

FIG Commission 3 Workshop
**"The Empowerment of Local Authorities:
Spatial Information and Spatial Planning Tools"**
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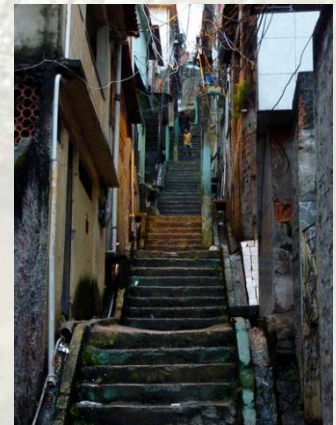
Conditioned Design in Suburban settlements - Sachnin as a case study

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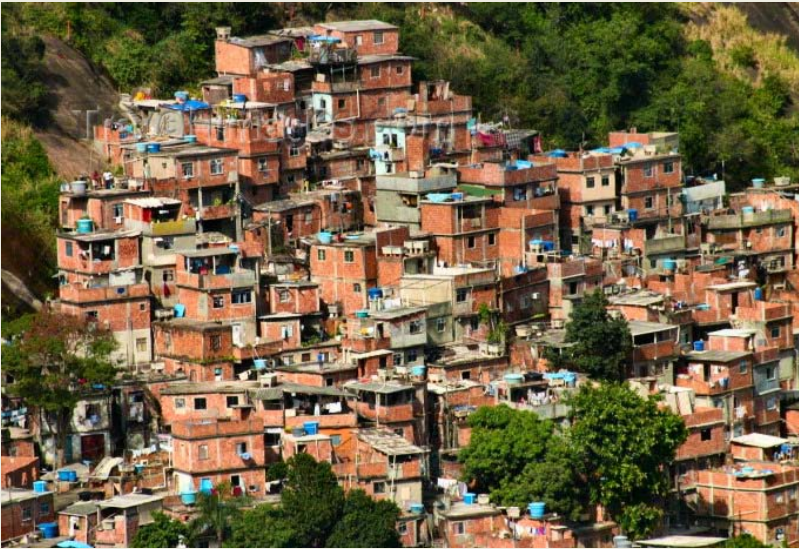
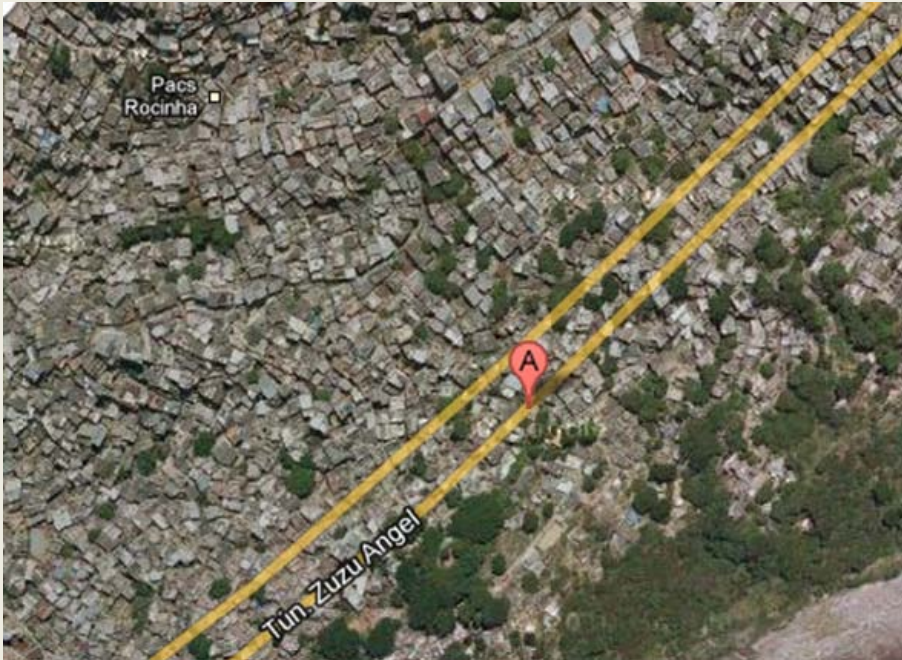
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Agenda:

- Introduction: What are Organic “Communities”?
 Sachnin as a case study
 Agent base Cellular Automata models
- Precedent research
- Research Hypothesis
- Research Objective
- The forces influencing the development
- Introducing the model
- Illustrating the results of the preliminary model
- The potential of using the model for street/paths simulation
- Conclusions
- Future work



Introduction: Organic “communities” are mainly formed by social forces (Bottom-up).



Favelas in Brazil



Arab settlements in the Galilee



**Arab settlements in the Galilee as organic entities.
Sachnin – as a case study**

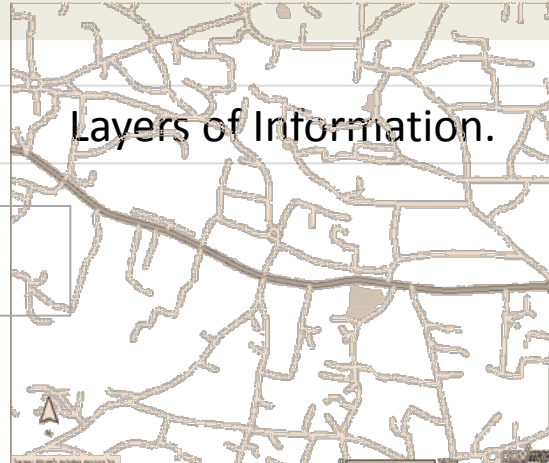
**Agent base Cellular Automata models may act as assisting tools for planning processes.
The model's purpose is to identify trends and patterns leading to a specific morphology**

**A simulating model for urban development may lead to better control and distribution of
urban resources and thus to an improved quality of life.**

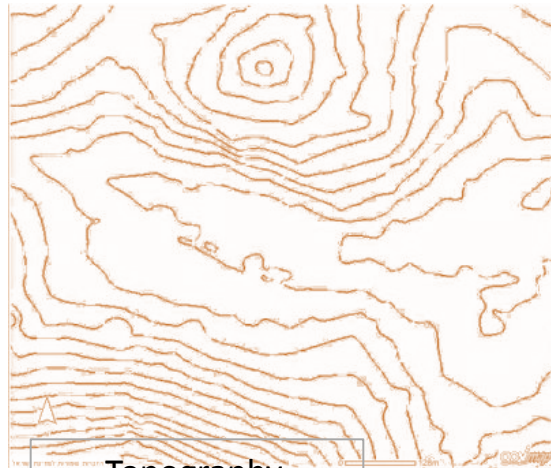
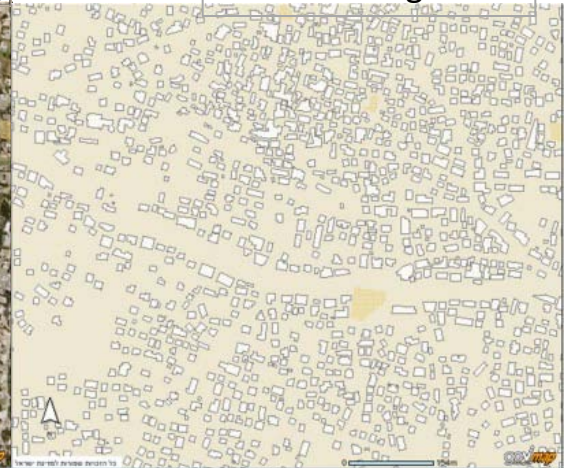


Layers of Information.

Roads and Pathways.



Buildings



Topography.



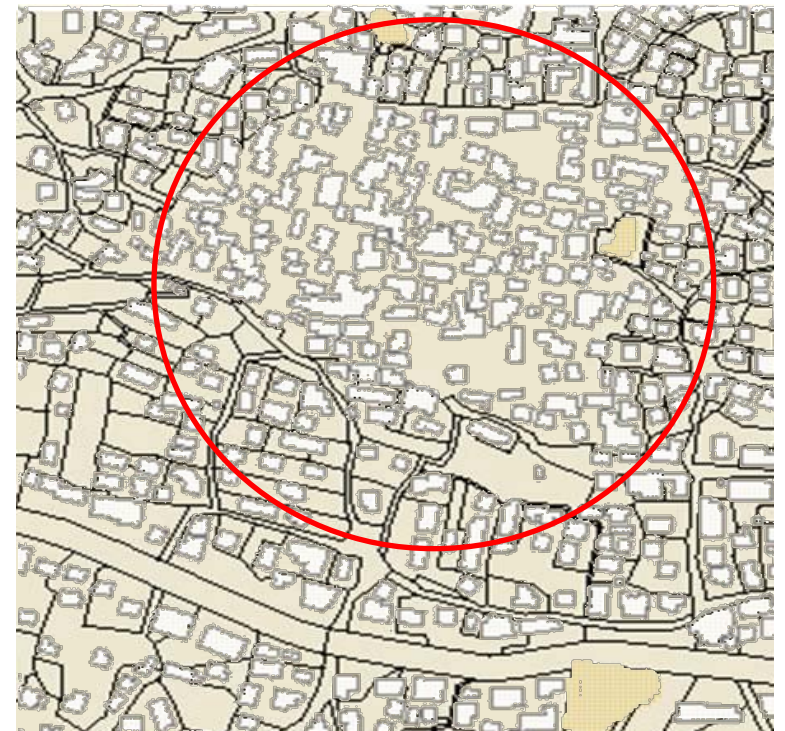
Cadastral blocks .



Exceptional plot morphologies:



different typology of sub-divisions.



no sub-divisions in the old part of the settlement.

Precedent research:

- Working with existing physical and social structures to create improved conditions ...an excellent example for a healthy approach. (Lesievtre, 2001).
- The forces influencing the Arab family and the Arab settlement (Rosenfeld, 1968). **Anthropology and Sociology**
- The influence of Zionist planning ideology in the Galilee on the unique pattern of the local Arab settlements (Falah, 1989).
Studies in geography and political geography
- Patterns of Arab settlements in the Galilee and the difference between the planning and the outcome in reality (Almagor and Benenson, 2009).
Geography

Previous work on the forces that shape the morphology of the Arab settlements in the Galilee (Khamaisi, 1994; Barur, 1994) is limited to data from the 80's

There is no current work looking into the social forces and their influence on the built morphology of these Arab settlements, nor an attempt to develop a model for simulating such developments!

Hypothesis:

Urban morphology plays a leading role in the cognitive perception of the built environment. Thus, identifying distortions in the cognitive perception may identify problematic places in terms of urban morphology.

Urban systems can be treated as complex ones. Thus, their order emerges from a superposition of 'top down' and 'bottom up' processes. Identifying these processes and their interactions, could lead to a better understanding of urban evolution.

Objectives:

Developing an Urban Simulation Model (USM) for organic suburban settlements

- Identifying trends and patterns leading to a specific morphology
- Interpreting the Social and cultural forces in the Agent base cellular automata model
- Illustrating the potential of using it for simulating **distribution of urban resources**

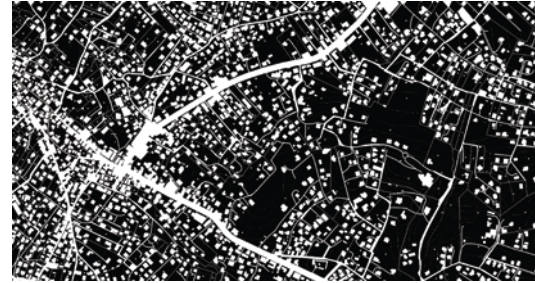


Diverse forces that influence the development of the organic Arab settlement.



Urban development plans

never act as a determining statement.



Basic Morphology

Many times the basic structure of the settlements will dictate its morphology.



Historical development

The old center of the settlement is central regarding the new development, therefore acting as a reference.



Agriculture land as future development

Remote agriculture lands become very attractive for future development.



Mountainous topography

The topographic structure significant in the settlement development and creates limitations in the development and access ways



Slow Maturation

Reserving lands for future generations ...realization can be postponed for many decades.



Lack of land for additional development

Many times dictates the pattern of filling and densification of the existing fabric



Local Political forces

Development is always oriented by the ruling Hamula and their political partners.



Sub implementation

Although great lack of development land, land owners keep the land for their future successors.



Extended families

Distinct lands for different” Hamulas”



Patterns of land ownership

Matured sons are expected to establish new households close to their Fathers’ house



Expropriation for public need

land owners ignore the expropriation by building in that area on purpose.



Inherited Agriculture land

Due to inheritance process that split the plots they are considered by all as a reserve for future development land.

The model

A preliminary Urban Simulation Model (USM) that employs an Agent Based (AB) model which is based on a Cellular Automata (CA) platform was developed.

The model is scripted in 'Repast Symphony' (RepastS) - an open source simulation toolkit, well adapted for AB and CA.

RepastS supports Java programming language and it integrates GIS functionality and has 3D extension (Dibble & Feldman, 2004).

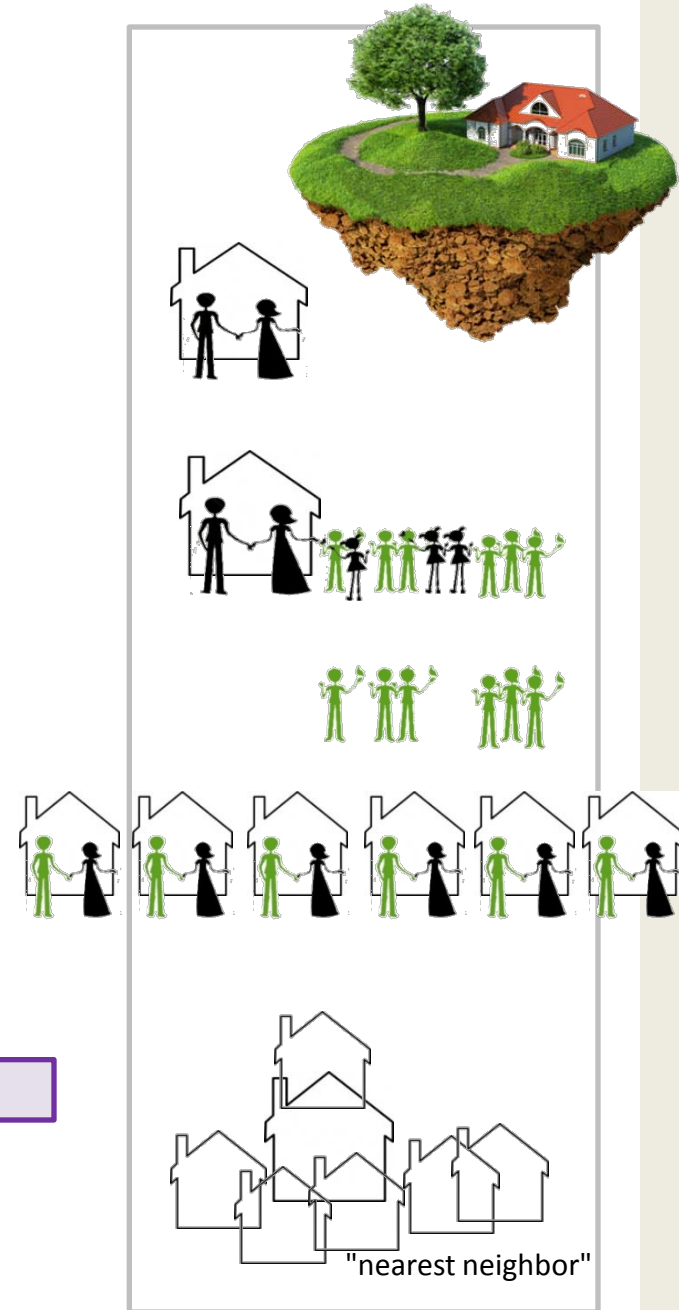
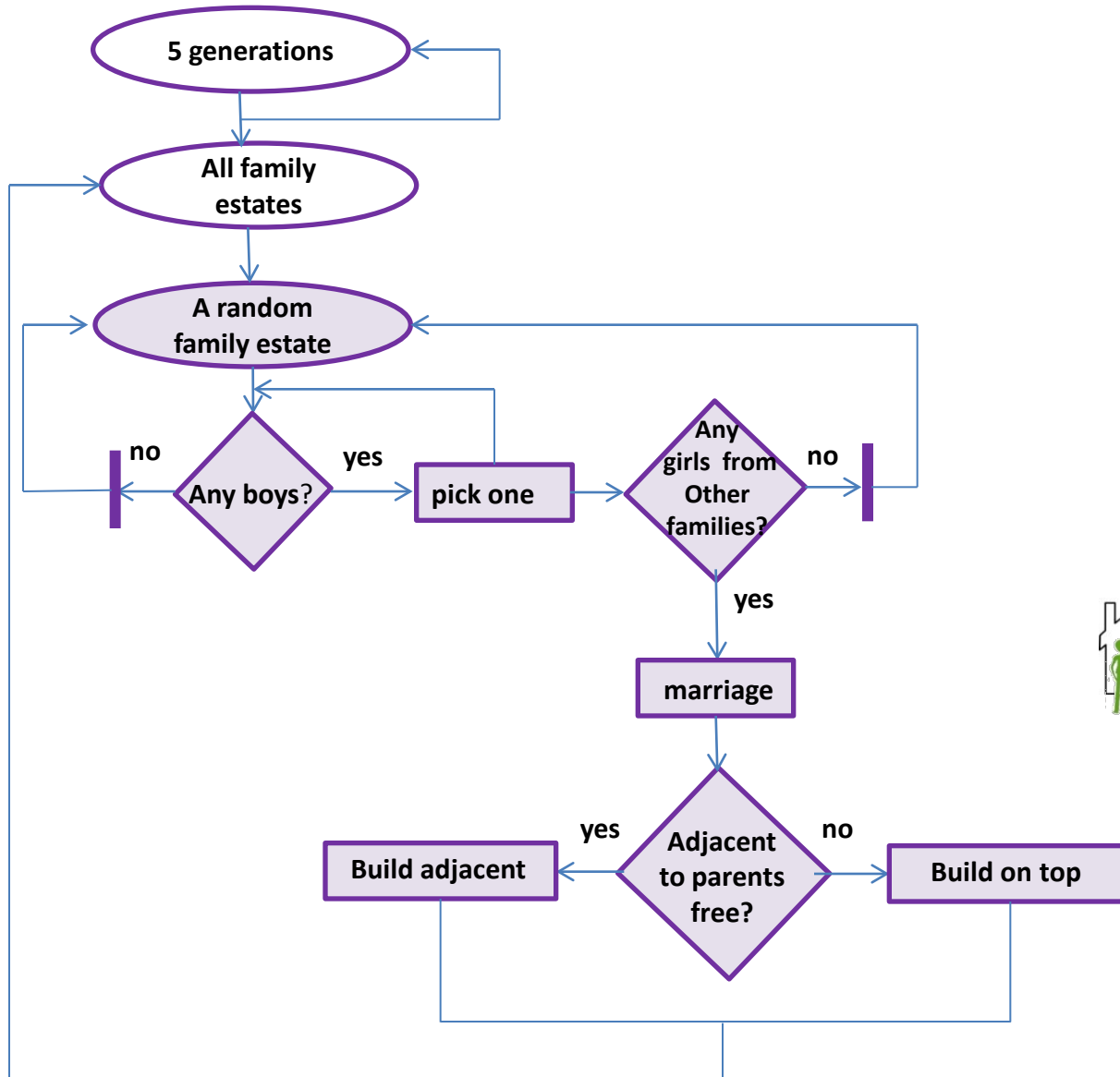
The model considers both '**top down**' and '**bottom up**' processes.

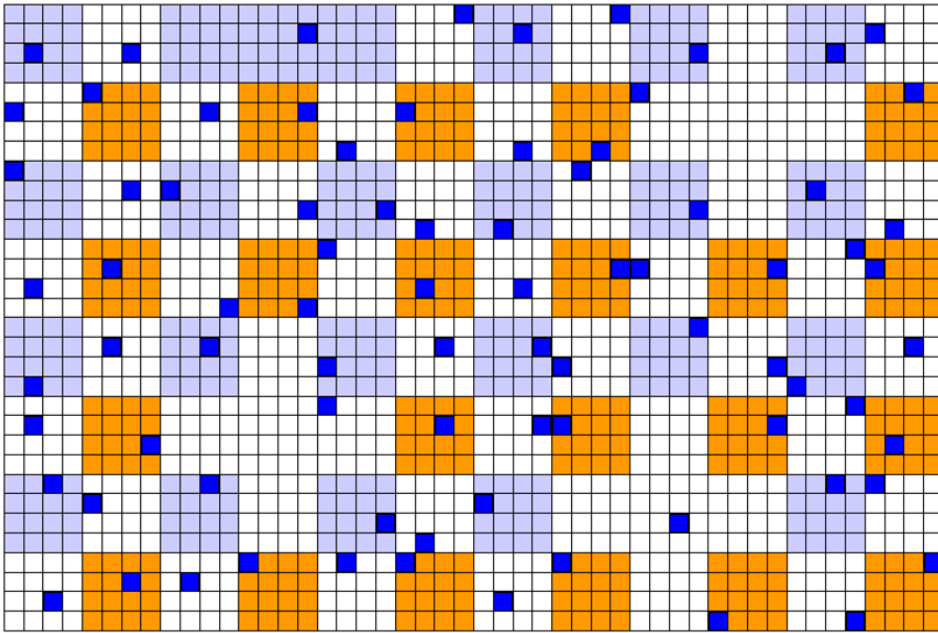
Top down forces represent urban plans, lots morphology, etc.

bottom up such as Traditional patriarchal form of the Arab family.
..."its influence on the settlement's development is very significant"
(Khamaisi, 1994).

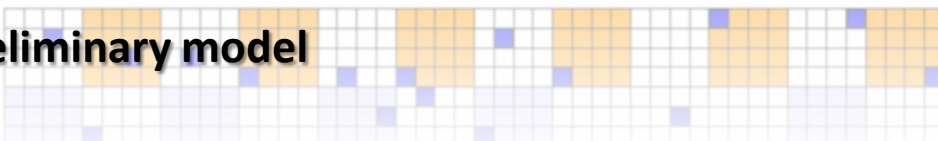


The preliminary model is based on the following stages:

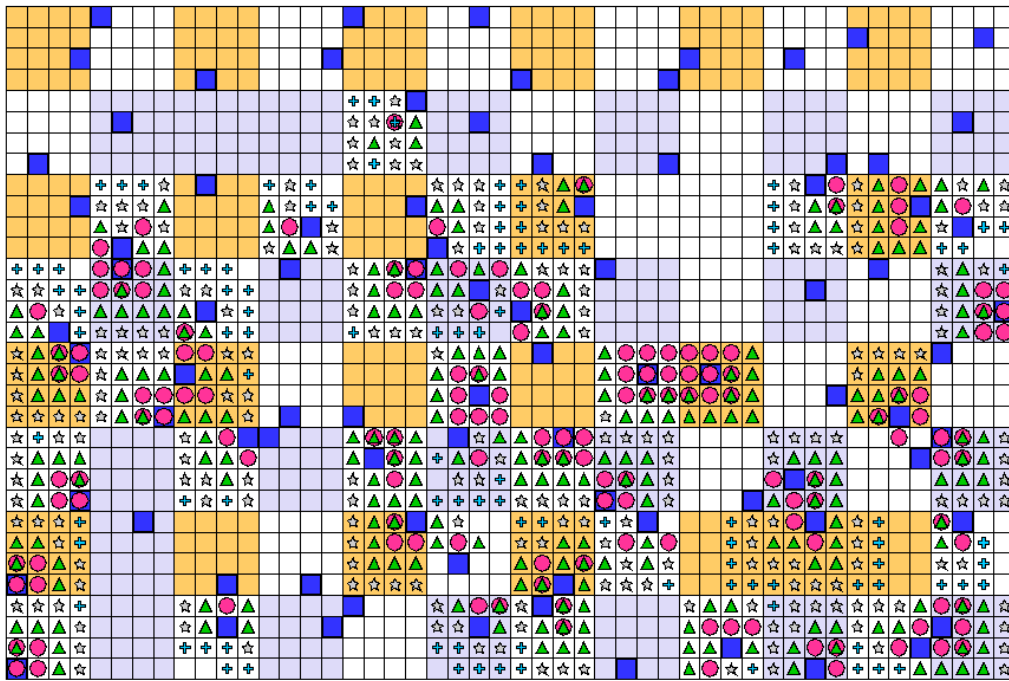




preliminary model



- Schematic rectangle grid, (8X12 in this case) representing the virtual settlement
- Each lot is built as a smaller grid of cells (4X4 in this case) or up to a combination of five basic lots (four connections) , represents an extended family estate.
- The extended family consists of parents and a random number (between 1-10) of children.
- The children's gender is distributed randomly.
- all the couples in the first generation build their houses in their estates randomly (i.e. the location within the family lot is chosen randomly, as illustrated above)
- Each house occupies one cell and is assumed to include an outdoor area (e.g., garden).
- The model follows five generations (including the initial one)



Illustrating the results of the model:

by generation

Blue squares – initial generation

Pink circle – second generation

Green triangle – third generation

Star – fourth generation

Cross - fifth generation

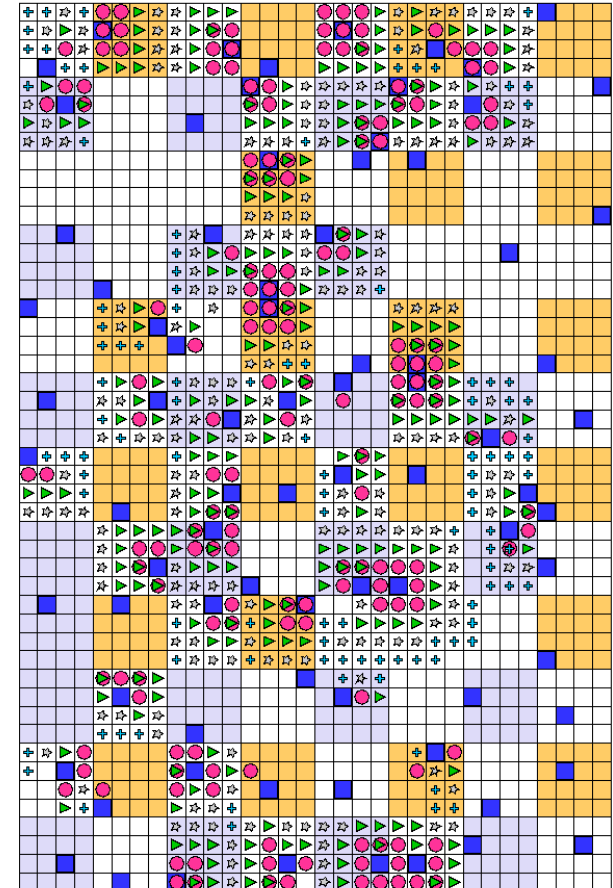
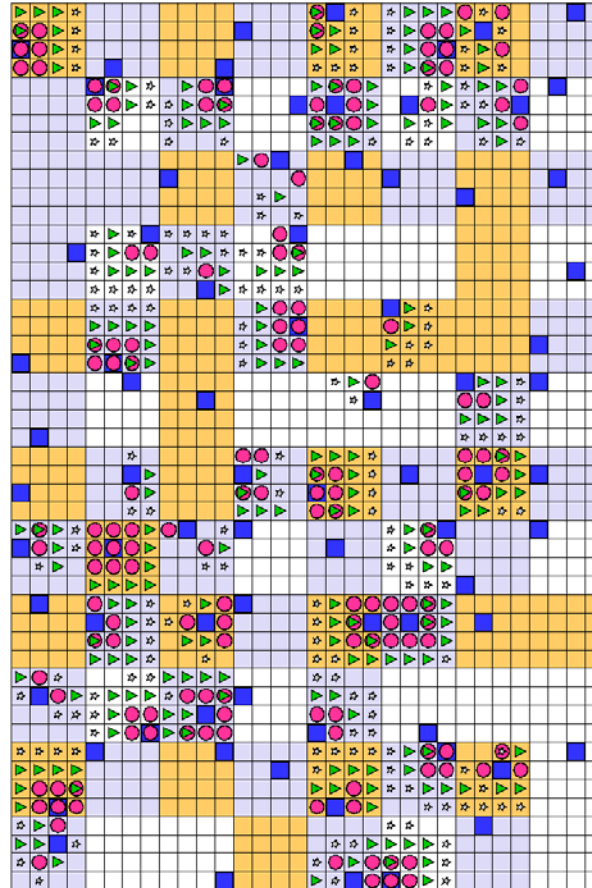
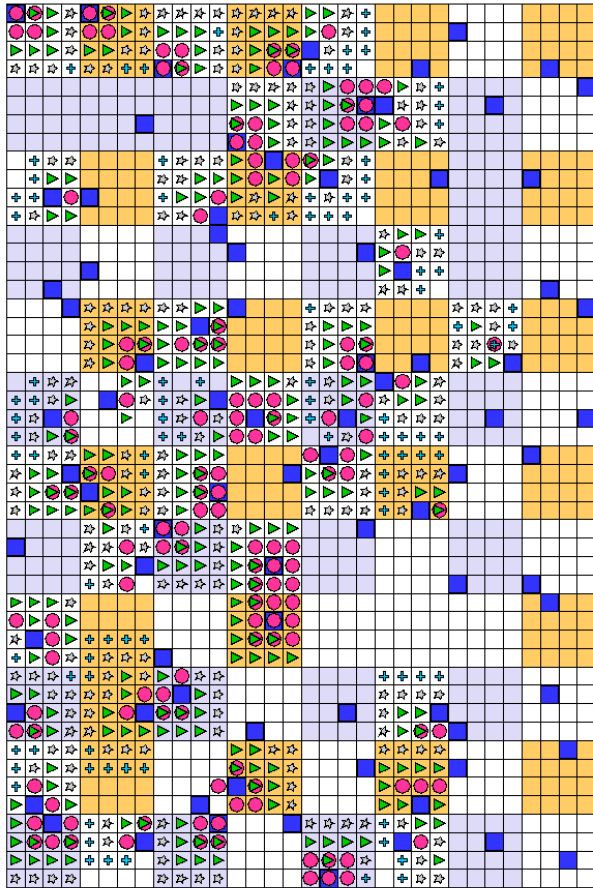
Various sized of lots:

All based on 4/4 lots

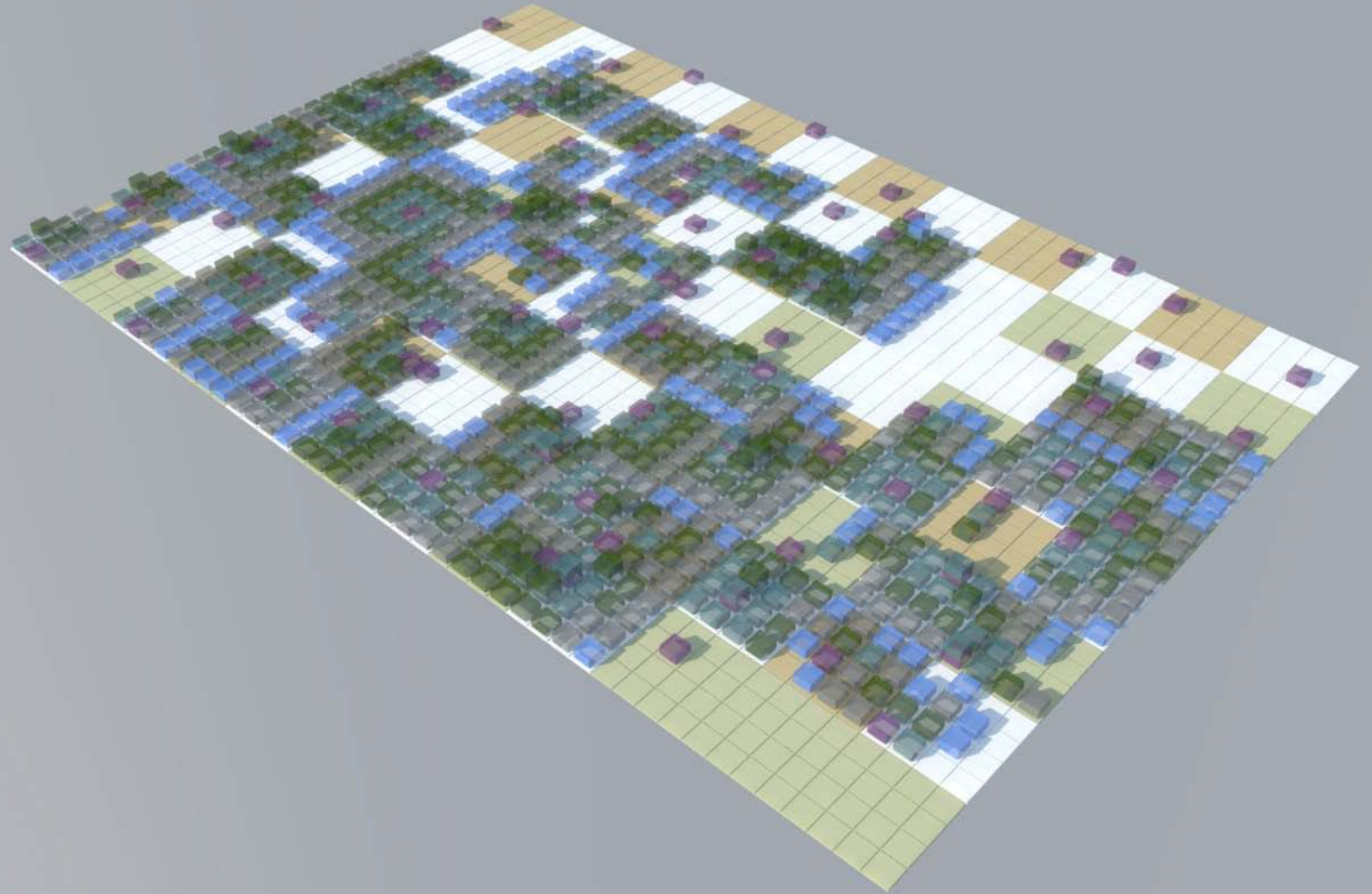
Up to 4 connections

Each color represents
different size and shape

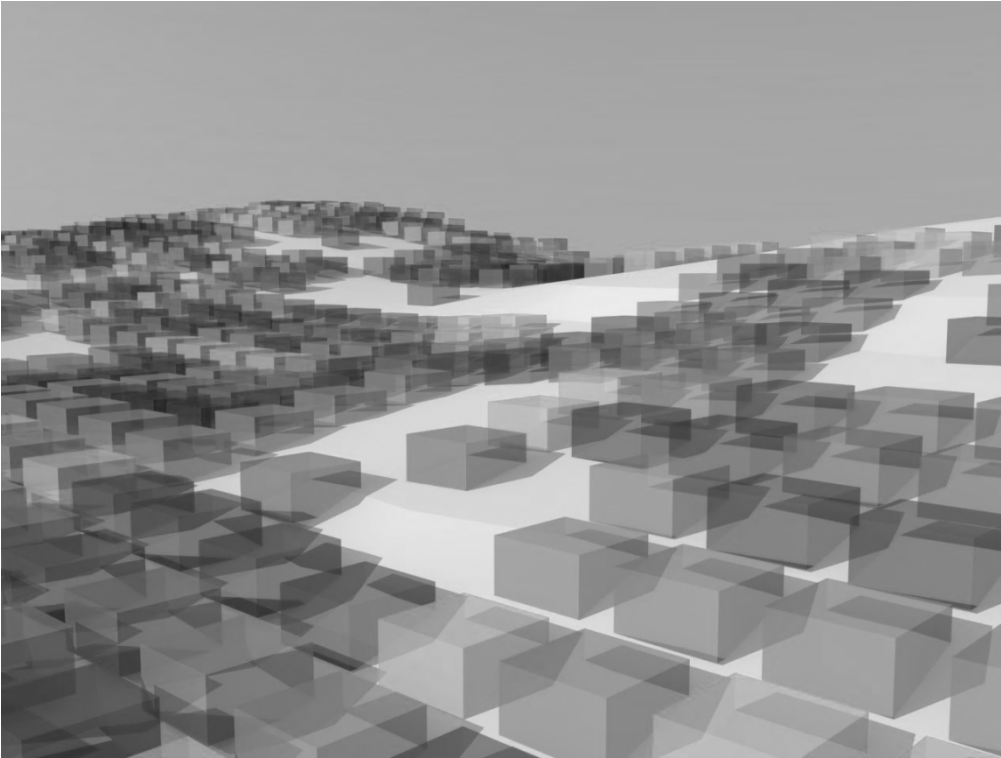
At Different runs variant patterns of morphology are obtained



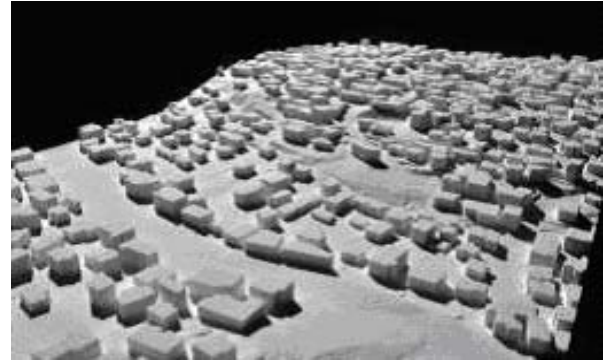
Based on the data it is possible to represent the built morphology using a 3D software
3D representation of the outputs:



3D representation of the outputs:

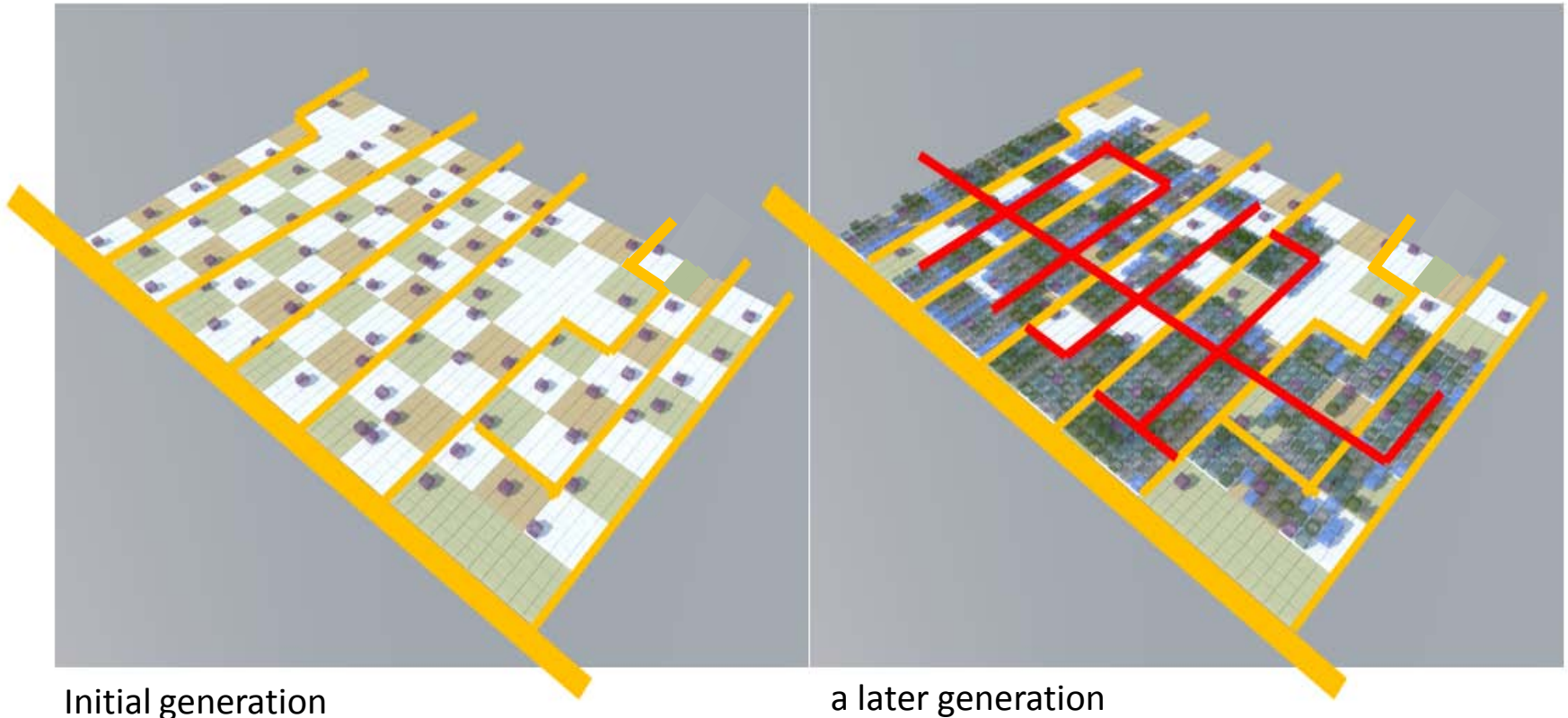


existing 3D layout conditions



Already in this stage, qualitative similarities are obtained between model results and reality

Using the Model for street/paths development simulation



Initial generation

a later generation

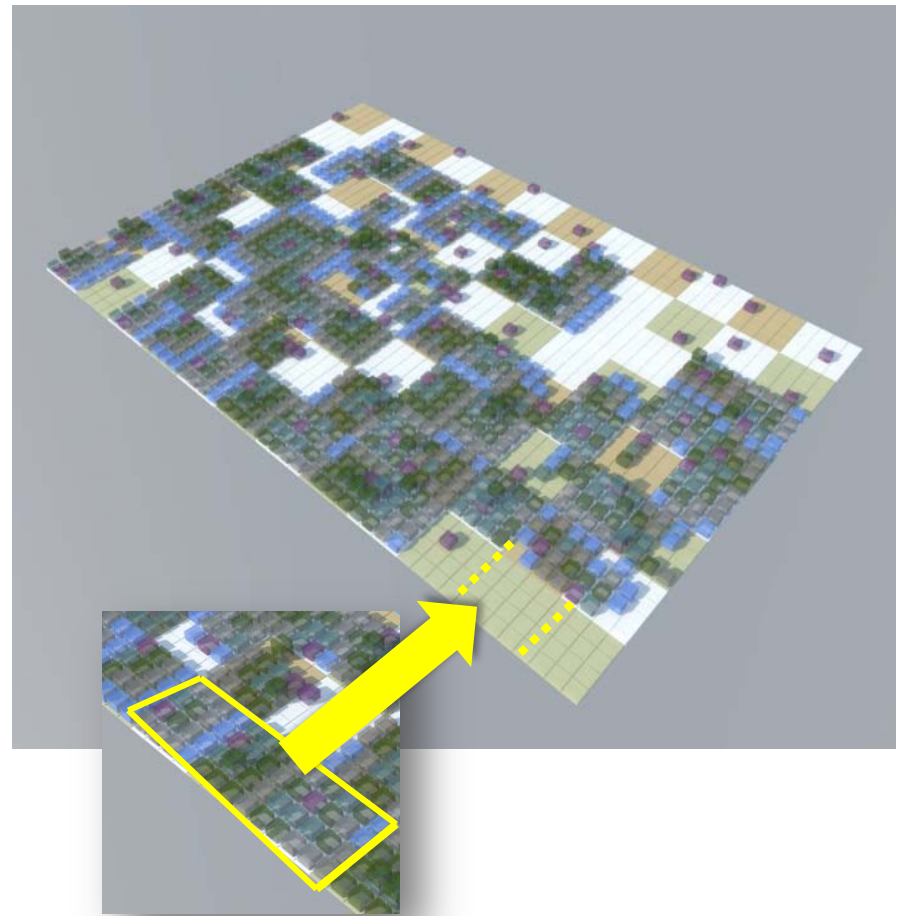
Streets/paths in this model are based on the concept of accessibility

1. Each lot has to have at least one accessible side to the pathway
2. Pathways do not divide lots in the initial generation
3. Pathways aspire to be as continuous possible

Using the model for CADASTRE sub-divisions:



B. “More of the same” morphology of the plots sub-division, inspired by neighboring fabric



A. A possible in-fill of building masses created by the model, following the nature of the traditional patriarchal form

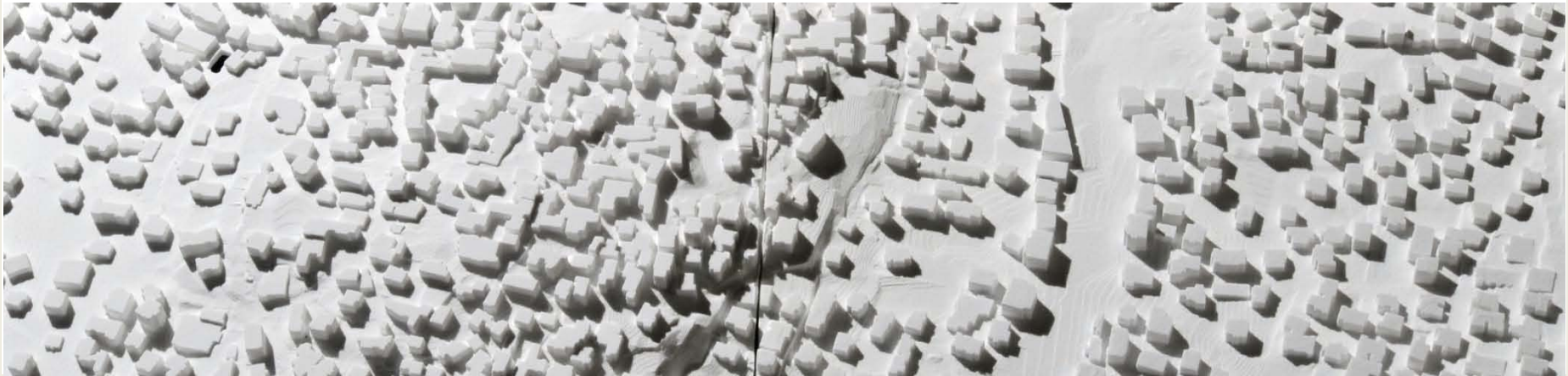
Conclusions:

In this work we showed that identifying one of the most influential processes that are related to the Arab settlement, i.e. the patriarchy culture of the population, leads to a better understanding of the urban evolution in terms of spatial distribution and configuration.

We proposed a possible use of the model for a path development and plots sub-division

A comprehensive version of this model could be used as a significant tool in a PSS (Planning Support System) that will allow the authorities to examine different scenarios of urban development and urban resources distribution in such organic settlements.

Such a model may contribute to the study of organic settlements and the power of culture and social behavior on the morphology.



Future work:

- Next generation**
- relating to realistic plot morphology
 - Inserting main road and public volumes
 - Hamula marriage principals
 - Topography as a generative force

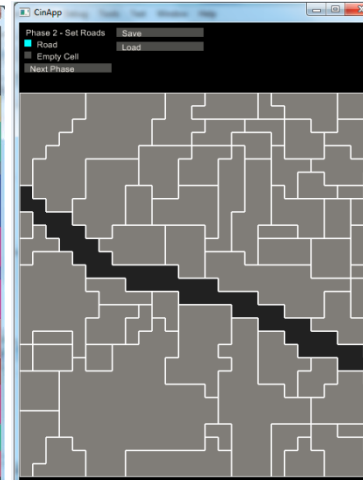
In future work we plan to calibrate our results with real data that would enable the utilization of this model to help Draw principles for future development



Cadastral blocks



"pixel" representation



marking the main road



Initial generation




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Thank you!

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