

Density Automata


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The world so large is growing ever so small. Haphazardly so. Rural populations are making their way quickly to urban concentrations, establishing residency in whichever fashion possible, thus slums are manifest. As of consequence, the health, safety, and overall standard of living for approximately one billion slum dwellers is less than poor, and on the decline. By the year 2030, this number will effectively double.



slum

/sləm/ 

noun

noun: **slum**; plural noun: **slums**

1. a squalid and overcrowded urban street or district inhabited by very poor people.
synonyms: [hovel](#), [rathole](#); [More](#)
 - a house or building unfit for human habitation.





Image: [http://www.citiesalliance.org/sites/citiesalliance.org/files/images/Slums%20in%20Nairobi,%20Kenya%20\(7\)_0.JPG](http://www.citiesalliance.org/sites/citiesalliance.org/files/images/Slums%20in%20Nairobi,%20Kenya%20(7)_0.JPG)



Image: http://www.uncubemagazine.com/sixcms/media.php/1323/MADEINSLUMS_%C2%A9%20FRANCESCOGIUSTI_VIEW_02small.jpg



Image: <http://www.urbanrealm.com/blogs/media/blogs/pauls/JANIO/HU/slum.jpg>



Image: http://newshour-tc.obs.nra/newshour/wa-content/uolnads/2015/07/india_slum.jpg

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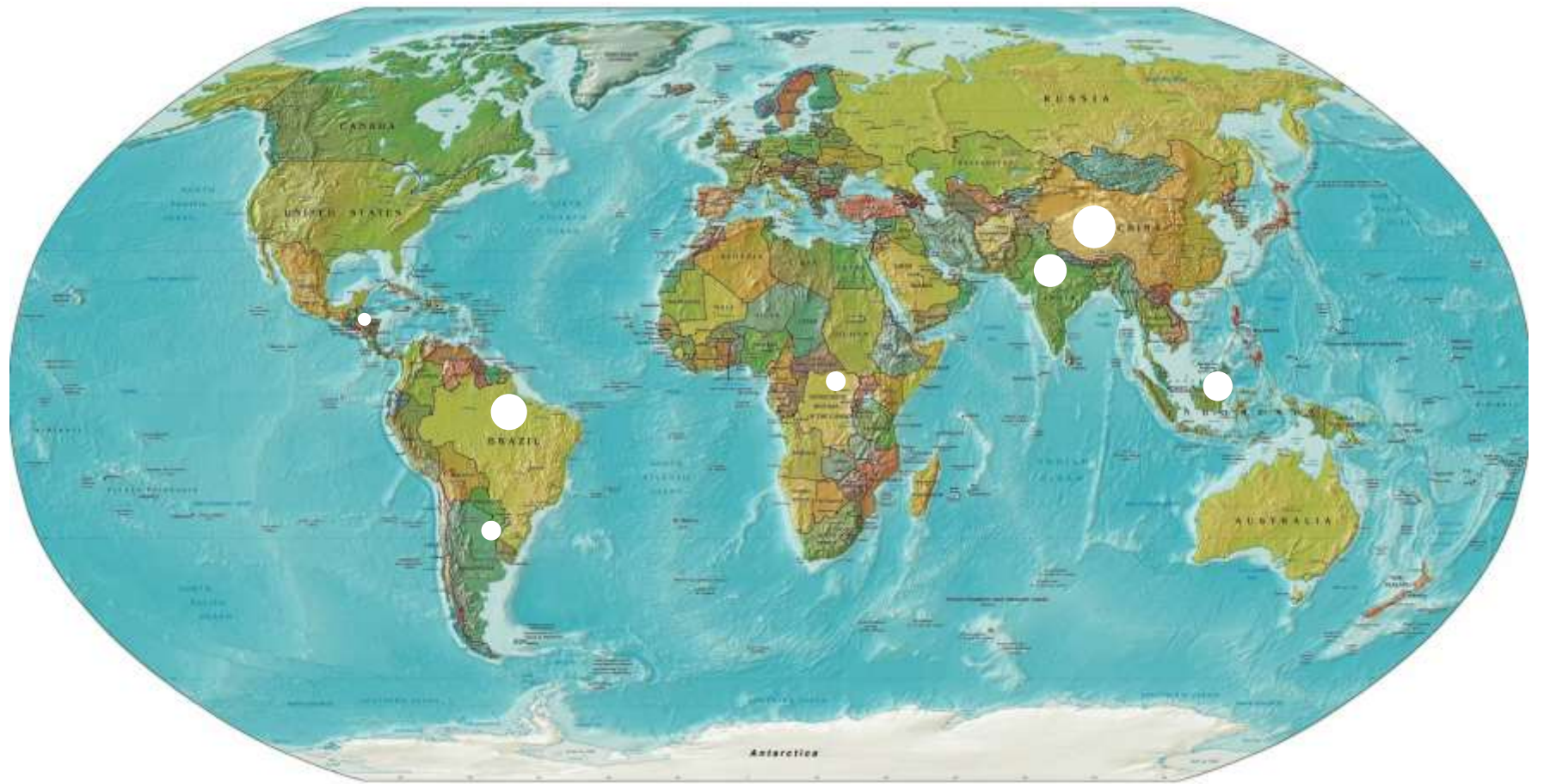


Image: Wikipedia



To solve this problem is not to solve at all, but rather alleviate.

Small steps must be taken in order to result in great progress, or one risks falling to the start once again. It is vital to allow density dwellers to hold the future in the hands of themselves, enabling sustainability and self-sufficiency.



1. A solution to this problem should be as flexible and adaptive as possible. It is neither realistic nor ideal to have a universal answer to solve such a diverse problem. The solution needs to be more of a blueprint able to be implemented in previously undeveloped areas, as well as in current slums.



2. It needs to be customizable to the region so that it reflects the people and culture of the city, country, and even the continent where the slum is located.



3. The solution to this problem of growing slums and shantytowns must empower the people residing there. In order to promote health, safety, and a higher standard of living, the inhabitants must be proactive citizens and take ownership in their community.



In order to accomplish all these goals, the solution must be focused around the family or homeowners and the home, rather than the slum community as a whole and the millions of residents therein. Focusing on the individual unit and how it relates to its surroundings is the starting point for achieving a successful transformation in the slum lifestyle.



The ideology for such a solution can be rooted in a natural phenomenon called cellular automata.

At its simplest form, cellular automata is a model of how a single cell will interact with its surroundings, and how that interaction will develop over time and throughout expansion.

Conway's Game of Life



Image: Wikipedia



If we treat the individual slum housing unit in a similar manner, a natural growth model is created. Each individual home follows a set of rules that govern the interplay between it and its surroundings and units that are directly next to it, without opposing an organic development or forcing a strict regime.



Rules

1. Each individual house must have at least one neighbor, and no more than three neighbors.
2. A house cannot have a neighbor sharing its front wall, where the main entrance is located.
3. There must be open spaces in the midst of homes that are dedicated as public, outdoor spaces.
4. Houses must be arranged in a way that allows clear pathways through neighborhoods and blocks.
5. There must be dedicated main streets, public transportation, and commercial areas that occur at regular intervals.



Although a “slum automata” promotes a grid structure with established infrastructure and organized thoroughfares, it can be easily integrated into any current slum condition and structure as it promotes a natural and organic expansion. This makes the solution ideal for slum rehabilitation, as it can be constructed in any existing slum and in urban sections of any shape.



Implementation and construction of this system can be broken down into small sections, which can then be integrated into both current conditions and future developments. Creating a series of interconnected systems, rather than a single, massive project, allows flexibility with the site geometry, project timeline, and available funds.



By focusing design attention on the single family unit, standardization can be achieved, allowing mass production and a reduction in cost for all parties involved. By creating a “kit of parts” for each house, there can be a prescribed amount of each material required. When advanced construction methods are available, adaptations to the unit can be made to satisfy the needs of the residents, such as a pitched roof, or adding a rain-water collection system.



An effective housing typology must also be a high-performing one.

- Passive Design
- Window-to-Wall Ratio
- Solar Analysis
- Wind Analysis
- Computational Fluid Dynamics (CFD)



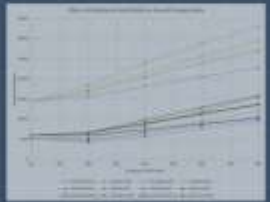
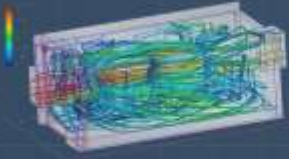
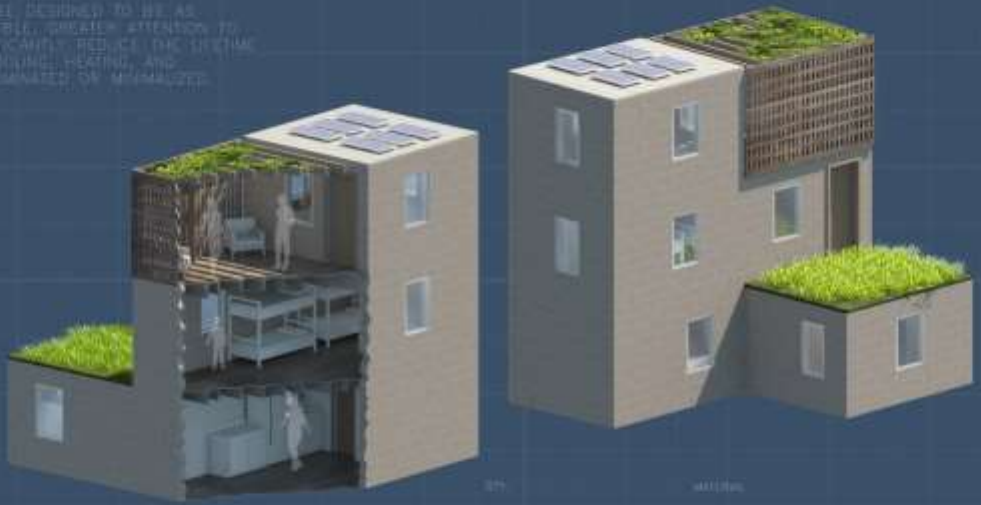
In essence, the people inhabiting the ever increasingly populated world are the priority. The first focus must be the family and the structure in which they reside.



AUTOMATA

DEVELOPING A SINGLE HOUSING UNIT THAT CAN GROW ORGANICALLY FROM BOTH EXISTING AND PROPOSED CONSTRUCTION CREATES FLEXIBILITY, WHICH IS PARAMOUNT IN A GLOBAL SOLUTION.

THE HOUSE SHOULD ALSO BE DESIGNED TO BE AS ENERGY EFFICIENT AS POSSIBLE. GREATER ATTENTION TO "GREEN" DESIGN CAN SIGNIFICANTLY REDUCE THE LIFETIME COST OF THE HOME, AS COOKING, HEATING, AND LIGHTING LOADS CAN BE ELIMINATED OR MINIMALIZED.



COMBINING DESIGN MEASURES SUCH AS NATURAL VENTILATION, THERMAL MASS, AND LOW RADIATION GAIN, AN ENERGY LOAD REMAINS WHICH COULD BE EASILY ACCOURED FOR WITH A FEW PHOTOVOLTAIC PANELS ON THE ROOF. BY MAKING A COMPLETE HOUSING DESIGN, FAMILIES CAN FINALLY THRIVE WITHIN SLUMS.

- 1450
 - 31
 - 18 SHEETS
 - 4 SHEETS
 - 75 CUBIC METERS
 - 8
- BRICKS
- 200MM CONCRETE BLOCKS
 - 200MM FLOOR JOISTS
 - 18MM WOOD
 - MEDIUM CORRUGATED METAL ROOFING
 - 10CM CONCRETE SLAB AND CONTINUOUS FOOTING
 - PHOTOVOLTAIC PANELS

SINGLE UNIT (2P) = 800 US DOLLARS

BY FOCUSING DESIGN ATTENTION ON A SINGLE FAMILY UNIT, STANDARDIZATION CAN BE ACHIEVED, ALLOWING MASS PRODUCTION AND A REDUCED COST.



GROWTH PROGRESSION



CELLULAR AUTOMATA MODELS HOW A "SINGLE CELL" CAN INTERACT WITH ITS NEIGHBORS AND CARRY AN ORGANIC EXPANSION/TROUCHING A SINGLE HOUSE AS A CELL, A SET OF RULES CAN BE DEVELOPED THAT ALLOW A NATURAL ORGANIZATION OF THE NEIGHBORHOOD.

1. EACH INDIVIDUAL HOUSE MUST HAVE AT LEAST ONE NEIGHBOR, AND NO MORE THAN THREE NEIGHBORS.
2. A HOUSE CANNOT HAVE A NEIGHBOR SHARING ITS FRONT WALL, WHERE THE MAIN ENTRANCE IS LOCATED.
3. IN THE MOST OF A CLUSTER OF HOUSES, SUCH AS A CITY BLOCK, THERE MUST BE A DEDICATED, OPEN AREA FOR COMMUNITY GREEN SPACE.
4. HOUSES MUST BE ARRANGED IN A WAY THAT ALLOWS CLEAR PATHWAYS THROUGH NEIGHBORHOODS AND BLOCKS.
5. THERE MUST BE DEDICATED MAIN STREETS, PUBLIC TRANSPORTATION, AND COMMERCIAL AREAS THAT OCCUR AT REGULAR INTERVALS.

WIND ANALYSIS



ANNUAL SOLAR ANALYSIS



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