

NATURAL PROCESSES IN CITIES

Kinda Al-Sayed

k.sayed@ucl.ac.uk

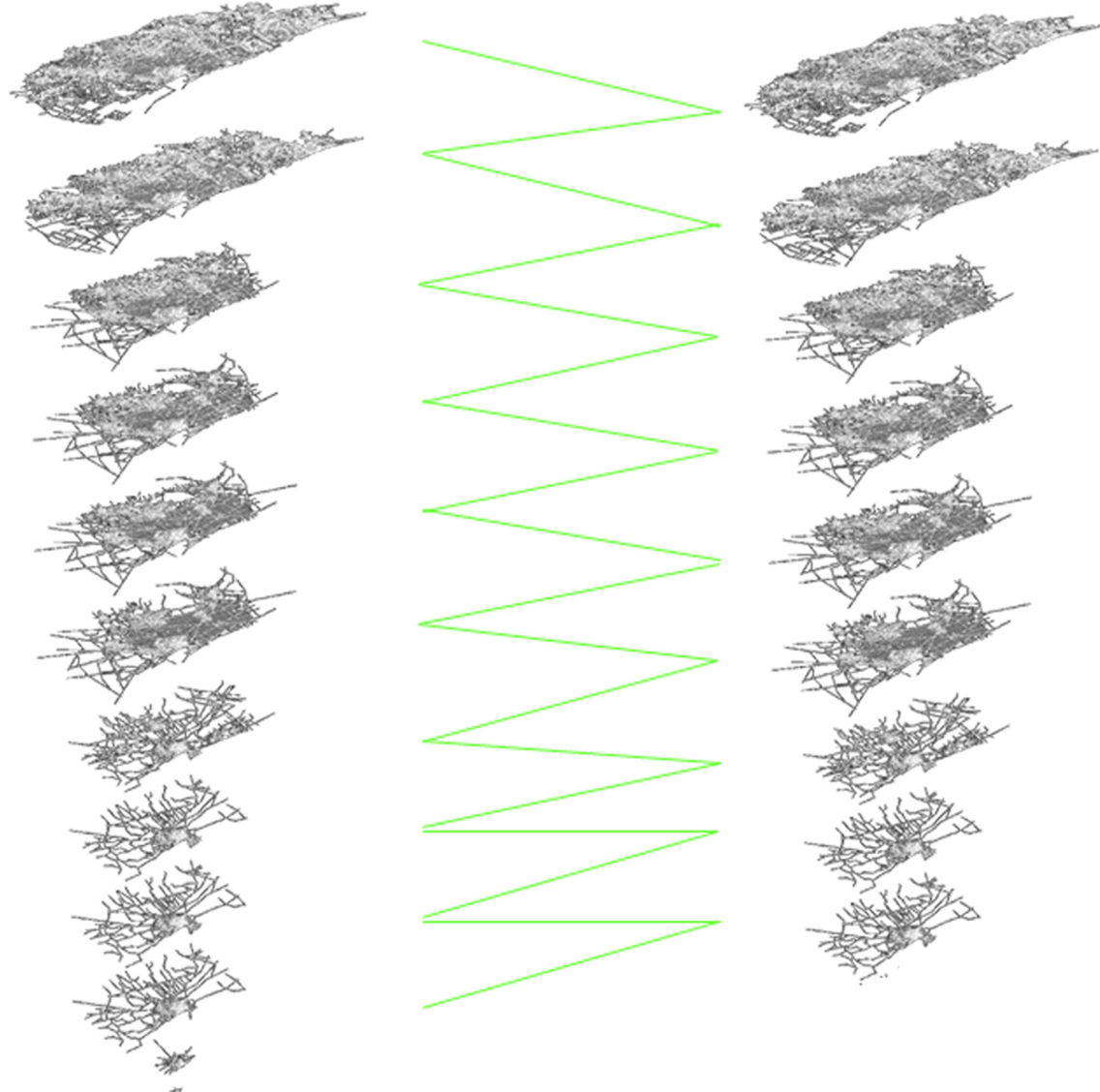
BARTLETT SCHOOL OF GRADUATE STUDIES

UNIVERSITY COLLEGE LONDON

MAPPING SPATIAL MORPHOGENESIS IN URBAN SYSTEM

Asynchronising structures

Mapping transformations in-between synchronic states of the growing system



State A+2

State A+1

State A

State T = transformation (A, A+1)

Infer invariants from urban growth patterns

Extract an invariant that marks growth patterns

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While aggregate integration values of elements in the system do not approximate a log normal distribution locally and a normal distribution globally
While system has not reached its maximum boundary and complexity is penalised by regulator (If connectivity value of a certain element raises above 10, then no more segments are attached to this particular segment)

// preferential attachment
If peripheral patches exhibit high changes in local integration then increase attachmentProbability
If routes of high angular choice Pn are on the edges and these routes have previously witnessed high changes in angular choice, then increase attachmentProbability at the intersection of these routes to add new elements and form patches.
If patches are above a certain number of elements and size of patches goes beyond certain proportions then increase attachmentProbability to distribute within a Gaussian that covers patches.
If a gain of centrality is at its utmost in sparsely spread structures then increase attachmentProbability to add new elements following a Gaussian distribution within a certain metric radius.
Add new elements of length segmentLength (short) and angle segmentAngle (near right angle) to the neighbouring edges with greatest attachmentProbability
If centres have high local integration compared to the whole system, then increase attachmentProbability to connect centres
Add new elements of length segmentLength (long) and angle segmentAngle (small) to the neighbouring edges with greatest attachmentProbability

// pruning
If the area within the constrained boundaries is filled, remove elements with lowest local integration values.

End loop
    
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ARE CITIES AUTONOMOUS?

Barcelona

In a process of preferential attachment, city structure records a certain memory wherever integration change takes place and recalls this memory to attach to new elements. This process is continuously updated throughout growth

In a process of structural differentiation cities adapt their uniform order to match that of organic grid structures



Transformation map (1698, 1806)



Higher gains in choice (angular betweenness) values [segment length weighted]



Street map 1855

Evidence on Preferential attachment

SO CAN WE SAY THAT CITIES HAVE MINDS?

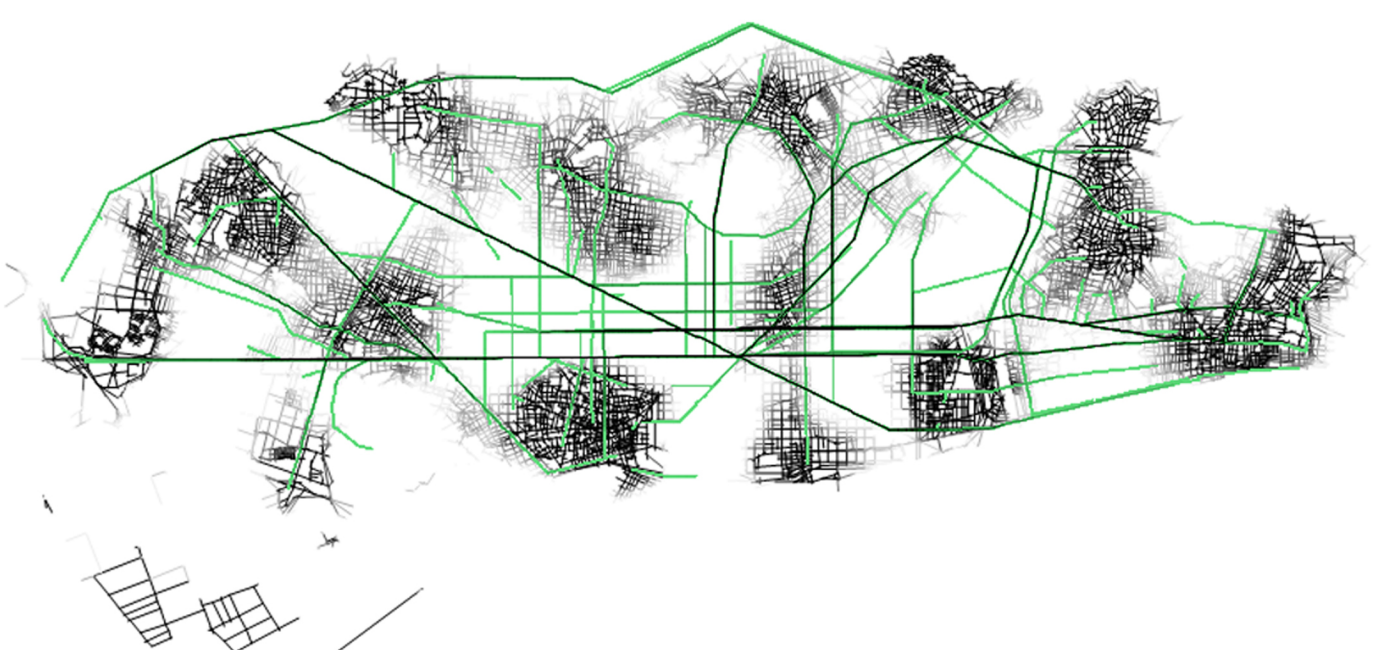
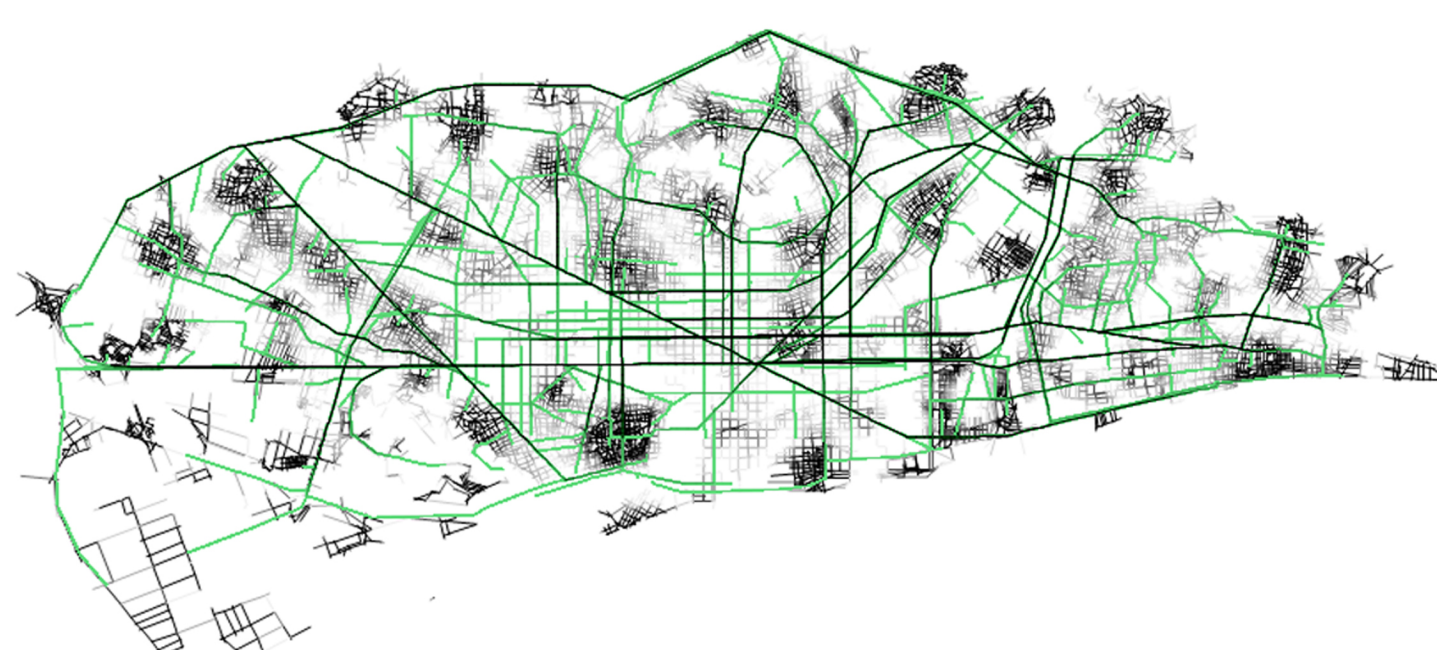
Foreground and background structures overlaid

How shall we treat cities ?

NATURAL

or

ARTIFICIAL



In essence, the supposed mind would borrow its intelligence from the collective minds of individuals who live within. It is a mind of a society that nests within the spatial structure of a city