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APOPTOSIS IN CITY SYSTEMS: A BIOMIMETIC APPROACH TO CITY REGENERATION

Stephen Ajadi

College of Advanced and Professional Studies, Makurdi, Nigeria
Email: stephenajadi@gmail.com

Abstract
Over the past few years there have been a number of cases of large scale urban translocation, city division, and new formations of contemporary settlements in various parts of the world. An increase in the ubiquity of civil unrest around the world and mass uprisings are typical causes of these processes. This poses a serious threat to the efficacy of classical urban and architectural design strategies, and their motive. Since this is a new development which urban and architecture hardly anticipated, it is imperative to seek new ways to curb, manage or mitigate the proliferation of extemporaneous city mutations. The effort here is to employ chiefly the idea of biomimetics in an analytical juxtaposition of natural processes like apoptosis, pyknosis, karyorrhexis, and karyolysis with certain city processes and systems. The aim is to establish a new environmentally friendly motive for the disintegration and integration of settlements. Aided with streamlined programmatic principles, computational and algorithmic design, city systems are studied in an African context. The biomimetic approach to the study of city mutations is tailored to provide a design and management platform that attempts to predict and/or manage unanticipated shifts of settlements within city systems at various levels of urban and architectural schemes in West Africa, especially Nigeria.

Keywords: Apoptosis, Mutations, City Systems, Biomimetics, Settlements

INTRODUCTION

West African and in turn Nigerian landscape urbanism has reached a stage where one of the major problems facing planning and the proliferation of efficient and capable architectural design is the inability to effectively predict, recognise, compile, coordinate, and manage city systems.

One of a set of plausible reasons is the fact that city systems are being mutated at a more rapid rate than before. Societies prior to the independence period in Africa have been majorly rural (Alagbe, 2006). By the mid-20th century, most Africa countries began to gain independence from their colonial countries. This led to almost a quantum leap in the interface of the sociology and the economics of the countries (Alagbe, 2006). The rise of African cities was a major consequence. In the world today, the sporadic character of city systems remains almost the same while the scenarios continue to grow increasingly complex. New city systems are springing up in cities that do not have a planning and architecture platform that expects such developments. The extemporaneity of these systems makes the prediction and management of these city systems a tough task. As tough as the task seems; it is as well expedient. There is a strong imperative for the need to understand the extemporaneity of new city systems because their existence and activity increase the ambiguity of the African city.

There exists a highly inefficient state when planning and architecture cannot comprehensively describe into detail the behaviour of the city. If the behaviour of a system seems vague and unclear, then the improvement and maintenance of such a system will be more or less impossible. Knowing when and how to disintegrate or re-integrate a system or settlement becomes very difficult. This research has noticed that every city system has a cause; this cause can be another system which in turn exits by the effect or impact of another system. Increased migration flows have become a global trend (Castles 2009), for instance, intercity migration in West Africa is caused by certain city systems such as quality of education and employment while migration in and out of West African cities is due to (amongst many others) crisis migration issues, such as trafficking, international refugee flows and other irregular migration to Europe (Olsen, 2011). In the midst this current interplay and sporadic behaviour of city systems, one major factor that evokes the responsibility of the planner and the architect is the issue of housing. Housing is the frame work of settlements, because as the name implies, a settlement is a place where people settle. It is the nature of people to settle in shelter. The outlook of cities shows that a house is the modern paradigm of shelter. The research largely focuses on developing biomimetic strategies to predict, recognise, compile, coordinate, and manage city systems.

A set of city systems that are thought to be the most sporadic and volatile in Nigeria and some West African countries are analysed and studied. The primary developed strategy involves dissolving certain city settlements in a way that raises extremely little or no concerns about the economic, social strata, health and sustainability of the urban landscape. For this purpose a biomimetic methodology is also employed to produce a strategy by which a city can be 'put to death', decentralised or dissolved, by mimicking the micro but highly efficient process of apoptosis. Biomimicry can be applied to design in a number of levels (Biomimicry guild, 2007). They are as follows:

- Organism level (Mimicry of a specific organism)
- Behaviour level (Mimicry of how an organism behaves or relates to its larger context)
- Ecosystem level (Mimicry of an ecosystem)

The methodology engages biomimicry at the behaviour process mapping level, with this method, the process of apoptosis is super imposed on certain parameters of a dissolution strategy of city settlements. Paradoxically, the most important motive of the conclusive strategy is not to arrive at a final conclusive strategy, but make the strategy malleable and flexible to adapt to future developments in city systems.

CITY SYSTEMS

This research delineates city systems at two levels:

- The micro level: This is the level at which they are defined as definite or indefinite pattern or patterns of activity that progress through a city or a very similar settlement.
- The macro level: This is the level at which they are defined as definite or indefinite patterns of activity of a number of cities themselves through larger territories and regions. At the macro level, individual cities or group of cities become players or actors in the systemic process.

Just like the human body comprises of systems (e.g. digestive, reproductive, respiratory, e.tc.) the city also comprises of systems, but unlike the human body, the operation of city systems are largely difficult to fully define, and city systems often fade out and emerge with time as a city grows.

Examples of city systems include the movement of food, transportation of the working class, scarcity of fuel, variation of security, e.tc. With these examples it is logical to posit that the existence of some city systems largely depend the on the existence of other city systems, in other words, while some city systems are independent, some are dependent and inter connected. Some city systems may have a conspicuous character in terms of their presence and mostly in terms of their operation. Some other systems remain 'off -the-grid' and furtive. The characters of city systems also vary in terms of their stability and the formality of their proliferation, some city systems emerge gradually and eventually disappear gradually; some progress in a very predictable pattern (e.g. the transportation of working class) with little deviations while some are extremely Brownian in motion. This research has designated the term 'player' to describe the functional drivers of a city system. A typical system has a player or a set of players. This can be described as the factor that makes a system come to life. Players are like the verbs of a city system, that is, they induce the functioning of the system. For instance, when the transportation of the working class population of city is defined as a city system, a number of the major players that will animate such a system will include vehicles, roads, and the working class population. Tracking the behaviour and patterns of these players produce a better understanding of a city system.

SELECTED CITY SYSTEMS

This research is to try to investigate and identify processes and patterns of delineating city systems in Nigeria (while other city systems in West Africa may be similar). As a set of city systems are selected for consideration and evaluation in this research endeavour, the criteria and method for selection depends on the aim to grasp the urbanism of the Nigerian city in an efficiently holistic way. The selected systems contain players that affect a large array of other city systems across the country (see table 1 and 2)

MUTATIONS IN CITY SYSTEMS

A mutation in a city system can be defined as a break (either sudden or gradual) in the usual developmental process of a city and the operation and performance of its systems. With an understanding of city systems and their players, it is necessary to know how city systems change or mutate and the factors that affect or catalyze such changes.

One of the primary objectives of this research is to understand how systems affect each other. Systems change based on time and policies (Ajadi, 2012; Fletcher, 2009).

Time Induced Mutations

This can be described as a 'natural process' though it can also be argued that it is in no way linked to nature since it borders on human behaviour. It is a process that has an autopoietic character. History is a tool that allows the analysis of city systems from the stand point of time (Fletcher, 2009). Many changes on cities and their systems can be traced to time, e.g. natural disasters, over population and global warming. These systems in turn initiate a chain reaction leading to a wide array of mutation scenarios.

Policy Induced Mutations

This can further be dichotomised into formal policies and informal policies. Formal policies are results of an organized and accepted political management. These policies influence all human related city systems as they initiate laws that control and restrict human behaviour. Informal policies are policies that exist based on the reaction of the inhabitants of a settlement to time and formal policies. There are cases where such informal cases go against the formal policies and sometimes lead to civil unrest (Adagba et al., 2012; James, 2012). Developments that arise from informal policies are also effective in mutating city systems. A common character of informal policies is that they are often championed by a section of a settlement and are usually short lived, as they eventually submit to the formal policies. However there are some instances where the informal and formal policies come to a middle ground. Based on recent events around the world, some informal policies have been noticed to subdue and overpower the formal policies governing their settlements. Examples include the uprisings of African states like Libya, and Egypt, with drastic city system mutations taking place in cities like Cairo and Tripoli.

Table 1. Selected City Systems

City system	Primary players	Character/effects of mutation
Fluctuation of Urban Security	Politics, Religion, and Poverty	When the level of security in a city/settlement fluctuates, it triggers the activation of other city systems like emigration and immigration which are also primary systems to secondary systems like population shuffle, and transportation costs.

Table 2. Further selected City Systems

City system	Primary players	Character/effects of mutation
Flood as a Population Mixer	Weather, Climate, Land, and Housing	This is a very important city system in this region of Africa as it involves very environmentally influential players like storm surges and consequent flooding, changes in disease vectors, and drought. Many of these players have an implication that significantly exceeds the coast and sometimes threaten the already vitrified national economies.
The Housing System	Security, Food, Transportation, Income levels	Housing affects the absorption capabilities of cities during migration and emigration; this might lead to the implosion of people in an over-stretched housing system. This raises primarily, health and security concerns. In Nigeria for example, the inadequacies of housing are due to different combinations of reasons across the country (Ibidun, 2009). The cost and affordability of housing has also been proved to be a major reason for the inadequacy of housing in Nigeria (Ibidun, 2009; Alagbe, 2006).
Migrations of Critical Population Groups	Social class and economy standards	This system is also a dominant player in almost all other city systems as the climax of any shift in the central process of a city is often manifested as the movement of people. Research on West African migration has tended to focus on specific 'crisis migration' issues (Irit, 2001). However the migration of certain population groups irrespective of scenario should also be considered important. This is one of the most important determining factors to predict, and manage when re-planning an urban landscape as its effect is felt in areas of the urban fabric that include anthropology, sociology, economics, and demographic growth.
Food and Market Flow	Agriculture and Economy standards	Food is a major need of man; therefore its dynamics in the environment can strongly determine mass human behaviour as man naturally seeks a condition of cheap and affordable access to food. Access to food is largely characterized by a market, so market dynamics on the other hand is a system player that characterizes food availability as shown in figure 1.
Politics	Policies	In the course of urban and architectural planning, it is absolutely imperative that the planner and the architect must be at least a spectator of politics (Ajadi, 2012). Politics controls and ultimately determines the activity and outcome of almost all other city systems since it acts on policies which use the law as an induced tool for controlling the management of a whole system of settlement.
Death and Birth of Settlements	Most other City Systems	The death and birth of settlements are known to 'naturally' occur based on the developmental and morphological pace of the sociological environment in which they perform (Ajadi, 2012). Systems often responsible for such death are usually

		terminal systems like food, availability of shelter and security. Some systems trigger the malfunction of other systems which in turn lead to a birth or a death of a settlement.

(Source: Ajadi, 2012)

THE PROCESS OF APOPTOSIS

Apoptosis is the process of programmed cell death (PCD) that may occur in multicellular organisms (Raffray & Gerald, 1997). Biochemical events lead to characteristic cell change in morphology and eventually death (Green & Douglas, 2011). These changes include blebbing (scarring of the cell surface), cell shrinkage, nuclear fragmentation, chromatin condensation, and chromosomal DNA fragmentation. Research shows that between 50 and 70 billion cells die each day due to apoptosis in the average human adult (Karam & Jose, 2009). The process of apoptosis is controlled by a diverse range of cell signals, which may originate either extracellularly (via extrinsic inducers) or intracellularly (via intrinsic inducers) (Karam & Jose, 2009). Extracellular signals may include a range of inducers form hormones to growth factors. These signals may positively (activate) or negatively (repress) affect apoptosis. It must be noted that a cell initiates intracellular apoptotic signalling in response to a stress, which may bring about cell suicide. Enzymes activate the apoptosis process with each signal resulting in the activation of another enzyme or process that in turn is another signal until finally the cell dies or sometimes the process abruptly ends when the cell no longer needs to die (Karam & Jose, 2009). Whether by an intrinsic inducer or an extrinsic inducer the formal active process of apoptosis will be taken to begin with the production of caspases. This is triggered in the intrinsic pathway when cytochrome-c is released by the mitochondria which ultimately activate caspases (Green & Douglas, 2011). A cell undergoing apoptosis shows the following characteristic morphology (Santos et al., 2000):

- First stage involves cell shrinkage and rounding are shown because of the breakdown of the proteinaceous (protein component) cytoskeleton by caspases.
- The cytoplasm appears dense, and the organelles appear tightly packed.
- Condensation of Chromatin into compact sections against the nuclear envelope (membrane) in a process known as pyknosis.
- Nuclear membrane becomes discontinuous and the DNA inside it is fragmented in a process referred to as karyorrhexis.
- The cell membrane shows irregular buds known as blebs.

- As a result of the blebbing, the cell breaks apart into several vesicles called apoptotic bodies, which are then phagocytosed. (i.e. 'swallowed' by phagocytotic bodies, e.g. white blood cells)

Based on the process enumerated, it must be noted that most of the decisive stages of apoptosis originates from the nucleus which is 'centre' of the cell. The apoptotic bodies are picked up and engulfed by other cells called phagocytotic bodies.

THE PROCESS OF NECROSIS

Necrosis is a form of cell injury that results in the premature death of cells in living tissue (Proskuryakov, et al., 2003). Necrosis is caused by factors external to the cell or tissue, such as infection that result unregulated digestion of cell components. In contrast, apoptosis is a naturally occurring programmed and targeted cause of cellular death. While apoptosis often provides beneficial effects to the organism, necrosis is almost always detrimental and can be fatal (Kasper et al., 2001).The process of necrosis does not follow the signal transduction pathway that apoptosis does but rather various receptors are activated that result in the loss of the strength of the cell membrane and an uncontrolled release of products of cell death into the intracellular space (Proskuryakov, et al., 2003). In this scenario, nearby phagocytes are prevented from locating and engulfing the dead cells. This results in a build-up of dead tissue near the site of the cell death, which often calls for the removal of necrotic tissue surgically; this process is known as debridement. There are two broad pathways in which necrosis may occur in an organism (Raffray & Gerald, 1997).

Cell Death Pathway:

The cell death pathway initially involves oncosis, where swellings of the cells occur (Raffray & Gerald, 1997). The cell then proceeds to blebbing, and this is followed by pkynosis, in which nuclear shrinkage transpires (Raffray & Gerald, 1997). In the final step of this pathway the nucleus is dissolved into the cytoplasm, which is referred to as karyolysis (Raffray & Gerald, 1997).

Figure 1: Cell death pathway

(Source: Ajadi, 2012)

Secondary Necrosis Pathway:

This pathway occurs after apoptosis and budding (Raffray & Gerald, 1997). Cellular changes of necrosis occur in this secondary form of apoptosis; the nucleus breaks into fragments, this is called karyorrhexis (Raffray & Gerald, 1997).

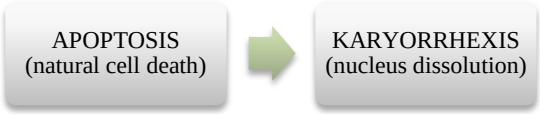

Figure 2: Secondary necrosis pathway

(Source: Ajadi, 2012)

RESEARCH METHODOLOGY

The aim is to apply the knowledge of city systems and their unique propensities for mutation to delineate and re-investigate the system of settlement integration and disintegration. This is done with an expectation of arriving at a method that will allow city systems and settlements to be integrated or disintegrated into the larger urban landscape with negligible or no negative impacts on the infrastructure, sociology, economics, health and security processes of the urban entity under consideration. The effort here is to employ chiefly the idea of biomimetics in an analytical juxtaposition and adaptation of the natural processes of apoptosis, with certain city processes and systems. Aided with streamlined programmatic principles, computational and algorithmic design, city systems are studied in an African context. The natural process of apoptosis is studied and super-imposed on a generic framework for disintegrating a settlement. This process is now combined with streamlined demographic algorithms to create a new idea that will drive further investigations of city system mutations and the integration and disintegration of settlements as a whole.

This method of investigation is adapted based on the identical characteristics of a cell and a settlement. Algorithmic and computational processes are also adopted to make the resulting outcome malleable and autopoietic, hermetic to a wide array of city system mutations that currently exist and that may arise in the future. It also helps in creating a system of parameters that will be very helpful in the advanced (computer aided) generative process of neighbourhood and city design, both from a planning and an architectural standpoint. The method employed seeks to create a platform for the proliferation of the idea of using biomimicry as a driving tool in investigating city system mutations, thereby effectively predicting, recognising, compiling, coordinating, and managing city systems.

THE BIOMIMETICS OF CITY INTEGRATION AND DISINTEGRATION

First of all, it will be helpful to understand the concept of biomimteics. Biomimetics or biomimcry is a scientific methodology that involves mimicking a natural process or phenomena and applying its benefits to other aspects of science and technology (Biomimicry guild, 2007). It can be basically put as the skillful plagerization of nature for the benefit of mankind. Here, a biomimetic apporach is employed to porvide a more sophisticated methodology of integrating and disintegrating a settlelement. The natural process of apoptosis and the bio-artificial process of necrosis are mimicked with an aim to establish an effective methodological platform for developing and co-ordinating urban startegies. The process of apoptosis is choosen becuase of its heirachial similarity with the city. The biological progression of complextiy can be convieneitly juxtaposed with the complexity progression of the settlements as seen in figure 3 below.

Figure 3: progression of complexity in cells and settlements

(Source: Ajadi, 2012)

As a cell is considered a settlement in this juxtapositive context, it will be helpful to delineate some key biomimteic interpretations of the cell with respect to a typical West African settlement. This creates a base for a streamlined specific vocabulary for the research methodology. Figure 6 illustrates primary interlinked nomenclatures for biomimetic comparism.

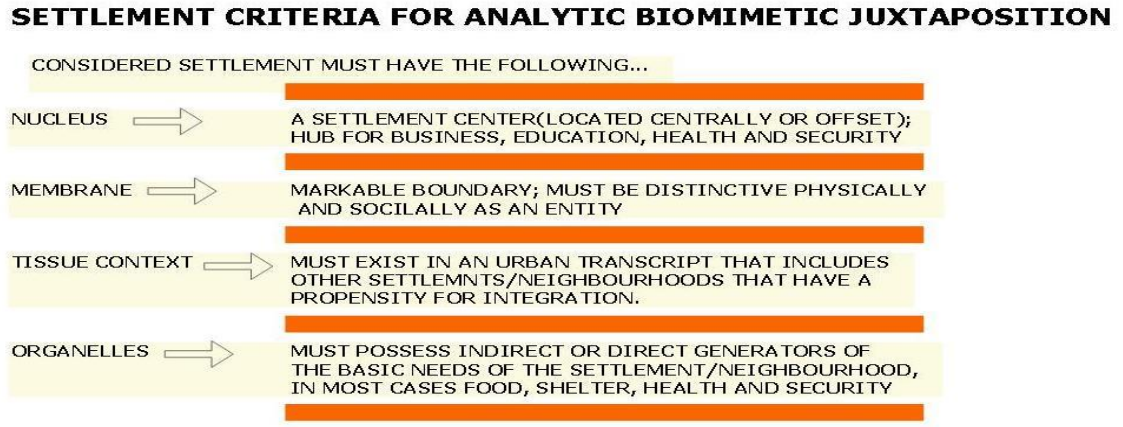

Figure 4: settlement criteria for analytic biomimetic juxtaposition

(Source: Ajadi, 2012)

AN APOPTOTIC SETTLEMENT DISINTEGRATION/INTEGRATION

Following the delineation of the natural process of apoptosis, an urban strategy is developed form the natural phenomena. This is done based on the interpretation of a series of processes that will now progress within the newly developed parameters and vocabulary of the biomimetic method. A biomimetic interpretation of the most essential strategies in this process is shown in Table 2. It is most imperative that the strategic framework is adapted to the dynamics of the city systems that are at play in the settlement region to be disintegrated. The process eventually leads to a grouping of the settlement into fragments or module sections. These sections should contain certain classes of people and city systems that are the needs of other settlements. For example a module section containing primary school teachers, primary schools, and paediatric clinics could be translocated to a settlement in need of more primary schools and health care.

Other factors to consider will be the family structure of the teachers as well as a keen look at the propensities for certain characteristics of the modules not to contradict certain city systems in the phagocytotic settlement e.g. religion and anthropological differences.

It is absolutely imperative that the urban strategy should be engaged based on a justified need for disintegration with respect to genuine extrinsic and intrinsic indicators of apoptosis; otherwise the process carried out may result in necrosis and ultimately a harmful shuffle of city systems.

Table 3.The Biomimetic Process of Apoptosis

	Biological Process	**Biomimetic Interpretation**
	Pre-Apoptotic Pathways	Pre-Disintegration Process
	Extrinsic Pathway:	External Initiator Process:
1	Some cytokines activate T-cells (Sun & Fink, 2007); FASL, (Fas lignand) a cytokine involved in cell death, TNF-related apoptosis inducing ligand (TRAIL), is also a cytokine that induces apoptosis.	Some external indicators justify an apoptotic disintegration of a settlement. Indicators may include, the master plan actualization, and city systems like security, land and housing, economic standards and politics.
2	The killer T-cell engages the cell to be disintegrated. A scenario with FASL involves death receptors clinging to it, connected to adaptor proteins that induce a recruitment of propase 8 that activates initiator caspase 8 which in turn activates effector caspase 3 (Sun & Fink, 2007).	External indicators are analyzed to establish a chain reaction comprising of strategic steps that importune the other steps. E.g. opening jobs in nearby settlements specifically for people in a selected settlement. A very safe psychological poise in the inhabitants of the settlement at this point should also be furtively initiated.
3	Caspase 3 cleaves other protein, the signal cascades within the cytoplasm.	The chain reaction strategy is allowed the benefit of a calculated time till demographic algorithms begin to indicate the willful emigration of people. If this is not achieved stage 2 should be reverted to.
	Intrinsic Pathway:	Internal Initiator Process:
4	Mitochondria releases cytochrome-c, Once cytochrome-c is released, it binds with Apoptotic protease activating factor - 1 (Apaf-1) and ATP, which then bind to pro-caspase-9 to create a protein complex known as an apoptosome. The apoptosome cleaves the pro-caspase to its active form of caspase-9, which in turn activates the effector caspase-3(Green & Douglas, 2011).	Respiration in a settlement is interpreted as the time based movement of people in and out of the settlement e.g. per day (Ajadi, 2010) People move in and out mainly to achieve means for their survival and hence the survival of the settlement. This process is adapted and re-engineered to establish a disintegration strategy that will lead to the result of stage 3. The strategy must be designed like a chain reaction sequence.
	APOPTOSIS PATHWAY	DISINTEGRATION PROCESS
5	Cell shrinkage due to the breakdown of the proteinaceous cytoskeleton by caspases. The cytoplasm appears dense, and the organelles appear tightly packed. Chromatin undergoes condensation into compact patches against the nuclear envelope in a process known as pyknosis (Santos et al., 2000).	All public branched parastatals begin to condense with respect to flexibility and priority; some exceptions may include police stations and some clinics. Settlement center condenses, expansion plans are gradually frozen. Scattered annexes are moved to nucleus cluster or out of the settlement.
6	The nucleus breaks into several discrete units due to the degradation of DNA .This is called karyorrhexis (Santos et al., 2000).	Gradual multiple dichotomization and fragmentation of sections of the settlement centre in order of dependence by the settlement. These fragments contain module

		sections of settlements comprising of different city system players and population classes. Neighbouring settlements are also analyzed and prepared for possible absorption of module sections.
7	The cell membrane shows irregular buds known as blebs. The cell breaks apart into several vesicles called apoptotic bodies, which are then phagocytosed (process called Phagocytosis) (Santos et al., 2000).	Module sections are gradually detached from parent settlement and grafted to new settlements (that will swallow them) according to their compatibilities and symbiotic factors.
		POST-DISINTEGRATION ANAYLSIS COMMENCES

(Source: Ajadi, 2012)

In order to more effectively track the behaviour of a number of city systems, some algorithms are theoretically developed with a bias for aiding in an easy indication of detecting extrinsic and intrinsic indicators that may justify the apoptosis of a settlement or a neighbourhood. Indicators depend on the master plan of the urban landscape and policies that are responsible for gradual or sudden shifts in certain urban behaviour including settlement dynamics.

Table 4. Delineation of parameters for intra-migration analyses

PARAMETER	NOTATION	NOTES
Original population	P_o	Original population of a settlement before shuffling.
New population	P_n	Momentary Population of a settlement after shuffling
Number of emigrants	N_e	Number of people(or life stock) moving out of settlement
Number of immigrants	N_i	Number of people(or life stock) moving into settlement
Original Working Class Population	W_o	Oringinal population of the working class population in a settlement before shuffling
New Working Class Population	W_n	Momentary Population of the working class population in a settlement after shuffling
Productive Emigration Index	P_{ei}	Difference between N_e and W_n
Productive Immigration Index	P_{ii}	Difference between N_i and W_n
Population Flux	$\sim P_x$	Relationship between P_o and P_n under a factor of 1.000

(Source: Ajadi, 2012)

Based on the above delineation, the momentary population of a settlement at any point in time after a population shuffle can be determined by:

Pn = Po - Ne + Ni ...(1) ; Pei and Pii values can be calculated as:

Pei = Ne - Wn ...(2); Pii = Ni - Wn ...(3)

Furthermore: ~Px = (Pn / Po) X 1.000; Net Emigration load: [(Ne - Wn)/(Po - Wn)]X 1.000 ...(4)

from ...(2) and ...(3) Ne =Pei + Wn ; Ni ==Pii + Wn therefore: Pn = Po - (Pei + Wn)+(Pii + Wn) ...(5)

~Px can also be expressed as: ~Px = [(Po + (Pei + Wn) +(Pii + Wn)) / Po] X 1.000 ...(6)

THE PATHOGENESIS OF FORCED SETTLEMENT DEMOLITION

This system can be likened to the bio-artificial process of necrosis. Unlike apoptosis, the necrotic process of eliminating a settlement destroys the settlement and makes it difficult or impossible for it to be absorbed by other settlements. Biomimetically, there is no is phagocytosis as the cell (settlement) is dissolved into the surrounding, that is,the institutional fragments of the settlement find no continuity in nearby (or other) settlements (see table 4 below).

Table 5. The Biomimetic Process of Necrosis

	BIOLOGICAL PROCESS	**BIOMIMETIC INTERPRETATION**
	Cell Death Pathway	Typical Elimination Process
1	Oncosis: swelling of the cell	The explosive growth of settlements is usually the signal indicator for urban necrosis. Most drastic measures are taken because of an explosion of population and housing.
2	Blebbing: Scarring/mutation of membrane	The boundaries of the settlement are demolished these are the regions of the neighbourhood or settlement that continue to grow. This is seen as an initial step in the process of demolition, areas showing this manifestation will most likely be scheduled for sudden (necrotic) demolition. The on-going demolition of Mpape in Abuja is a typical example.
3	Pyknosis: shrinkage of nucleus	This stage involves an almost irreversible process of demolishing or evicting the main sources of social survival in the settlement (banks, schools, markets, religious centres e.tc.) e.g. the demolition of Mpape in Abuja and the expulsion of commercial motorcycles in Lagos.
4	Karyolysis: dissolution of nucleus into the cytoplasm	Occurring simultaneously with stage 3, the nucleus of the settlement is dispersed within the collapsing settlement and outside it, thus bringing about a total elimination of the settlement. This often triggers a complex shuffle of city systems in detrimental ways.

(Source: Ajadi, 2012)

This makes it difficult to track the proliferation of people and city systems and hence it is difficult to predict the effects of the process. It must be stated here that demolition in the context of this research does not necessarily mean the ‘felling’ of houses and infrastructure but also the forced dispersal of people from their default place of abode. The death of settlements often occurs gradually and they are often due to changes in other urban systems. However, some West African cities (Nigeria in particular) have developed the habit of forcefully terminating and introducing settlements via a methodology so abrupt that it risks changing the very tempo of the urban development pace (Ajadi,2012).

Less than a decade ago, when a new leadership system took charge of the largest original black city in the world (Lagos state, in Nigeria), a rather radical and effective necrotic reformation of the megacity began (Ajadi, 2012). The aim of the new political system was to drastically reduce the population of one of the fastest growing cities in the world. His 'strategic' approach of clearing all overcrowded slums and sporadic clusters of people under the bridges seemed a great relief effort for the people of Lagos. However, Lagos for example has almost 70% of the population living in slum communities with population densities between790-1240 people per hectare (Ibidun, 2009). This effort caused a serious problem for the neighbouring south-western states. The policy importuned the sudden ejection of well over 1million people from Lagos into the nearby states. These people were the agents of the worst vices of the city (Ajadi, 2012): thieves, con-artists and the likes. Others were mainly poor people living deep below the poverty line. The unexpected arrival of these people in neighbouring states became a problem as none of the states affected were designed to suddenly handle such volume of such type of people. Therefore as the crime rates in Lagos plummeted drastically, those of Ogun, Oyo, Osun and Ekiti sky-rocketed (Ajadi, 2012). Such strategies still continue in Lagos till date with scheduled demolitions of mega-shanties like Makoko and the recent strategic expulsion of commercial bike riders form Lagos state. This move will surely decimate the transportation system of the city and at the same time increase security concerns for nearby cities, despite the uncertain propensity for it to make motorcycle transportation cheaper in other states. The on-going demolition of Mpape, an old sub-urban settlement in Abuja is also a typical example. The removal of vital settlement systems has already begun (blebbing and pyknosis in this case) in August 2012 as the main market has been demolished with just a notice of a month, and in a few weeks 10288 houses will also be removed in one of the many stages of demolition (Adetayo, 2012). Such necrotic strategies like these could only spell disaster in the long term because extemporaneously and forcefully demolishing most of the slums (or any settlement/neighbourhood) in a city with no phagocytotic settlements prepped up will only lead to a very complex shuffle of city systems; a scenario, that even most master plans do not seem to be ready for.

CONCLUSION

In conclusion, the sudden and forceful removal of settlements in any city is a detrimental strategy. Even if scenarios that require a sudden shutdown and disintegration of settlements arise (e.g. epidemics or war), it is still much safer to engage an apoptotic strategy in the disintegration and integration process. Unless the loss of lives is counted as an option, in any urban transcript, people are partly synonymous to energy; even though they can however be created, they cannot be destroyed, they can only be transformed from one form of living to another. This research continues, by considering the direct computational adaptation of this biomimetic strategy for ease of application by translating the framework of the strategy into a script that can be helpful in generating designs of neighbourhoods and settlements. Research shows that computational design on an algorithmic platform is very useful in simulating urban scenarios and generating design of easily deployable settlements. The research will proceed in trying to investigate the relationships of urban disintegration with a more complex juxtaposition with Apoptosis. This will be done by studying specifically, the complex signal transduction system in the natural process of apoptosis and finding out the levels of adaptability and translative propensities that exist within it. An ongoing research adaptation of the biomimetic strategy is being implemented in a proposed design for a semi vertical settlement with all the criteria for adaption. The design is generated with a bias for an easy apoptosis process if need (see Figure 5, 6 and 7- Appendix below). A far wider set of city systems will also be considered on a scenario case level. Scripting on software like Rhino and processing coupled with computer aided modelling on AutoCAD and Sketchup will also be employed to find out how to make the application of such a process more direct and user friendly. The framework can be written in script form and/or generatively adapted to a generative process of neighbourhoods and settlements. This will help African and other urban schemes to make more informed planning decisions regarding the birth and death of settlements in the future.

REFERENCES

Adagba O., Ugwu S.C., Eme, & Okechukwu I., (2012), 'Activities of Boko Haram and Insecurity Question in Nigeria', Arabian Journal of Business and Management Review, Vol. 1 (9), pp.77-99.

Adetayo O., (2012), ' Why 10,288 houses'll be demolished in Abuja –Minister' Online Punch

news; August 20. retrieved November 25, 2012 from: http://www.punchng.com/news/why-10288-housesll-be-demolished-in-abuja-minister/

Ajadi, B.S., (2010) 'From Here to There: High Speed Railway Station for Central Business District, Abuja' Undergraduate thesis of architecture, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.

Ajadi, B.S., (2012), 'Ghosts of the Primitives: The Predicament of X, Y, Z in Nigerian Architecture -1', Sun National Newspaper, April 1, Vol 6. (468), Lagos, Aba, Abuja, p.46.

Ajadi, B.S., (2012), 'Ghosts of the Primitives: The Predicament of X, Y, Z in Nigerian Architecture -2', Sun National Newspaper, April 8, Vol 6. (475), Lagos, Aba, Abuja, p.45.

Ajadi, B.S., (2012) 'Morphing the Rules: Advanced Adaptations of Mud in Nigerian Buildings' In: Editors, Laryea S., Agyepong S.A., Leiringer, R., and Huges, W., Conference Proceeding, 24-26 July 2012, Reading: WABER Conference, pp.163-175.

Alagbe O.A., (2006), 'Combating The Challenges Of Rise In Urban Slums In Cities In Developing World: A Case Study Of Lagos State', Lecture: International Conference On the Built Environment. Extracted October20, 2012 from: http://eprints.covenantuniversity.edu.ng/390/1/Combating_the_Challenges_of_Rise_in_Urban_Slums_in_Cities_in_Developing_World_A_Case_Study_of_Lagos_State.pdf

Biomimicry Guild, (2007), 'Innovation Inspired by Nature Work Book', USA: Biomimicry Guild Press.

Castles, S., (2009) 'The Age of Migration. International Population Movements in the Modern World', USA: Palgrave Macmillan.

Fletcher B. (1999), 'A History of Architecture', New Delhi: CBS publishers. pp 629-632, 712-715.

Green & Douglas, (2011), 'Means To an End.' New York: Cold Spring Harbor Laboratory Press.

Ibidun O.A.,(2009), 'Vulnerability of Poor Urban Coastal Communities to Climate Change in Lagos', Lecture: 5th Urban Research Symposium, Marseille. Extracted October20,2012from: http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1256566800920/adelekan.pdf

Irit S., (2001), ' Intraurban Housing Mobility in a Traditional West African City: Shelter or Business Decision?', Urban Studies Journal, Vol. 38 (3), pp.535-540.

James J.F., (2012), 'Confronting the Terrorism of Boko Haram in Nigeria', Florida: JSOU Press.

Karam, Jose A., (2009), 'Apoptosis in Carcinogenesis and Chemotherapy.' Netherlands: Springer.

Kasper D.L., Zaleznik D.F., (2001), 'Gas gangrene, antibiotic associated colitis, and other Clostridial infections.' In Braunwald E., Kasper D.L. et.al (Eds). Harrisons's Principles of Internal Medicine 15th ed., New York, McGraw Hill, pp. 922-927.

Olsen A.W., (2011), 'Reconsidering West African Migration Changing focus from European immigration to intra-regional flows', Denmark: Vesterkopi AS.

Proskuryakov, S. Y., Konoplyannikov, A. G., & Gabai, V. L., (2003), 'Necrosis: a specific form of programmed cell death?' Experimental Cell Research Vol 283, pp.1-16.

Raffray, M., & Gerald M. C., (1997), 'Apoptosis and necrosis in toxicology: A continuum or distinct modes of cell death?' Pharmacology & Therapeutics Vol 75, pp.153-177.

Santos A.S., Daugas E., Ravagnan L., et al., (2000), 'Two Distinct Pathways Leading to Nuclear Apoptosis'. Journal of Experimental Medicine Vol192 (4): 571–80.

Shelby D., (2009),'Data Mapping, Modeling and Experiential Simulation as information Management Tools in Urban System and Infrastructure Design' Zofnass Program for Infrastructure Sustainability, Report, pp.1-20.
Sun M, & Fink P.J., (2007), 'A new class of reverse signaling costimulators belongs to the TNF family'. J. Immunol. Vol 179 (7): pp.4307–4312.

Appendix – figures: 5, 6 and 7

Figure 5: Plan view of an ongoing neigbourhood Design (Source: Ajadi, 2012)

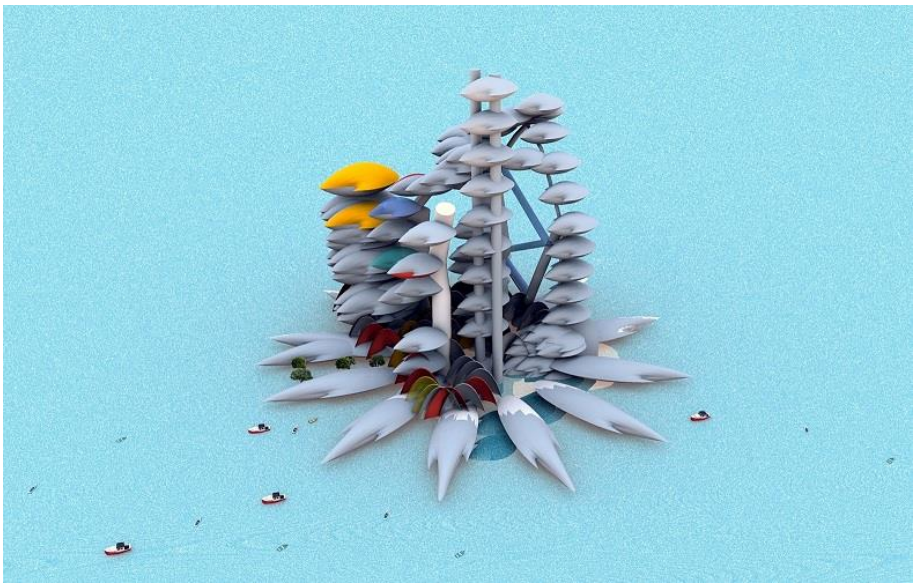

Figure 6: Offset sky view
(Source: Ajadi, 2012)

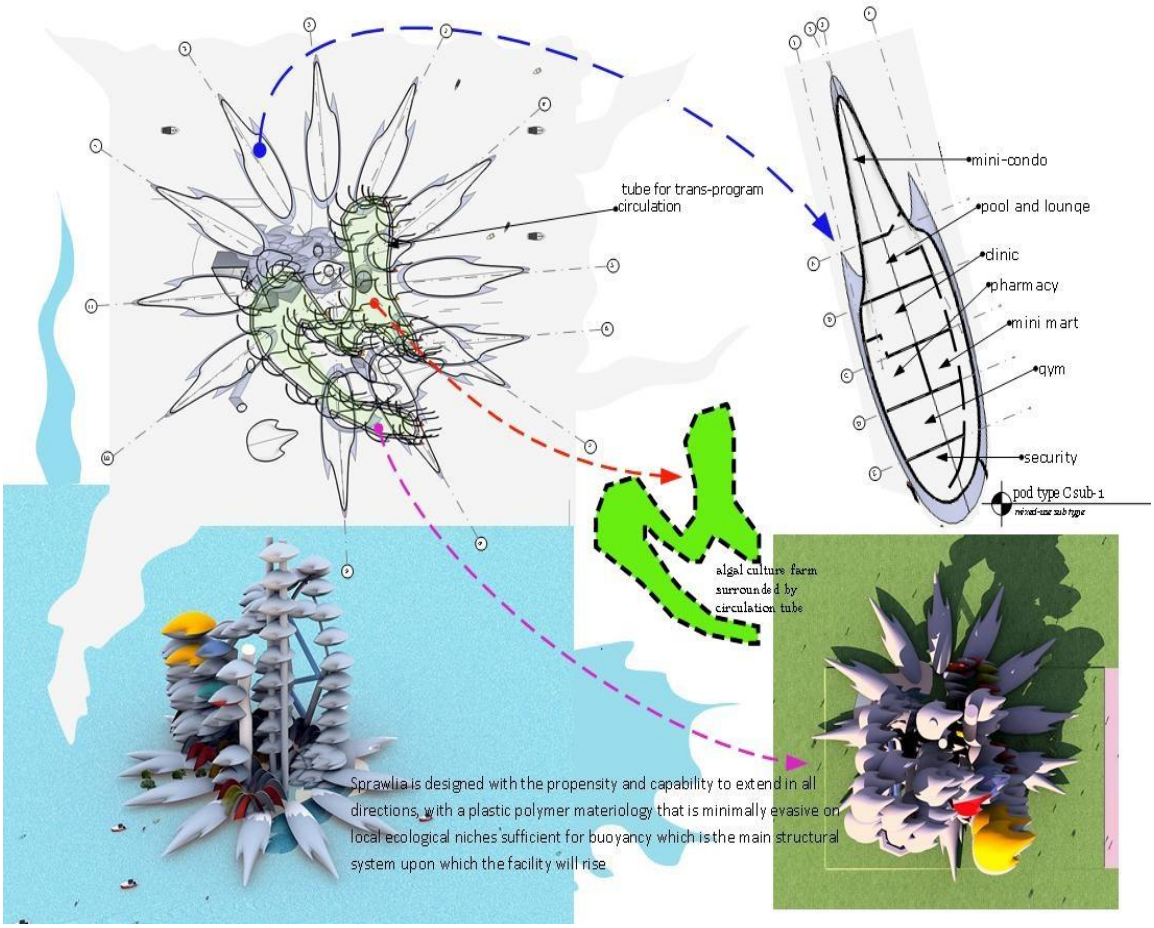

Figure 7: Vertical neighbourhood design showing a spatial strategy
(Source: Ajadi, 2012)