



# Content

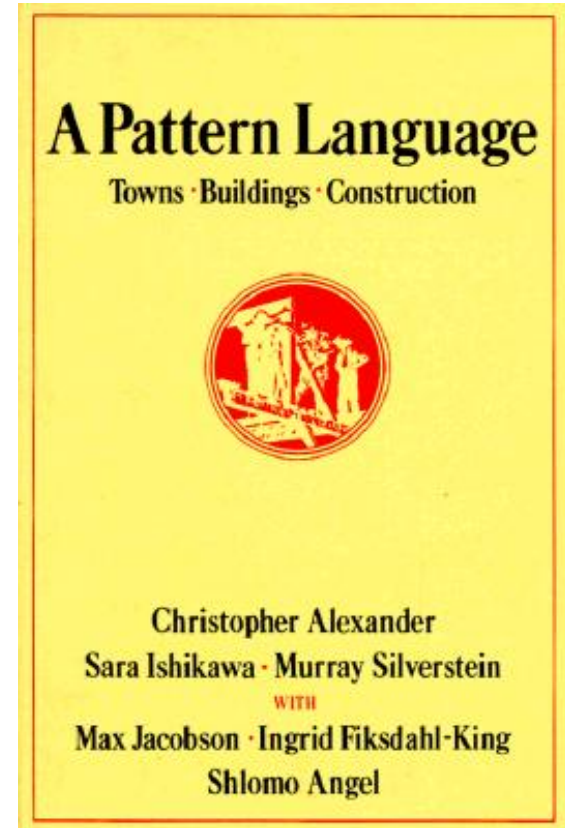
- Urban Patterns definitions | Basic categories
- Urban Form | Formation and typologies
- Bottom-Up | Behavioral | Parametric Modelling and simulations (EmCity tool) and Urban Emergence | Graininess
- Contemporary tendencies in Urban modelling and simulations
- Exercise:
  - Built your own rule-based city patterns in Grasshopper based on parametric modelling methodology
  - Analyse your created urban patterns based on previously introduced methods

# A Pattern

- Christopher Alexander, Sara Ishikawa, Murray Silverstein, *A Pattern Language: Towns, Buildings, Construction*, Oxford University Press, 1977

The basic element of the spatial language which is supposed to be common for everybody in the production of living environments.

(Alexander et al 1977).



# A Pattern

Nolli's plan of Rome – inverted image  
by Giambattista Nolli, ca. 1701-1756

Source:

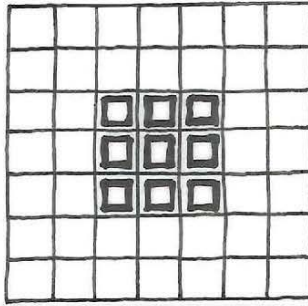
<http://www.lib.berkeley.edu/EART/maps/nolli.html>  
<accessed online, 1/10/2016>

# Morphology | Urban Fabric | Urban Formation

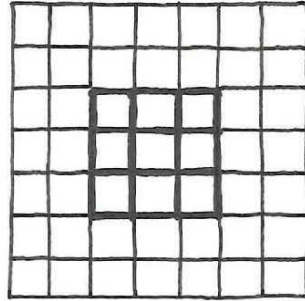
*Form, structure and pattern are the main categories of morphology.*

*Urban Fabric – physical expression of patterns in urban space.*

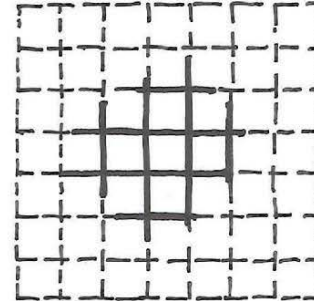
*Formation – indicates two meanings – forming process and a formed product.*



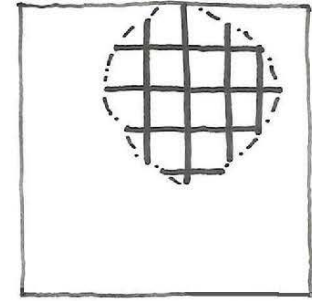
***preserving***



***reinforcing***



***repairing***



***creating***

The basic types of spatial (re)establishment (Attoe and Logan, 1989: 106)

Attoe, W., Logan, D. (1989) *American Urban Architecture: Catalysts in the Design of Cities*,  
Berkeley: University of California Press), taken from ÇALIŞKAN, O, PATTERN FORMATION IN URBANISM, thesis, 2013, TU Delft.

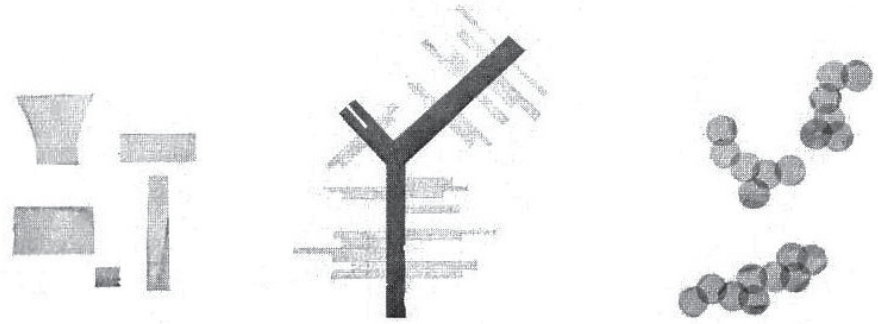
# Types of Urban Formations

<b>Collective</b>	Urban fabric as a collective product (common building codes, singular design instances on individual parcels, open-space network), formation is a subject of collective interest
<b>Complex</b>	Patterns as complex systems
<b>Evolutionary</b>	Patterns as new evolutionary species, urban (building) mutations, new recombination and mutations in design. Open-ended character of development. Mutation + inheritance.
<b>Typological</b>	Urban families, diverse individual interpretations, combinations, variations, continuous combinatorial processes of various typologies, shared generative knowledge, adaptive according to external conditions.
<b>Rule-based</b>	Rule-sets defined by the system, resolving conflicting interests (which form, where to built...) -procedural and formal
<b>Law-governed</b>	Rules cooperating with the structural laws of morphological possibilities (hierarchical organisation (city, district, building, floor plan, interior arrangement)
<b>Control-driven</b>	Territorial rules in design control (territorial relations between the public domain and the private space)

ÇALIŞKAN, O, PATTERN FORMATION IN URBANISM, dissertation thesis, 2013, TU Delft.

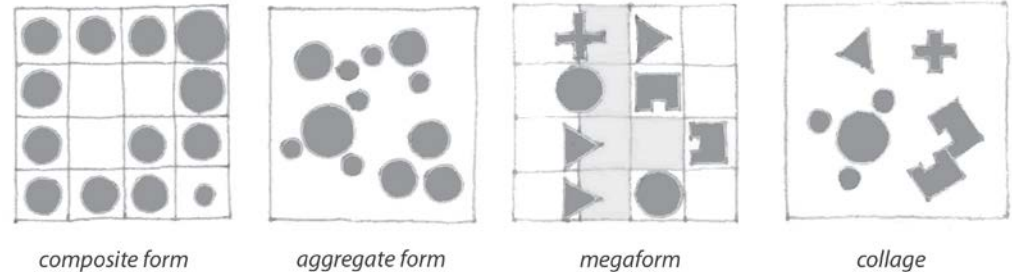
# Typologies of Collective Urban Formations

The typology of collective form suggested by F. Maki:  
*Compositional form* –left-,  
*magaform* –middle- and  
*group-form*–right- (Source: Maki, 1964: 6)



Maki, F. (1964) *Investigations In Collective Form*, St. Louis: Washington University

Revisited typologies:  
Composite, Aggregate, Megaform, Colage  
(Source: Çaliskan, 2013)



ÇALIŞKAN, O, *PATTERN FORMATION IN URBANISM*, dissertation thesis, 2013, TU Delft.

# Typologies of Collective Urban Formations

A neighbourhood in Amsterdam.



An informal (squatter) development in Ankara, Turkey: The aggregation of many individual buildings creates an irregular order. (Adapted from: Ankara Municipality, 2000)

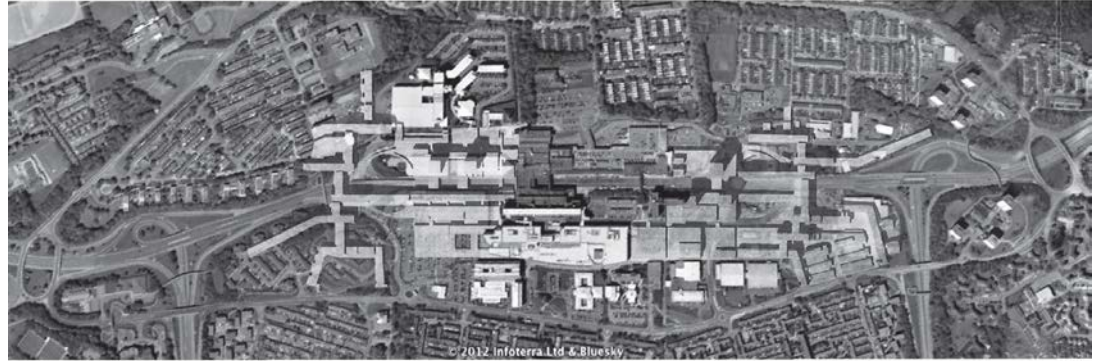


ÇALIŞKAN, O, PATTERN FORMATION IN URBANISM, dissertation thesis, 2013, TU Delft.



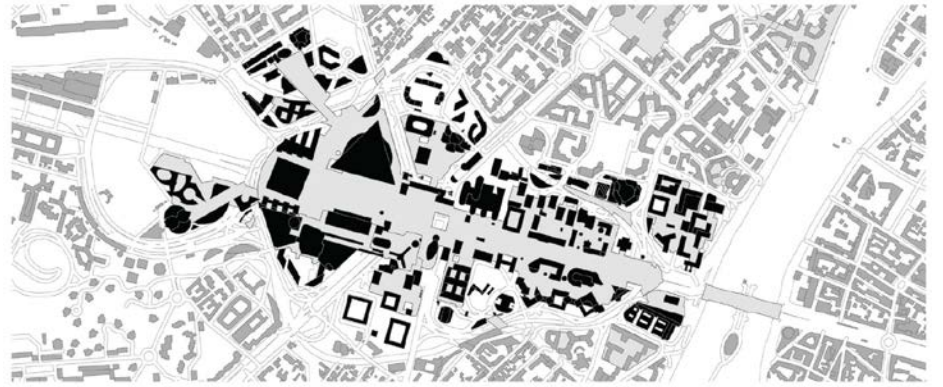
# Typologies of Collective Urban Formations

Superimposition of the original design project to Town Centre, Cumbernauld: Despite the partial realisation, it is considered 'the most complete megastructure ever built' since its design in 1960. (Adapted from: Banham, 1976: 168; Google Earth, 2012)



Banham, R. (1976) Megastructure: Urban Futures of the Recent Past, London: Thames and Hudson

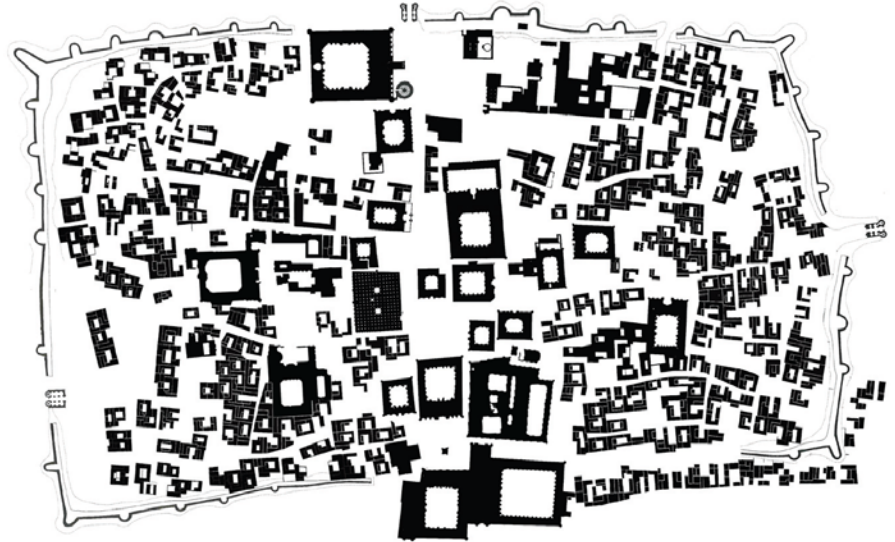
The campus-form of La Défense, Paris:  
Located in an orbital motorway system with a central spine, the collective form is organised in an open, but a spatially controlled system.



ÇALIŞKAN, O, PATTERN FORMATION IN URBANISM, dissertation thesis, 2013, TU Delft.

# Typologies of Collective Urban Formations

The historic centre of the city of Khiva, Uzbekistan: A number of madrasas, the mosques complex, the bazaar and the residential buildings compose a collage-like urban fabric. (Source: Herdeg, 1990: 65)



ÇALIŞKAN, O, PATTERN FORMATION IN URBANISM, dissertation thesis, 2013, TU Delft.

Herdeg, K. (1990) Formal Structure in Islamic Architecture of Iran and Turkistan, New York: Rizoli

# Typologies of Collective Urban Formations

The site plan of the Maidan-I-Shah and its surrounding fabric: The megaform of the mosque, the shopping arcades and the bazaar, compositional form of the government complex and the aggregate form of the residential fabric are integrated in the same context (Source: Herdeg, 1990: 13).



ÇALIŞKAN, O, PATTERN FORMATION IN URBANISM, dissertation thesis, 2013, TU Delft.

Herdeg, K. (1990) Formal Structure in Islamic Architecture of Iran and Turkistan, New York: Rizoli





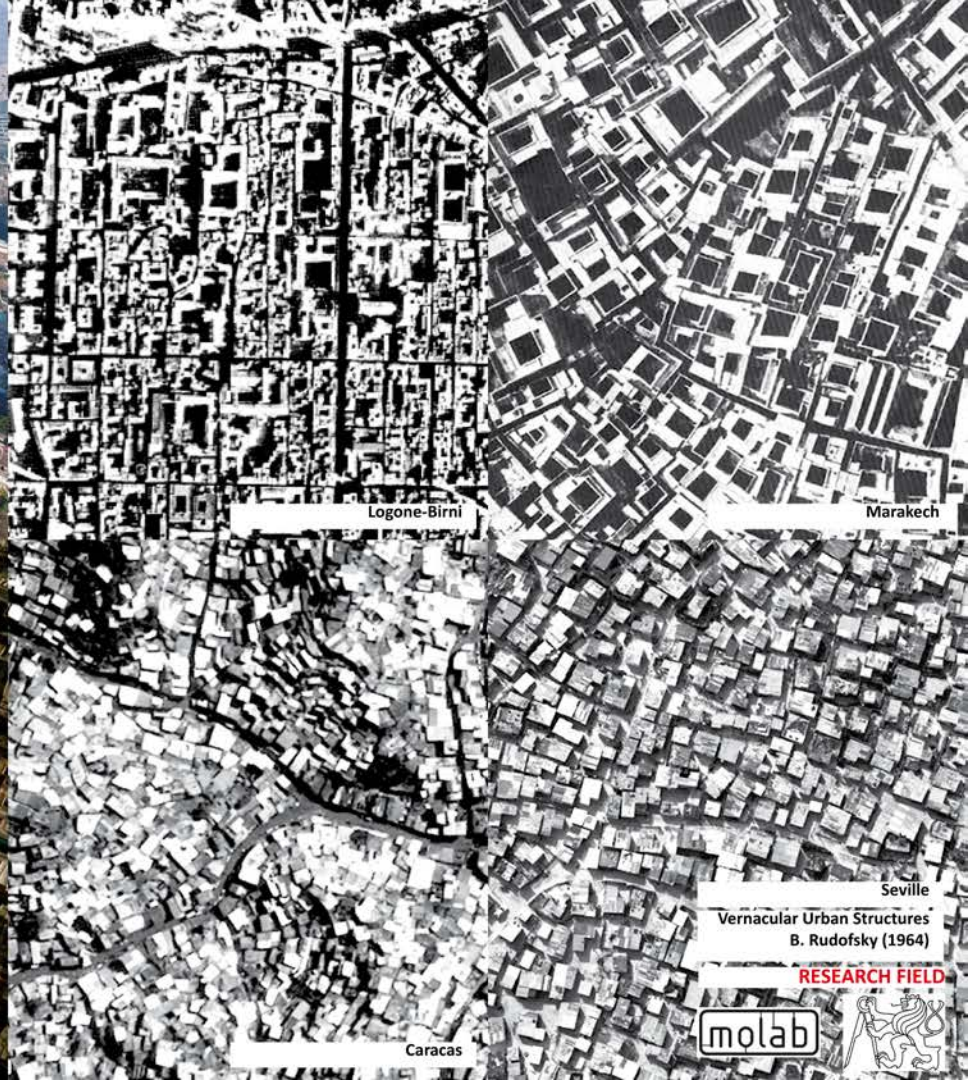
Barrios - Caracas

accessed April 18 2015 <<http://caracas1010a.blogspot.sg/>>



Marrakech Morocco  
accessed April 18  
2015

<<http://www.magnumphotos.com/image/PAR35963.html>>



Logone-Birni

Marakech

Seville

Vernacular Urban Structures  
B. Rudofsky (1964)

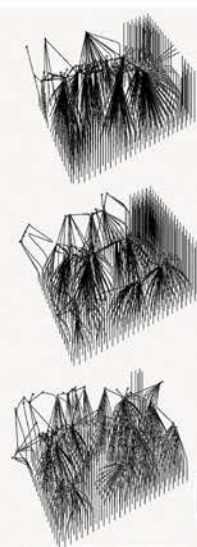
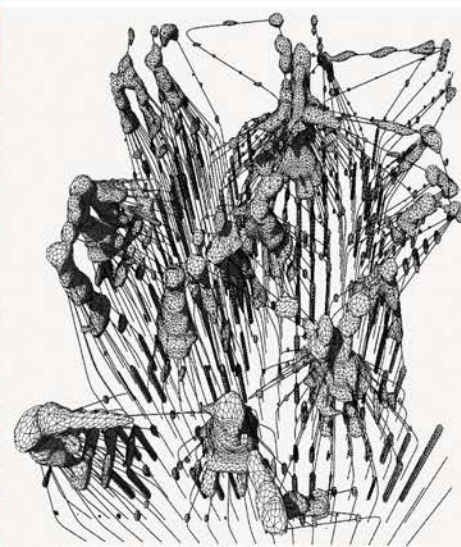
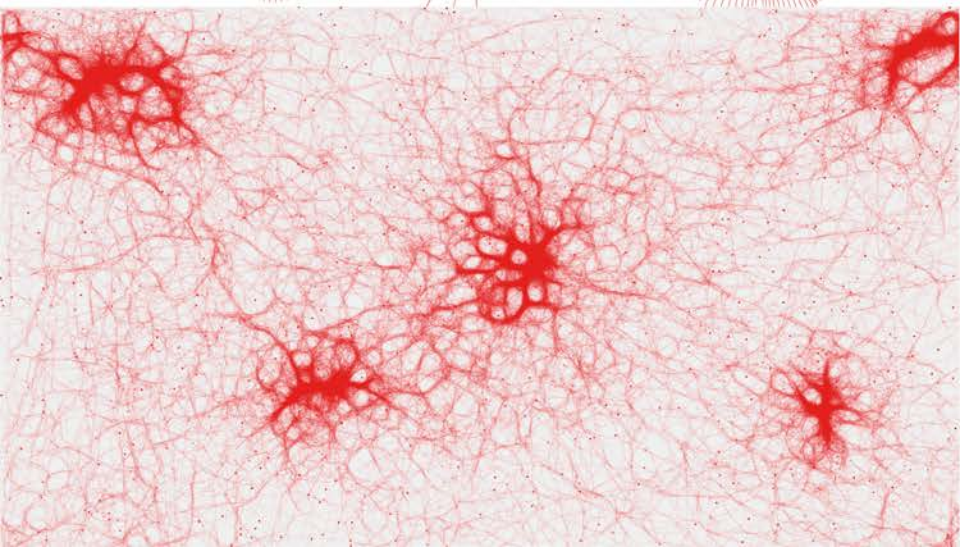
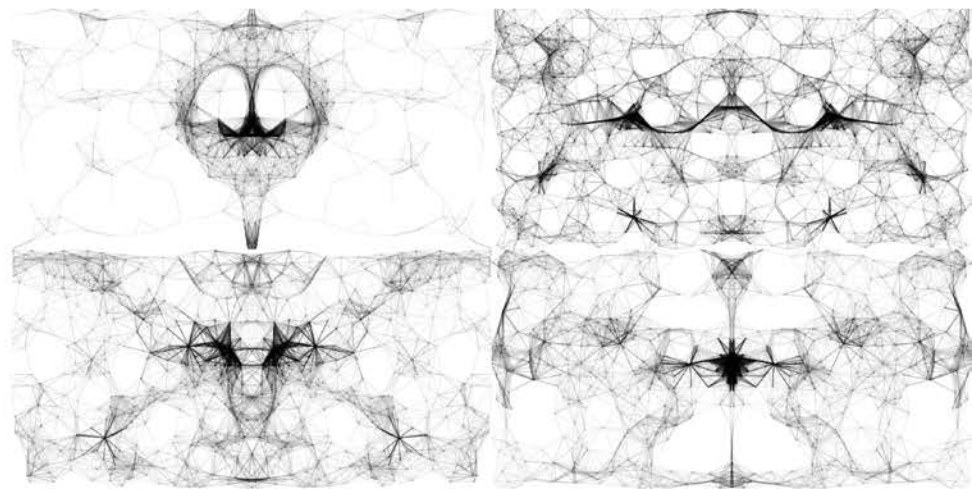
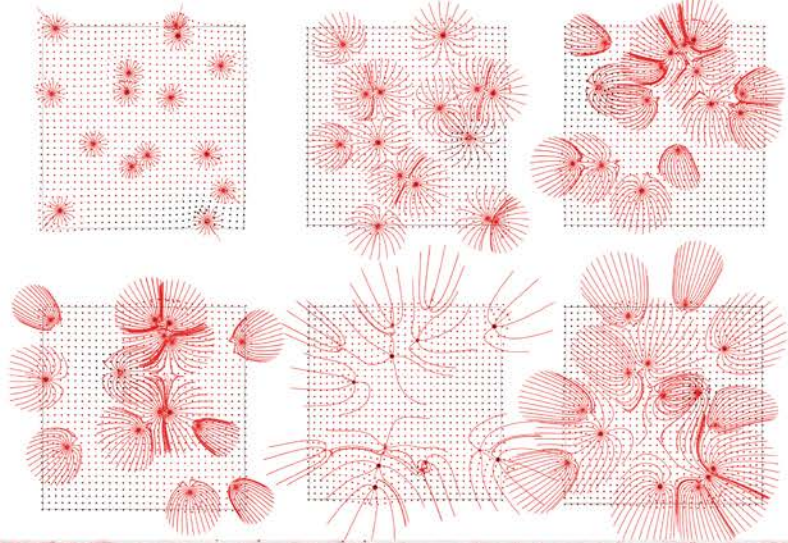
RESEARCH FIELD

molab



Caracas



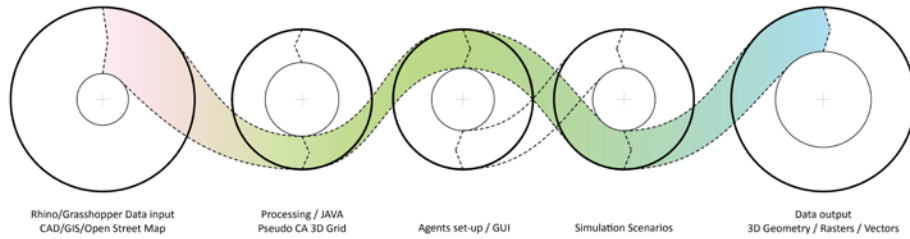


METHODOLOGY  
EXPLORATION

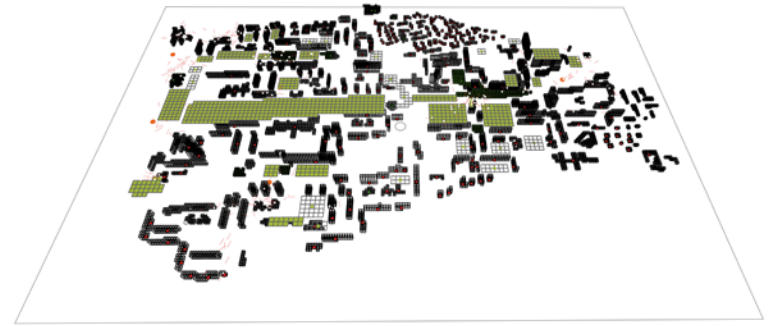
molab



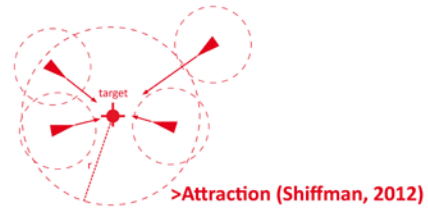
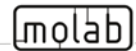




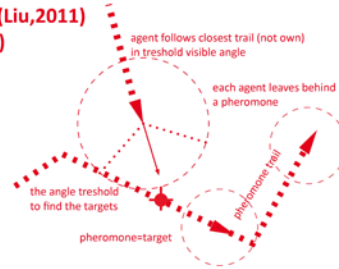
## WORKFLOW DIAGRAM



ABM MODEL

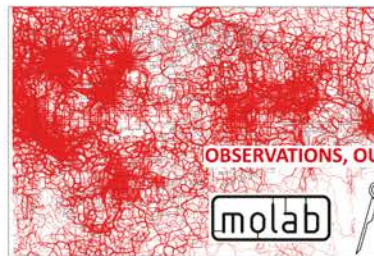
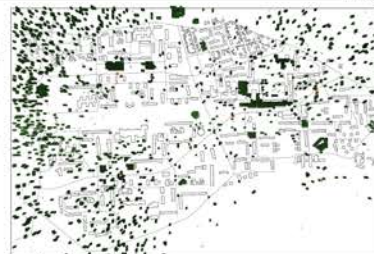
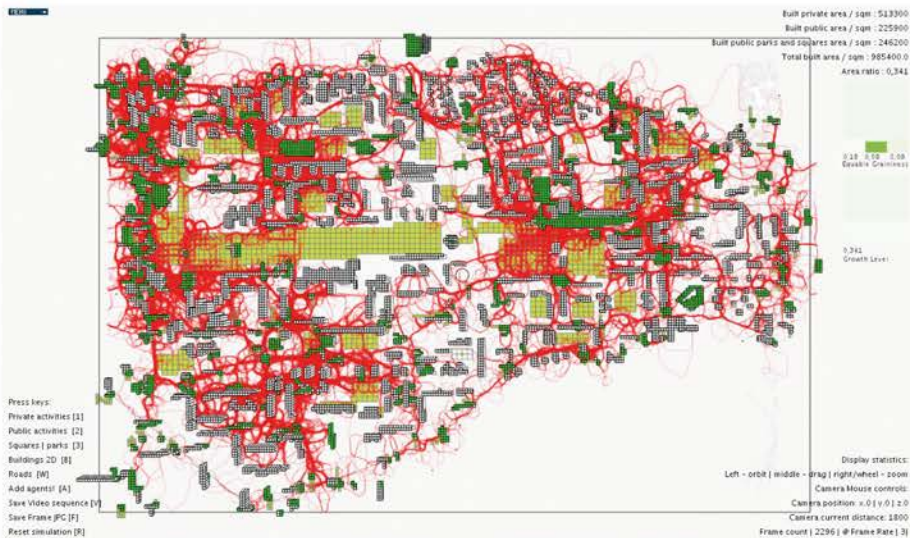


>Stigmergy (Liu,2011)  
(Erioli, 2014)



## METHODOLOGY





OBSERVATIONS, OUTCOMES

molab







VISUAL EVALUATION - COMPARISON

Marrakech

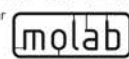
Seville

Logone-Birni

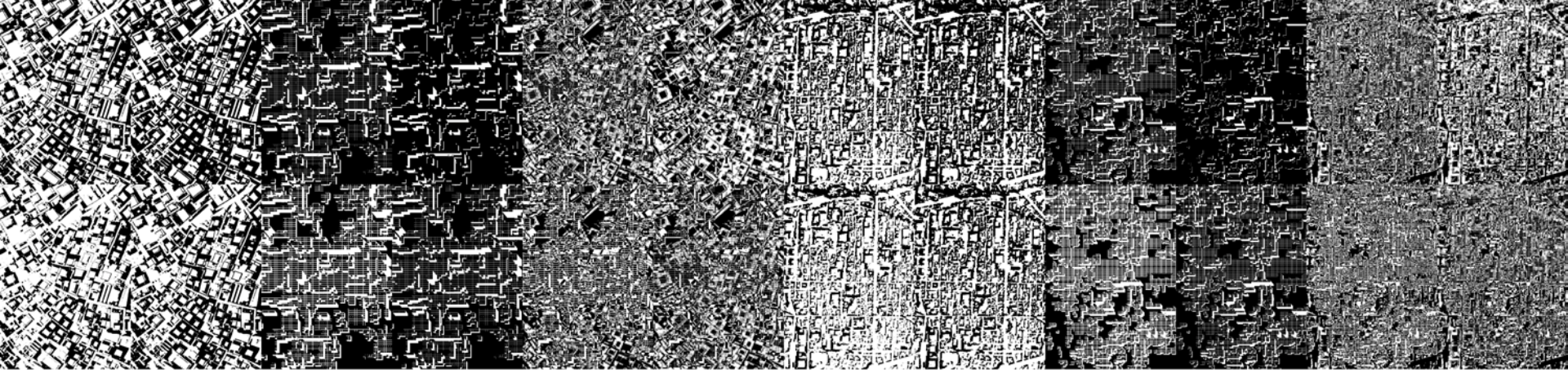
Marrakech

Caracas

Zanzibar

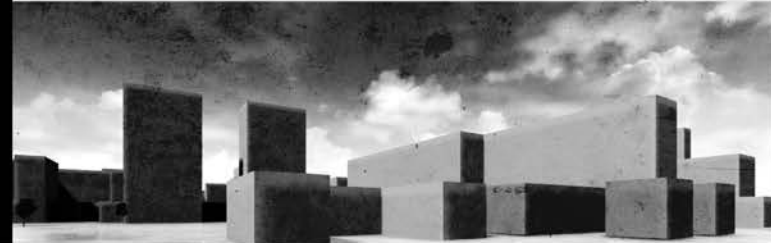
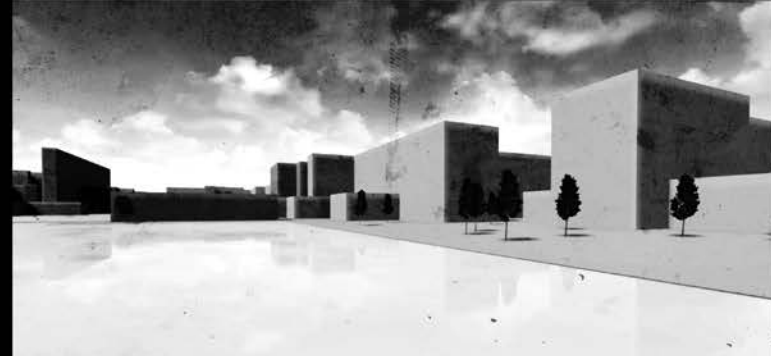
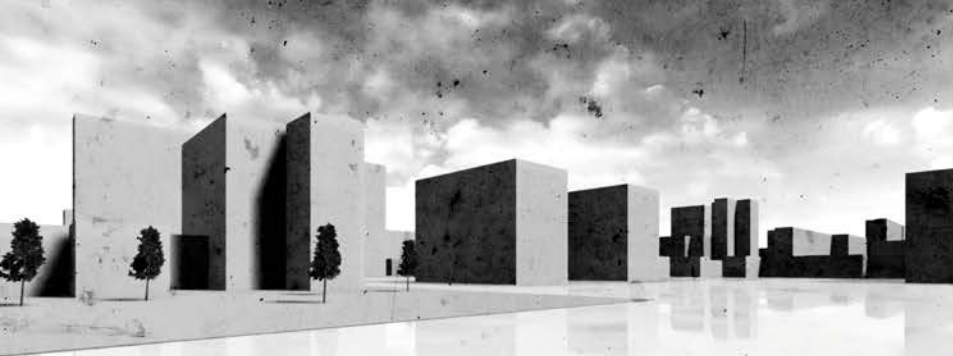






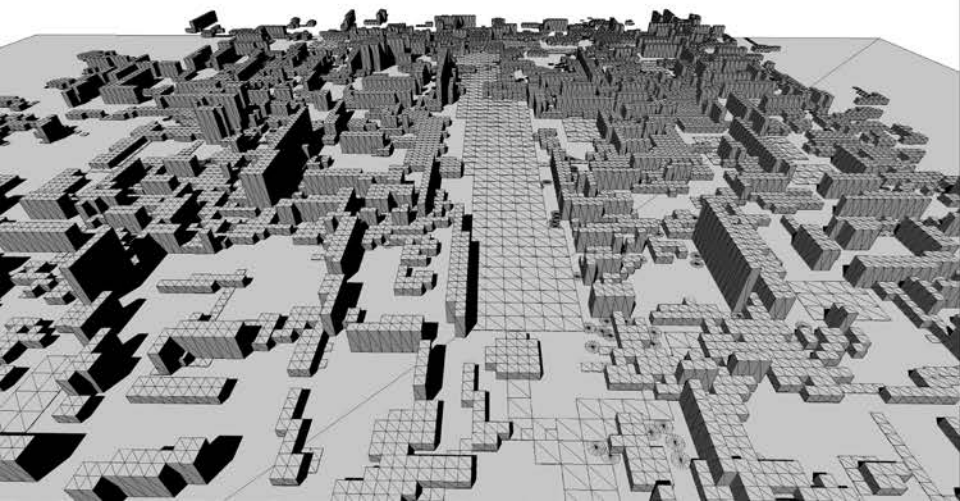
Original	Erode	Original	Erode	Standard deviation: 0.2 Window type: Gaussian Filter width:11 SSIM : 0.4254711833	Original	Erode	Original	Erode	Standard deviation: 0.2 Window type: Gaussian Filter width:11 SSIM : 0.426781145427649
Dilate	Dilate then Erode (close holes)	Dilate	Dilate then Erode (close holes)	Standard deviation: 1 Window type: Gaussian Filter width:11 SSIM : 0.14005448466046388	Dilate	Dilate then Erode (close holes)	Dilate	Dilate then Erode (close holes)	Standard deviation: 1 Window type: Gaussian Filter width:11 SSIM : 0.10071124227947303

PIXEL BASED COMPARISON- EVALUATION - THE STRUCTURAL INDEX OF SIMILARITY (SSIM) BETWEEN IMAGES (Zhou et al. 2004)



VISUAL QUALITATIVE EVALUATION FROM THE 1<sup>ST</sup> PERSON'S POSITION - UNREAL ENGINE





# Excercise 04:

## Rule-based pattern-formation simulation (Grasshopper)

Download any topography data (any GeoTIFF relief from <https://geodata4edu.ethz.ch/portal.jsp> or earthexplorer.)

Convert to JPEG, import the file to Rhino, make a surface from an image. Use Grasshopper definition, e.g. <https://generativelandscapes.wordpress.com/2014/09/12/surfaces-from-image-sampler-example-4-6/>.

Tessellate the surface by means of appropriate method (e.g. Voronoi or others according to the morphological characteristics of the land area) and scale the subdivided parts according to the preferred attractor points or preferred typology of urban formations. (You can use several attractors on a curve). Try several possibilities of scaling / transformations / formations.

Populate the tessellated surface with buildings in relevant form (e.g. use and scale the shape of plots) according to certain rule-set (e.g. distance restrictions from attractor points, connectivity with the road network, etc.)

Simulate the growth of the city and analyse it by means of previously introduced analytic methods.

Study the video tutorials. Bring your own ideas to the system, change certain characteristics, try to use any other modelling methodologies or techniques/parameters. Prepare your questions.

# Excercise 04:

## Rule-based pattern-formation simulation (Grasshopper)

Other Useful links for Grasshopper:

<http://atlv.org/education/grasshopper/>

<http://www.co-de-it.com/wordpress/code/grasshopper-code>

<http://object-e.net/tools>

<http://www.grasshopper3d.com/forum/topics/scaling-voronoi-with-attractor-point>

<https://explodebreps.wordpress.com/grasshopper-components/>

# References

BATTY, M, Cities and Complexity: Understanding Cities with Cellular Automata, Agent-based models, and Fractals, MIT Press, 2007, Cambridge, Massachusetts.

ÇALIŞKAN, O, PATTERN FORMATION IN URBANISM: A Critical Reflection on Urban Morphology, Planning and Design, dissertation thesis, TU Delft, 2013. < <http://repository.tudelft.nl/islandora/object/uuid:9a0f4d24-bc77-469e-9f56-e6c14eda252a/?collection=research> > [online][accessed 15. 10. 2016].

HENSEL, M, MENGES, A, WEINSTOCK, M, (guest ed.), AD Emergence: Morphogenetic Design Strategies, Issue 3, Wiley-Academy, 2004, London.

HOLLAND, J,H, Emergence: From Chaos to Order, Oxford University Press, 1998, New-York.

JOHNSON, S, 2001, Emergence, Penguin books, London.

POLETTTO, M, PASQUERO, C, [ecoLogicStudio] Systemic Architecture: Operating Manual for the Self-organizing City, Routledge, 2012, London and New York.

# References

- RUDOLFSKY, B, Architecture without architects: A Short introduction to Non-Pedigreed Architecture, Doubleday&Company, Inc, Garden City, 1964, New York.
- SPYROPOULOS, T, Adaptive Ecologies: Correlated Systems of Living, Architectural Association and Authors, AA Publications, 2013, London.
- VEREBES, T. (ed.), Masterplanning the Adaptive City: Computational Urbanism in the Twenty-first century. London and New York: Routledge Taylor & Francis Group, 2014.
- WEINSTOCK, M, The Architecture of Emergence: The evolution of Form in Nature and Civilisation, John Wiley & Sons, 2012, London.



# Web Links

- Batty, M 2011, *A science of Cities*. [online] [accessed 7.2. 2013] <<http://www.complexcity.info/>>.
- Schumacher, Patrick. [online]. Parametricism - A New Global Style for Architecture and Urban Design, London, 2008 [online][accessed 23. 10. 2010] <<http://www.patrikschumacher.com/>>.
- Future Cities Laboratory, [online][accessed. 16.9. 2014]< <http://www.futurecities.ethz.ch/>>.
- Live! Singapore, Senseable City Laboratory, [online][accessed. 21.3.2015] <<http://senseable.mit.edu/livesingapore/visualizations.html>>.
- Ocean CN Facebook profile, [online][accessed. 21.3. 2015] <<https://www.facebook.com/pages/Ocean-CN-Consultancy-Network/175147175872792>>.
- Bolojan, Daniel [online], Nonstandard Studio [accessed. 21.3.2015] < <https://nonstandardstudio.wordpress.com/>>.
- Sanchez, Jose. [online], Block'Hood [accessed 16.9. 2015] <<http://www.plethora-project.com/blockhood/>>.
- Buš, Peter. [online]. Emergence in Urban Environments, dissertation thesis. [accessed 30.9. 2015] <[http://www.archa3d.com/images/emergence/Emergence\\_in\\_Urban\\_Environments\\_phd\\_thesis.pdf](http://www.archa3d.com/images/emergence/Emergence_in_Urban_Environments_phd_thesis.pdf)>.