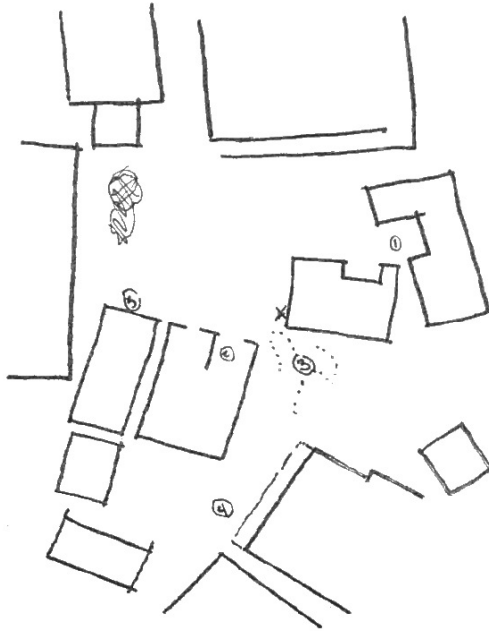
① 3 women 20-30 cooking
② 6a women selling / seeds
③ 4 <10 boys playing
④ 2 girls 10 playing
⑤ 1:1 20s sitting on porch
⑥
⑦

Date 3 7/1
time 14:30

---

① "
② "
③ "
④ "
⑤ 1: F: 20s: chatting w/ neighbor
⑥ 1: M: 20s :
⑦ 1: M: 10 late-20s
⑧ 2: F: 10: spying

Date 7/1
time 14:40

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