Lecture 4
Urban Pattern Formation:
Bottom-up Patterns
Emergent Urban strategies

Digital Urban Simulation
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

• Excercise:
  • 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


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

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.

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

Types of Urban Formations

Collective  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

Complex  Patterns as complex systems

Evolutionary  Patterns as new evolutionary species, urban (building) mutations, new recombination and mutations in design. Open-ended character of development. Mutation + inheritance.

Typological  Urban families, diverse individual interpretations, combinations, variations, continuous combinatorial processes of various typologies, shared generative knowledge, adaptive according to external conditions.

Rule-based  Rule-sets defined by the system, resolving conflicting interests (which form, where to built...) -procedural and formal

Law-governed  Rules cooperating with the structural laws of morphological possibilities (hierarchical organisation (city, district, building, floor plan, interior arrangement)

Control-driven  Territorial rules in design control (territorial relations between the public domain and the private space)

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: Çalık, 2013)

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)

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)


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.

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)
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).

A city is a social interactions by individual parts (agents) with physical solid environments (cells).

Batty recognizes the structure of a city as a cellular system of modules (cellular automata) that interact and influence each other.

Manuel DeLanda (2011)

Theory of Assemblage.

A complex whole is an assemblage. A city is such a great example.

Every entity in the world is assembled from other entities.

Relations

John Holland (1998)

"The behaviour of the whole is much more complex than the behaviour of its internal parts..." in mutually hierarchically interlocked mechanisms.

The principle of "building blocks". The world is taken apart into more understandable objects and parts.

Interaction between objects are based on rules determined by condition clauses (if...then...).

THEORETICAL FRAMEWORK

THE BUILDING BLOCK (Holland 1998, Batty 2007)

STATE-OF-THE-ART

METHODOLOGY
VISUAL QUALITATIVE EVALUATION FROM THE 1ST PERSON’S POSITION - UNREAL ENGINE
Exercise 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.
Excersise 04:
Rule-based pattern-formation simulation (Grasshopper)

Other Useful links for Grasshopper:

http://atlvs.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


References


Web Links


• Bolojan, Daniel [online], Nonstandard Studio [accesed. 21.3.2015] <https://nonstandardstudio.wordpress.com/>.
