Transnational Network of Integrated Planning Labs: co-creating knowledge on forward-looking transdisciplinary planning perspectives addressing climate change and urban life in the post-pandemic city.

InPlaLabs

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Project: Erasmus+ 2023-1-EL01-KA220-HED-000160477
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Transnational Network of Integrated Planning Labs:
Co-creating knowledge on forward-looking transdisciplinary planning perspectives addressing climate change and urban life in the post-pandemic city

Project number: 2023-1-EL01-KA220-HED-000160477 Erasmus+

Introduction to Space Syntax as an Evidence based Design tool: Processing using QGIS Space Syntax Toolkit
10.06.2025

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Course Structure

1. **Theoretical framework and space syntax terms**
2. **Introduction to Space Syntax toolkit and what it measures**

3. **Results: spatial analysis of urban systems using SSx Toolkit**
4. **Types of analysis**

5. **Interpreting the results of the spatial analysis**

- Understand the impact of spatial layouts on various aspects
- Testing scenarios
- Correlations between spatial values and other forms of data

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Proposed Timeframe (3 hours)

- 40 min | **Section 1 | Lecture**
- 10 min | Questions and discussion
- 20 min | **Section 2 | Spatial analysis demo using QGIS**
- 20 min | Miro exercises or hands-on training using the SSx toolkit
- **Break (20 mins)**
- 40 min | **Section 3 | Interpreting the results of the spatial analysis**
- 20 min | Miro exercises to read the analysis and ask research questions
- 10 min | Questions and discussion

Section 1: Theoretical framework

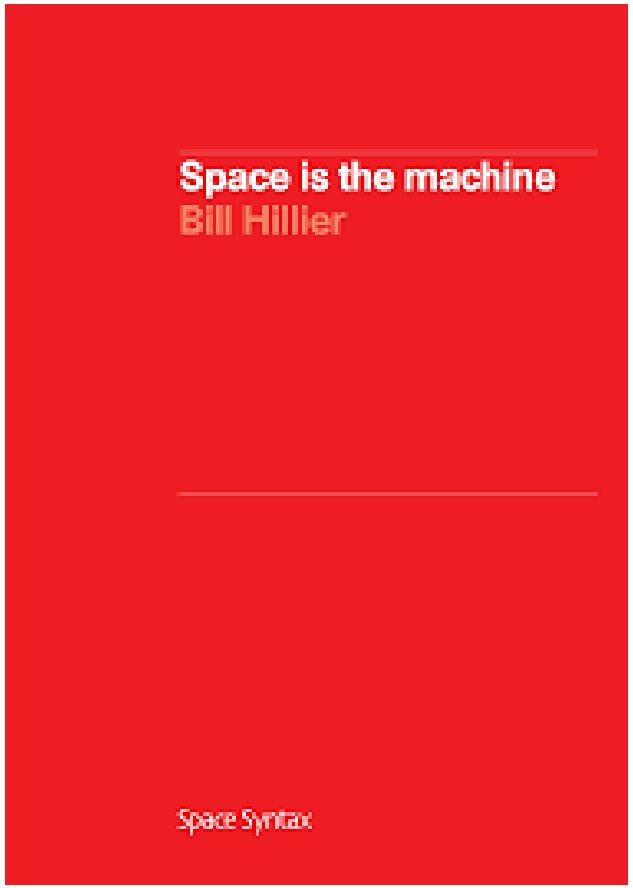
Bill Hillier's theories of:

“natural movement” - how urban space shapes flows

the **“movement economy”** - how land uses exploit movement

“ centrality” – how urban centres are the outcome of a long-term historical process of the formation and location of centres.

the **“dual grid”** - how the foreground & background street networks interrelate...



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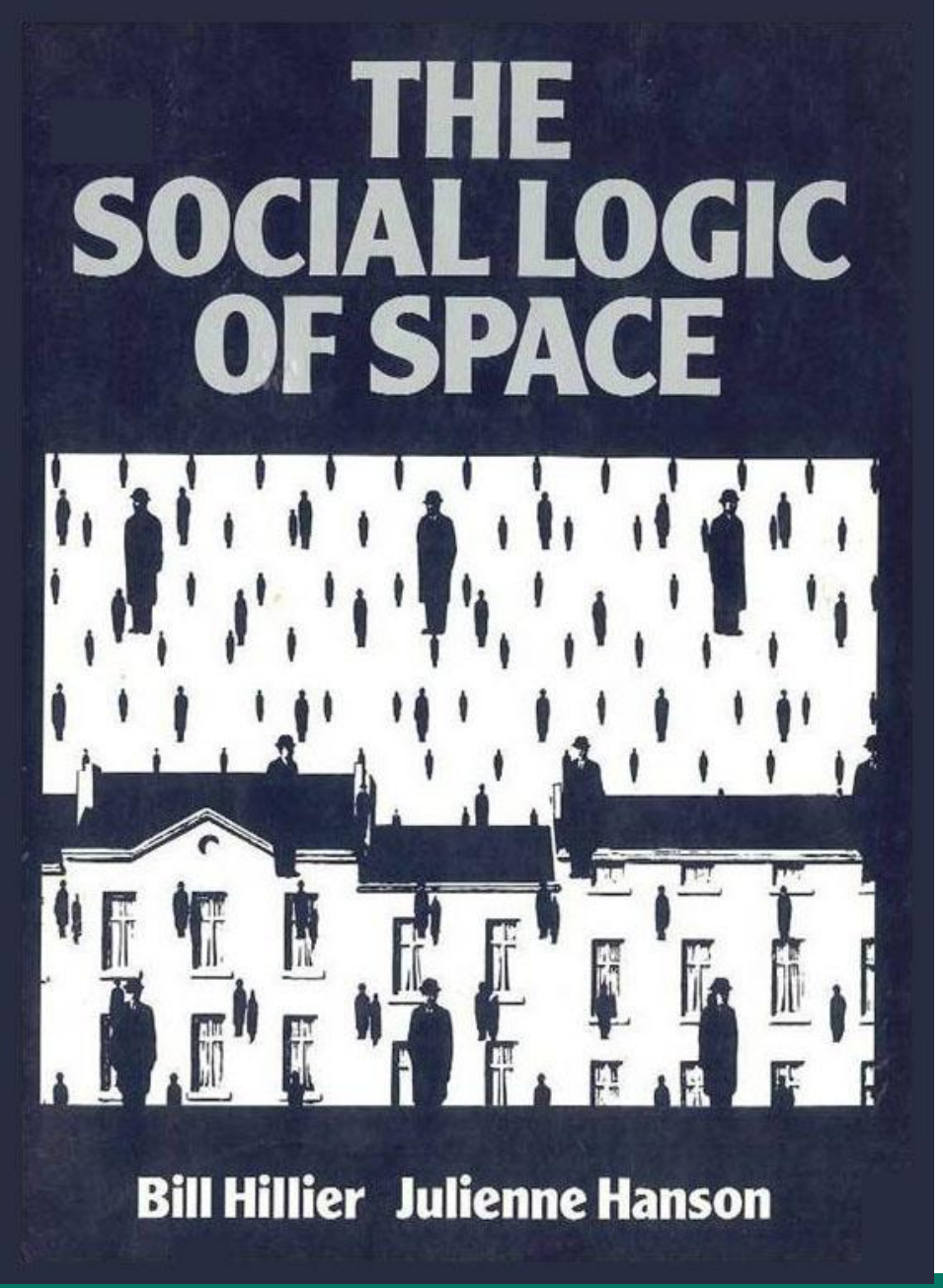

- Developed in the 1970s by Bill Hillier, Julienne Hanson and colleagues at UCL.
- Originally to understand the failure of modernist council estates.
- More generally to understand and simulate the social effects of design.
- Key Publication: *The Social Logic of Space*, 1984.

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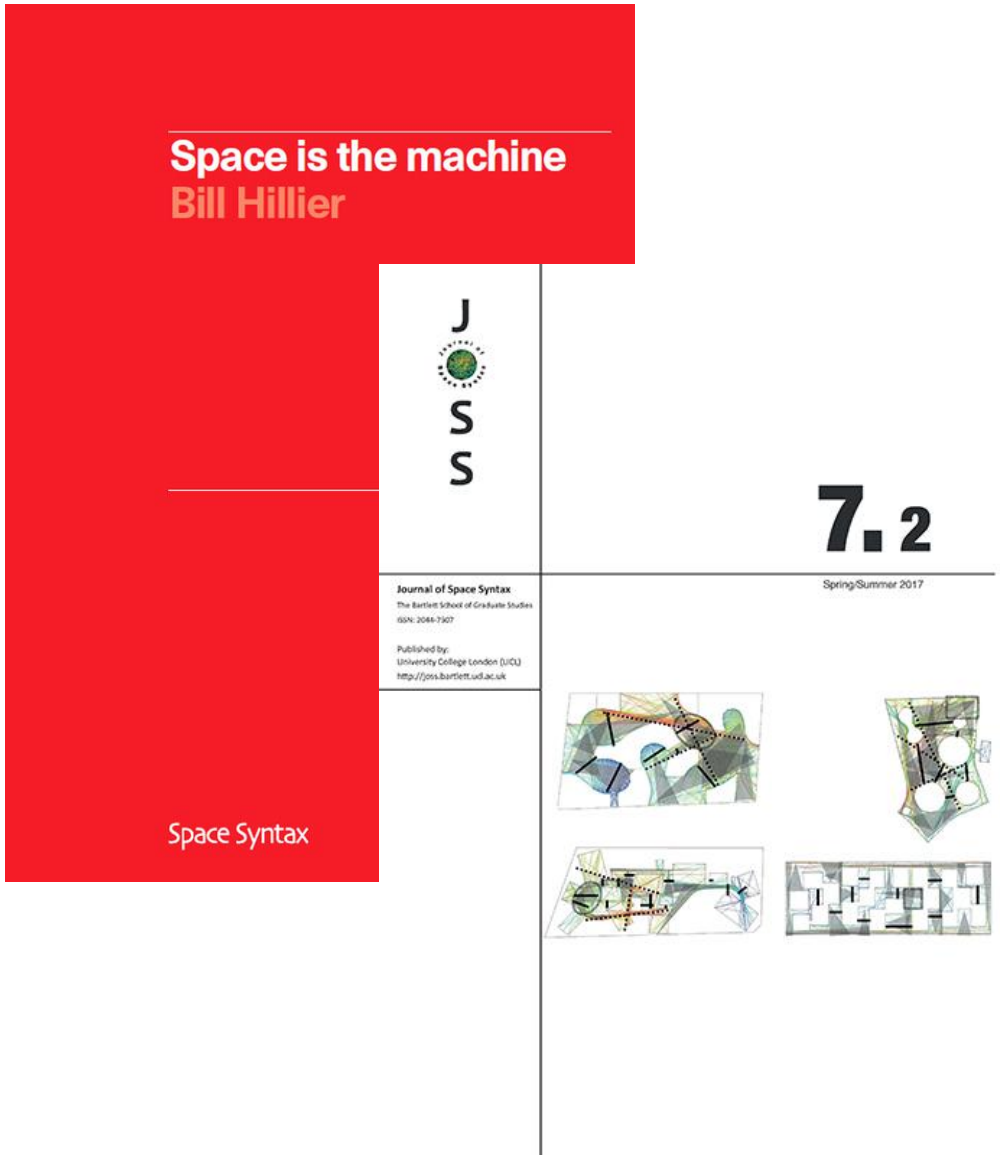

- Publication of *Space is The Machine*, 1996.
- Bi-annual Space Syntax Symposia started in 1997.
- Publication of Journal of Space Syntax (JOSS) started in 2010.
- Now used by hundreds of universities and practices worldwide.
- Variety of research applications.

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Section 1: Theoretical framework

Space syntax basics

Space syntax is both a theory and a method for quantitatively describing patterns of spatial layout and relating these patterns to social activities such as movement, behaviour, and even social meaning and interpretation.

Movement is a linear process, during which visual information changes from point to point.

Interaction and **inhabitation** require convex spaces in which all points can see all others.

The network of spaces in a system is termed **configuration** and by analysing mathematically these relationships of spatial layouts it is possible to develop an understanding of space independent of architectural type and style.

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Useful space syntax terms

Spatial Configuration: The relationship of one space to all the other spaces in a system.

Graph theory: A graph is a collection of nodes connected by edges to create pairwise relations between them.

Space Syntax: The space i**n between the buildings** in cities or the organization of space *within* buildings

In language, syntax refers to the (limited set of) ways in which words can be arranged to create meaning – underlying rules for the **arrangement of elements** - different from semantics

Here, this term refers to a set of **underlying principles of spatial arrangement** that we experience subconsciously as we move around cities. These are based on the *network properties* of urban space – or what Bill Hillier and colleagues called 'spatial configuration' (the relationship of each space to all the other spaces in a given system)

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Space syntax propositions

1. space is not a background to human activity but is **intrinsic** to it.

2. space is first and foremost **configurational**. In other words, what happens in any individual space – a room, corridor, street or public space – is fundamentally influenced by the relationships between that space and the network of spaces to which it is connected.

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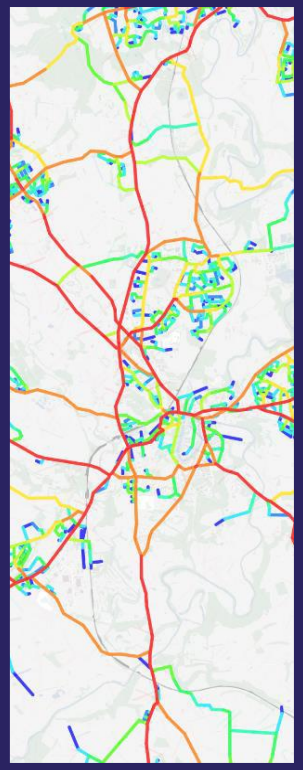
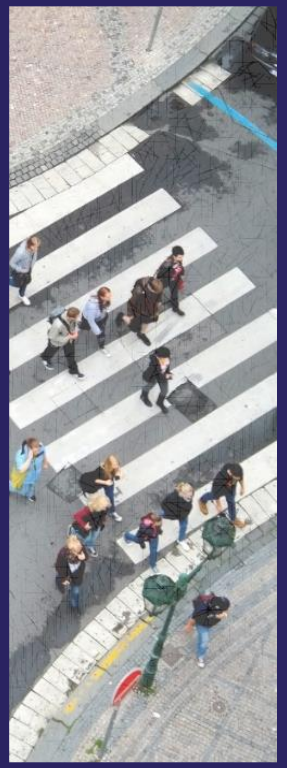
Key relationships

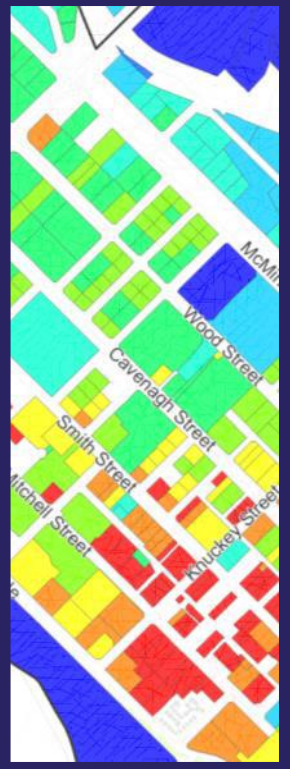


Urban form



Movement

Land use



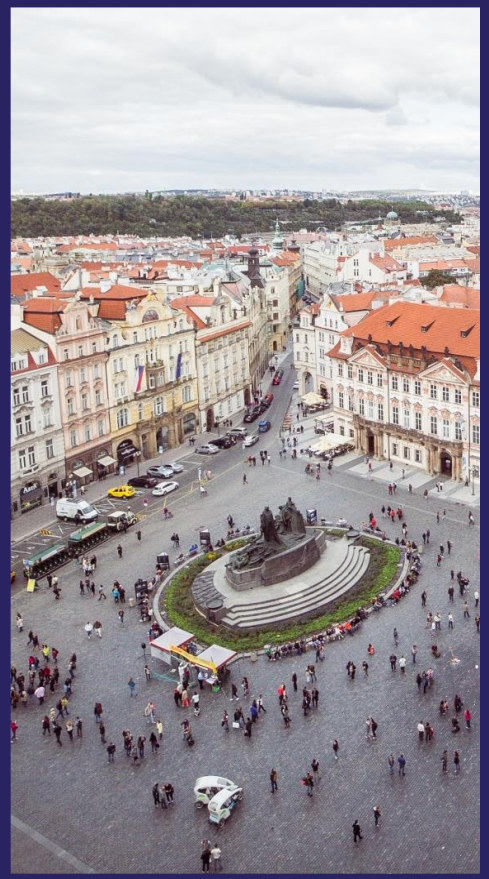
Economy

Crime

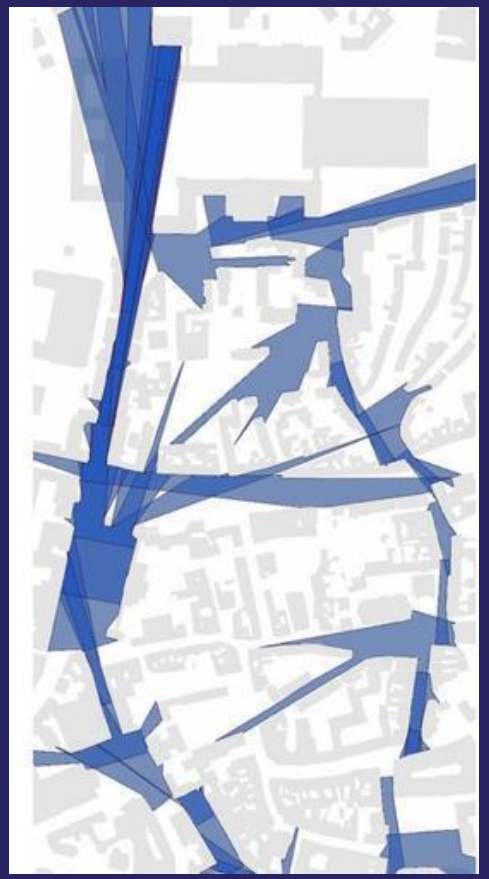
Sustainability

How space influences human behaviour

Move along lines



Interact in convex spaces



Perceive changes in visual fields as they move

Space syntax concepts

1. **dual grid** and the **generic city** – how the foreground and background street network interrelate.

2. **natural movement** – how urban space shapes flows.

3. **movement economy** – how land uses exploit movement.

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Principle 1: The Generic City

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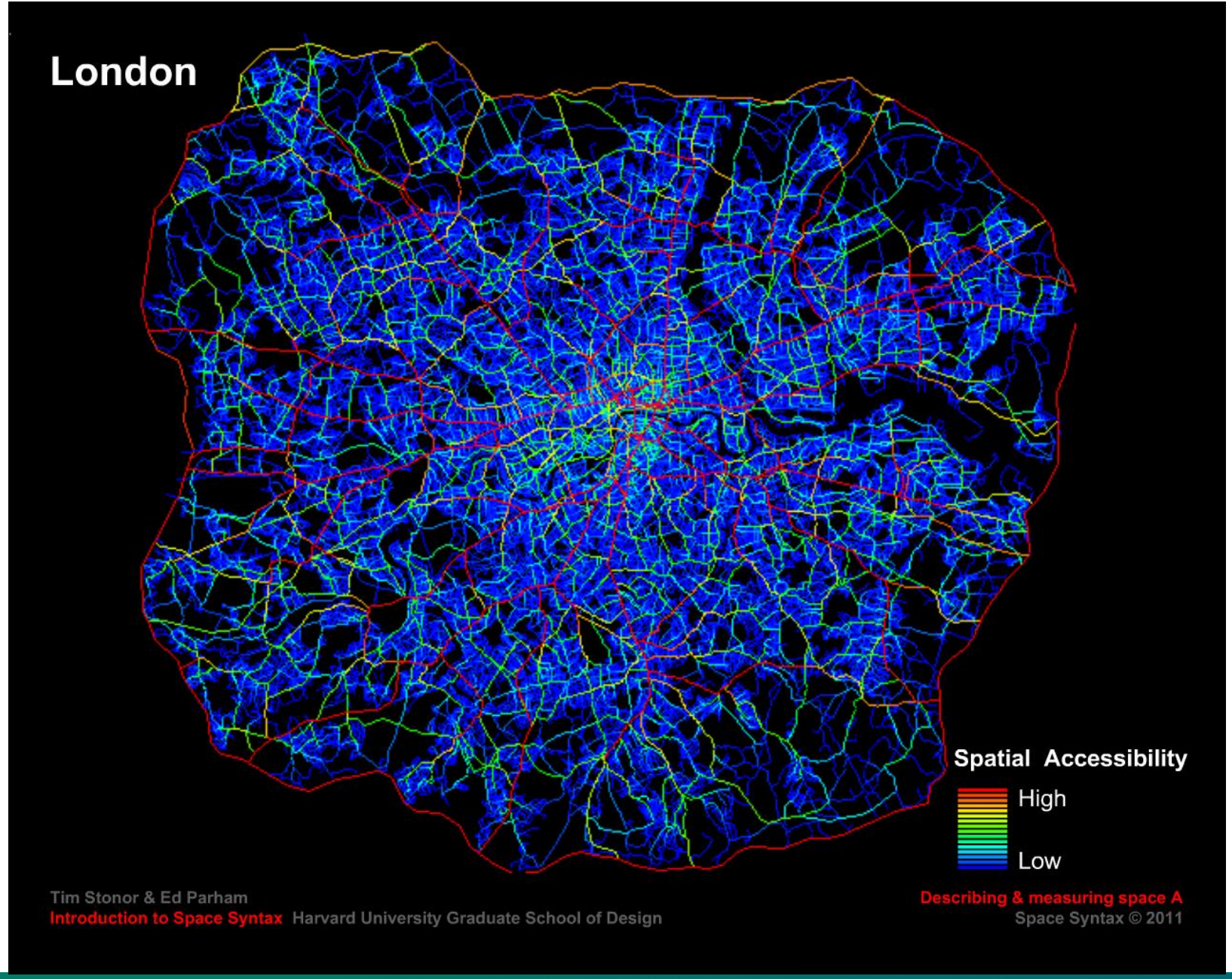
Google Earth



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Google Earth
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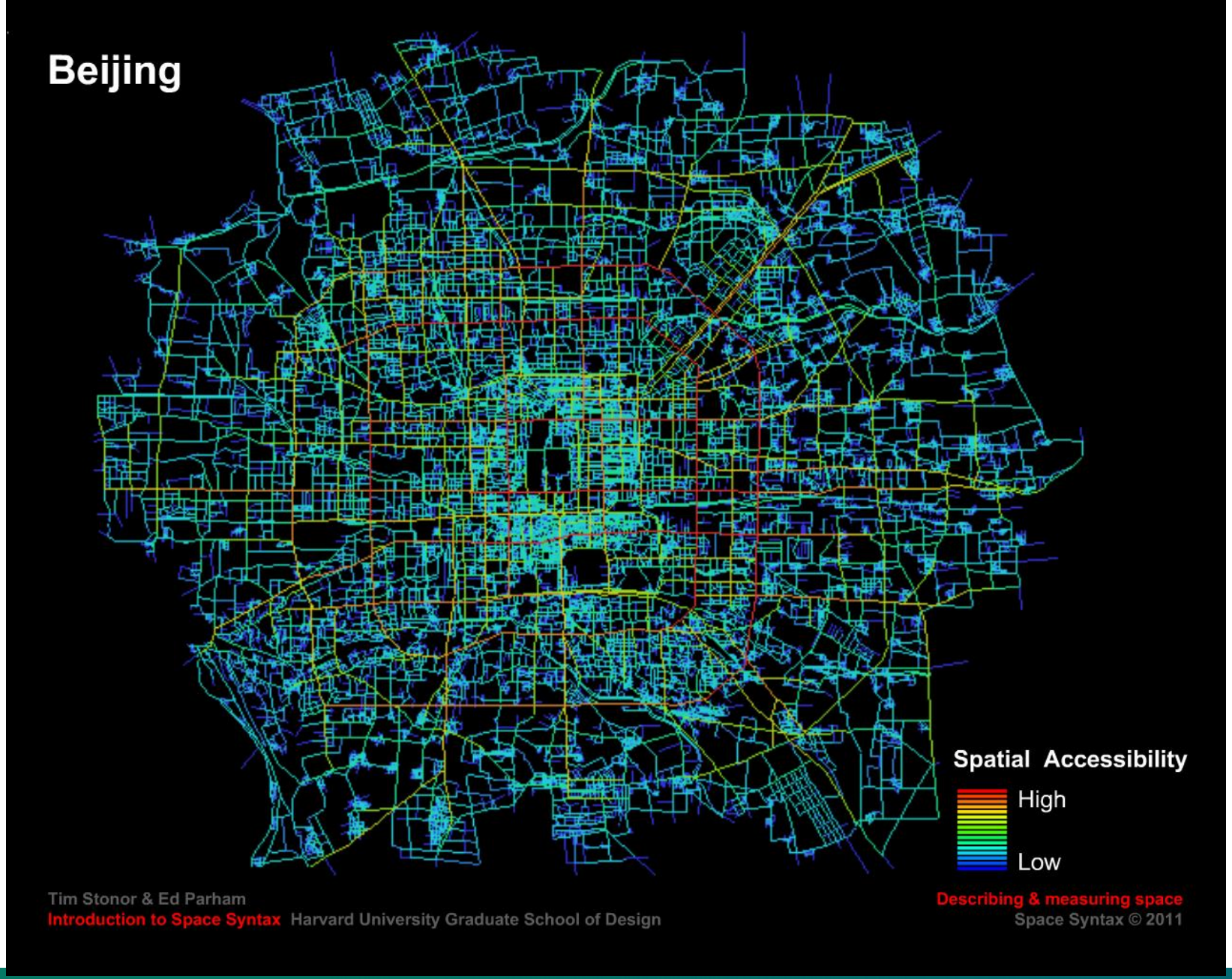

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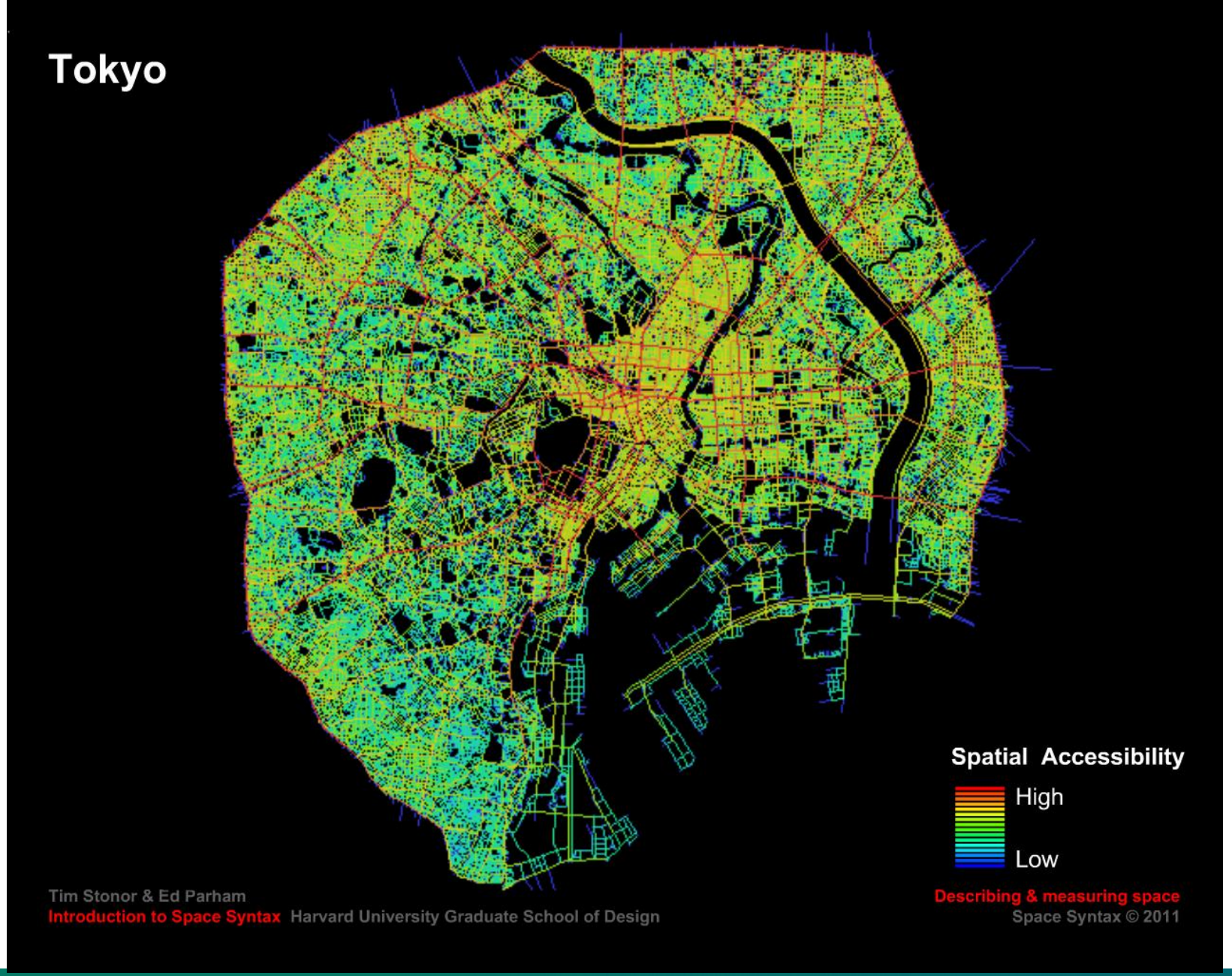

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The **generic city** is a theoretical proposition that there is a universal city with many spatial and functional invariants across cultures.

All cities are comprised of a very small number of long lines and a very large number of short lines, and these constitute a dual system made up of **foreground and background** networks with different geometries.

The **foreground network takes** a more or less universal form (deformed wheel) of a network of linked centres at different scales, and has emerged to maximise grid-induced movement, driven by micro-economic activity.

The **background network** is largely residential and is configured to restrain and structure movement in the image of a particular culture, and so tends to be culturally idiosyncratic, often expressed through a different geometry and this makes the city as a whole look spatially different.

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Principle 2: Natural Movement

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Movement is a linear process, during which visual information changes from point to point.

[Space syntax] *mapping intended to represent what can be seen and experienced by a human within a space… implicitly includes the relation between humans and physical form* (Kropf, 2009).

Evidence from cognitive science and from the analysis of aggregated urban flow data show that geometric and topological factors are involved in navigation (far more than metric properties).

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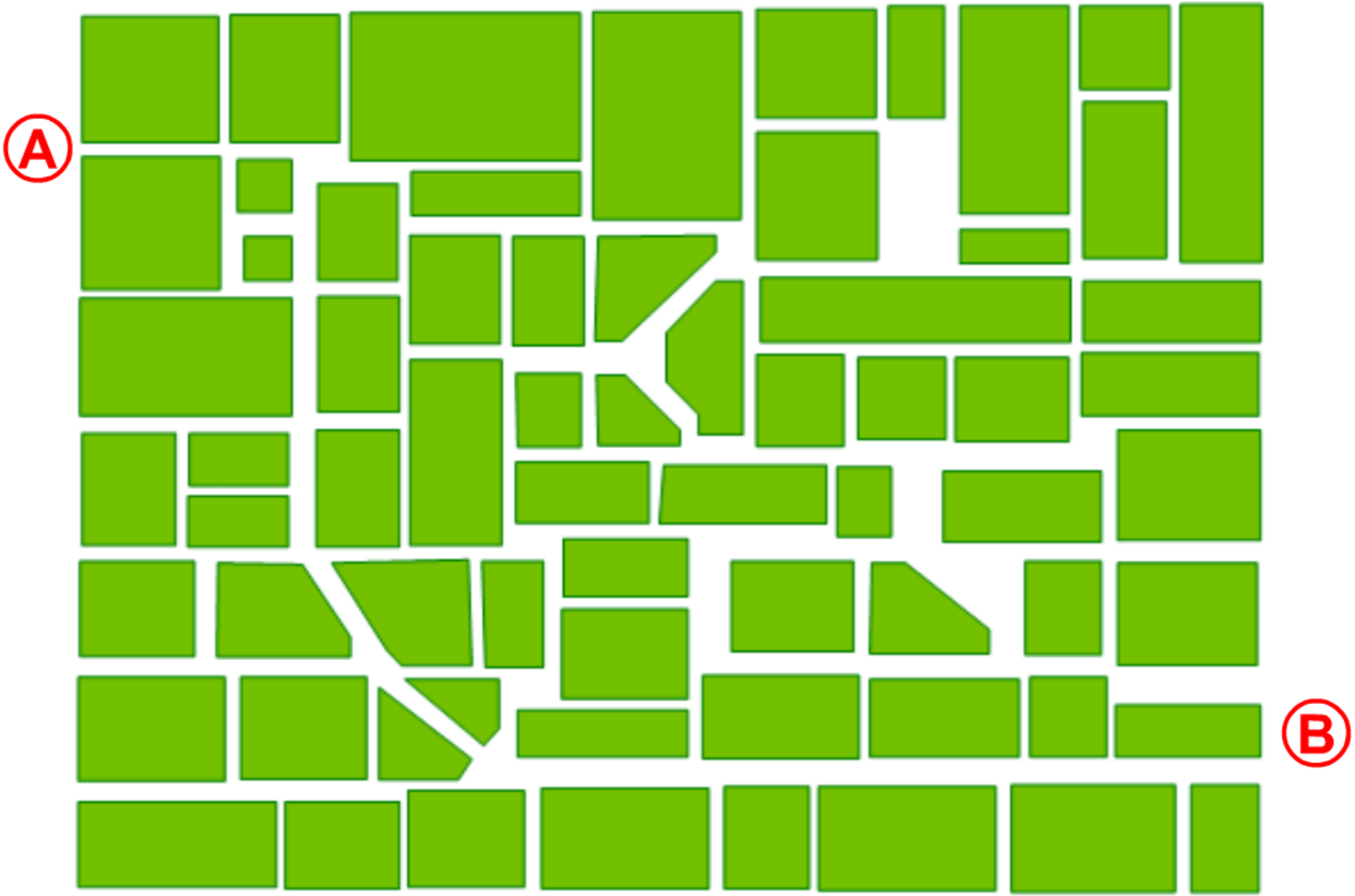
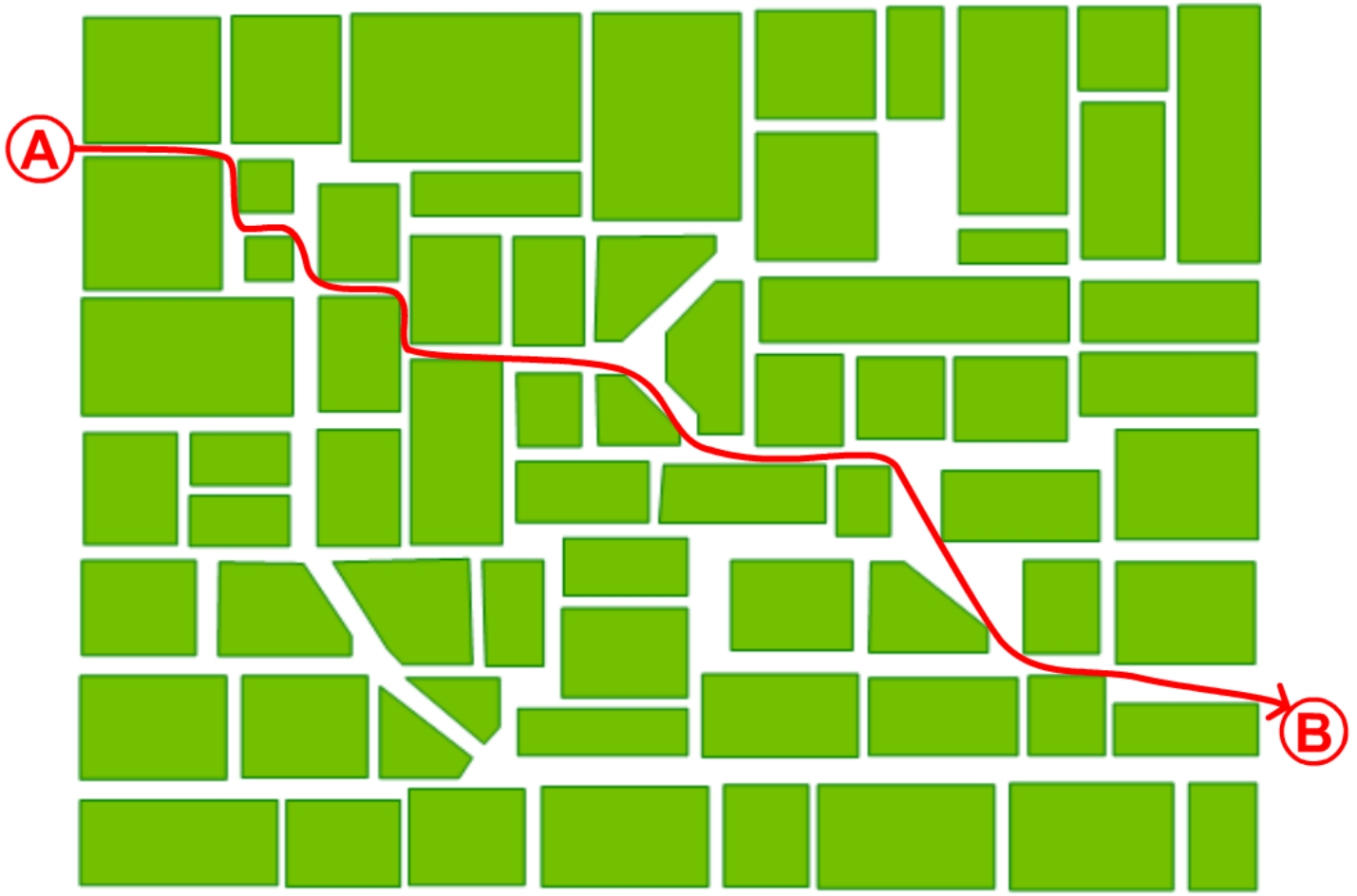
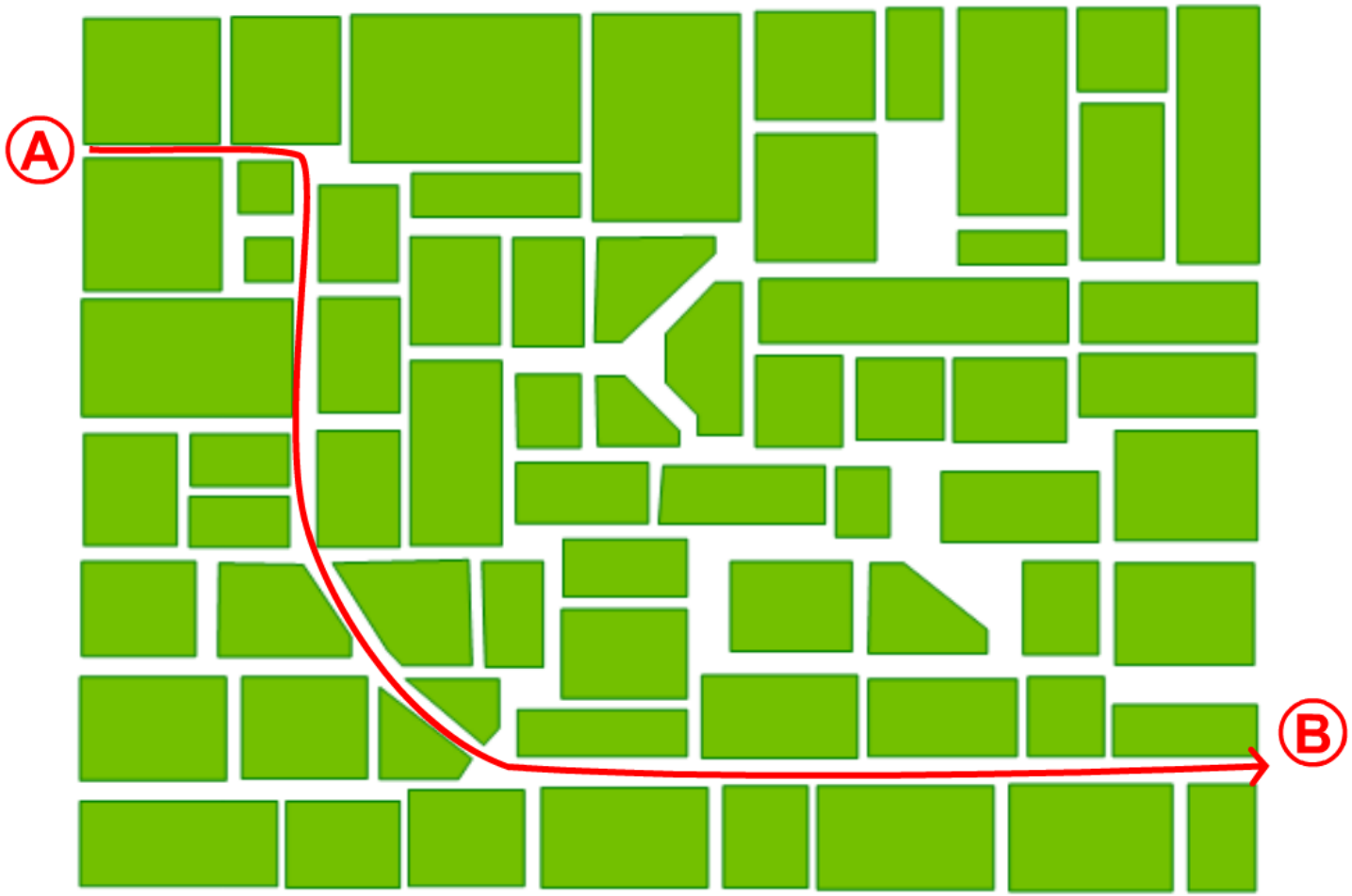
Exercise 2



Shortest path/least metric distance?



Simplest path/least angle change?



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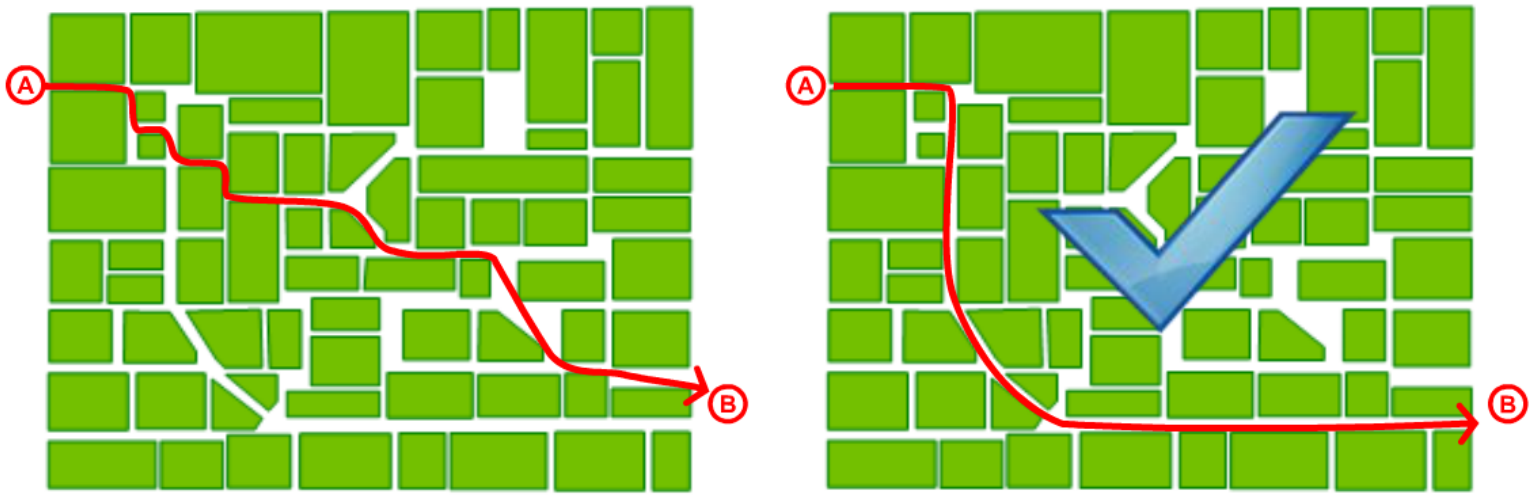
Most people prefer simplest paths



Observation studies show that most people prefer simple, more direct paths over complex, indirect paths – even if the complex path is shorter.

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A desire path - an unofficial shortcut - in a park in Tunbridge Wells. Photograph: Alamy

Michigan State University didn't put in pavements when new buildings were created. Instead, it waited for students to create their own paths. Photograph: USGS © 2011 Microsoft Corporation

Natural movement is the proportion of urban pedestrian movement determined by the grid configuration itself.

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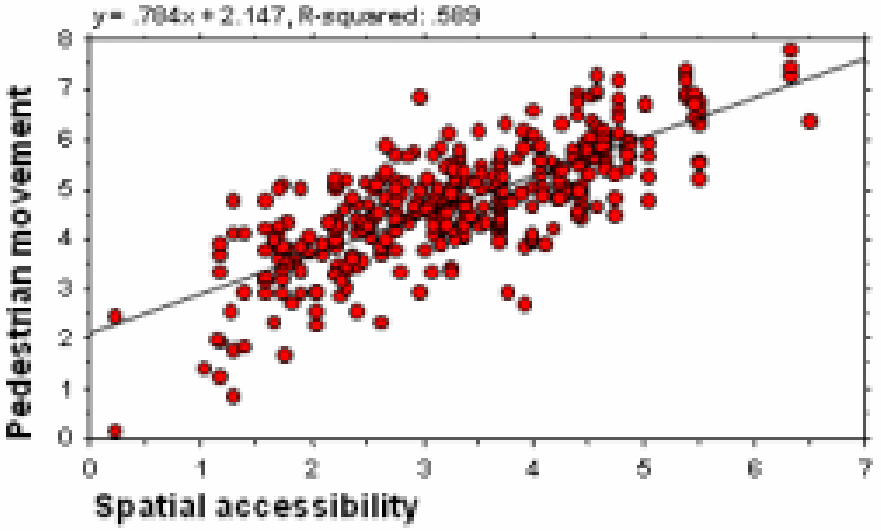
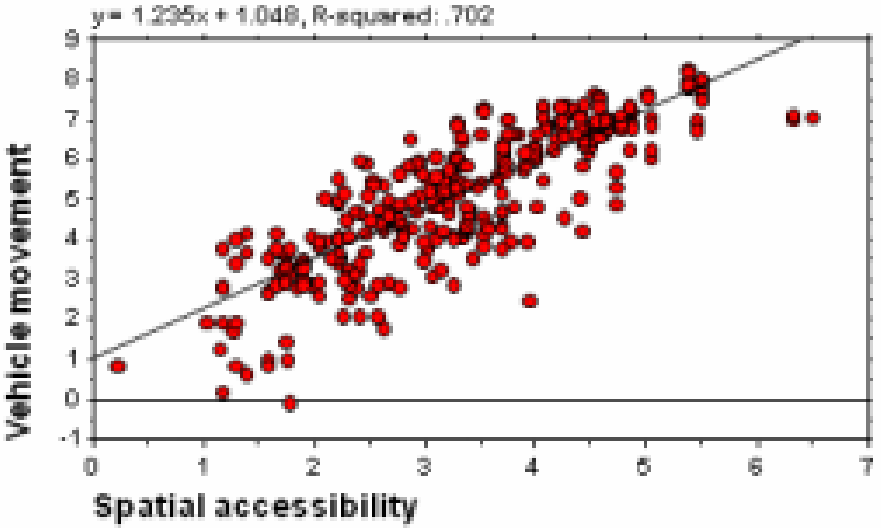
Key discovery #1 Spatial layout organises movement





Research shows that **60-80%** of movement flows are due to the structure of the network, measured by spatial accessibility.

More accessible places get more movement

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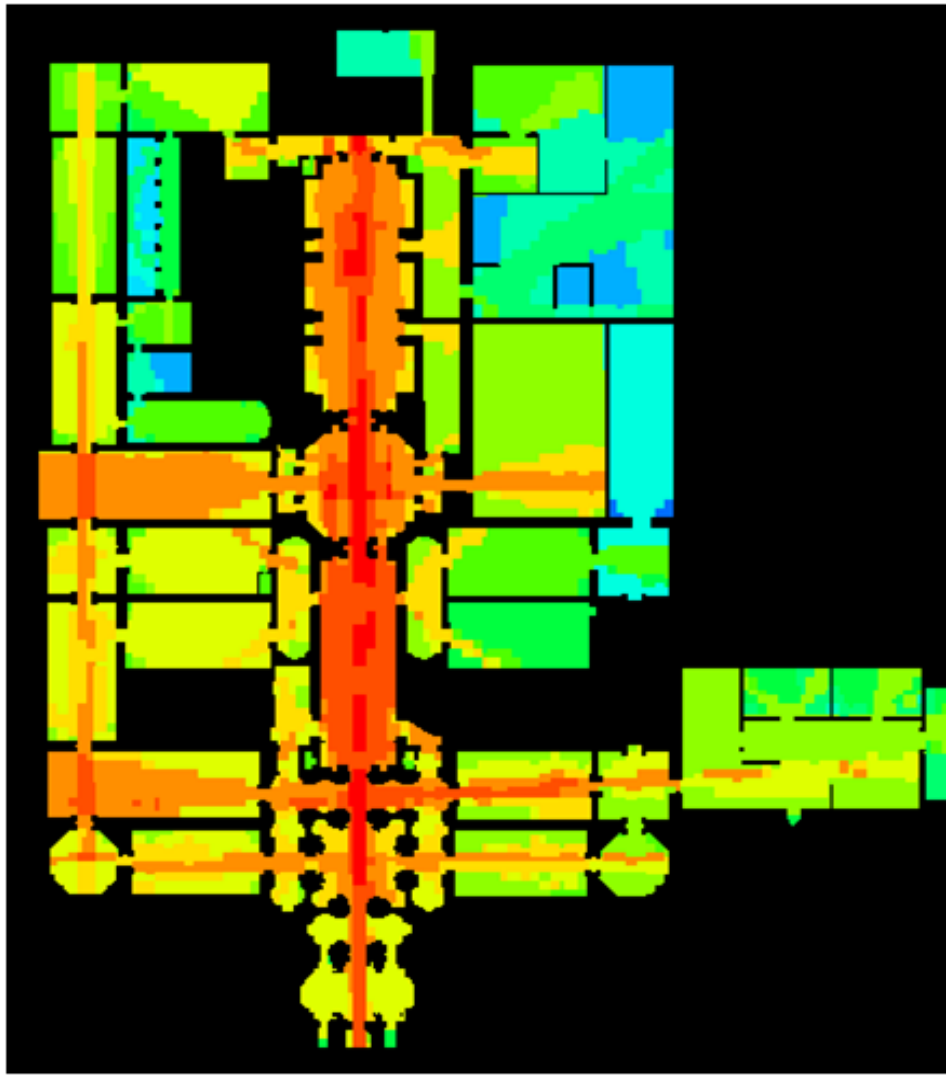

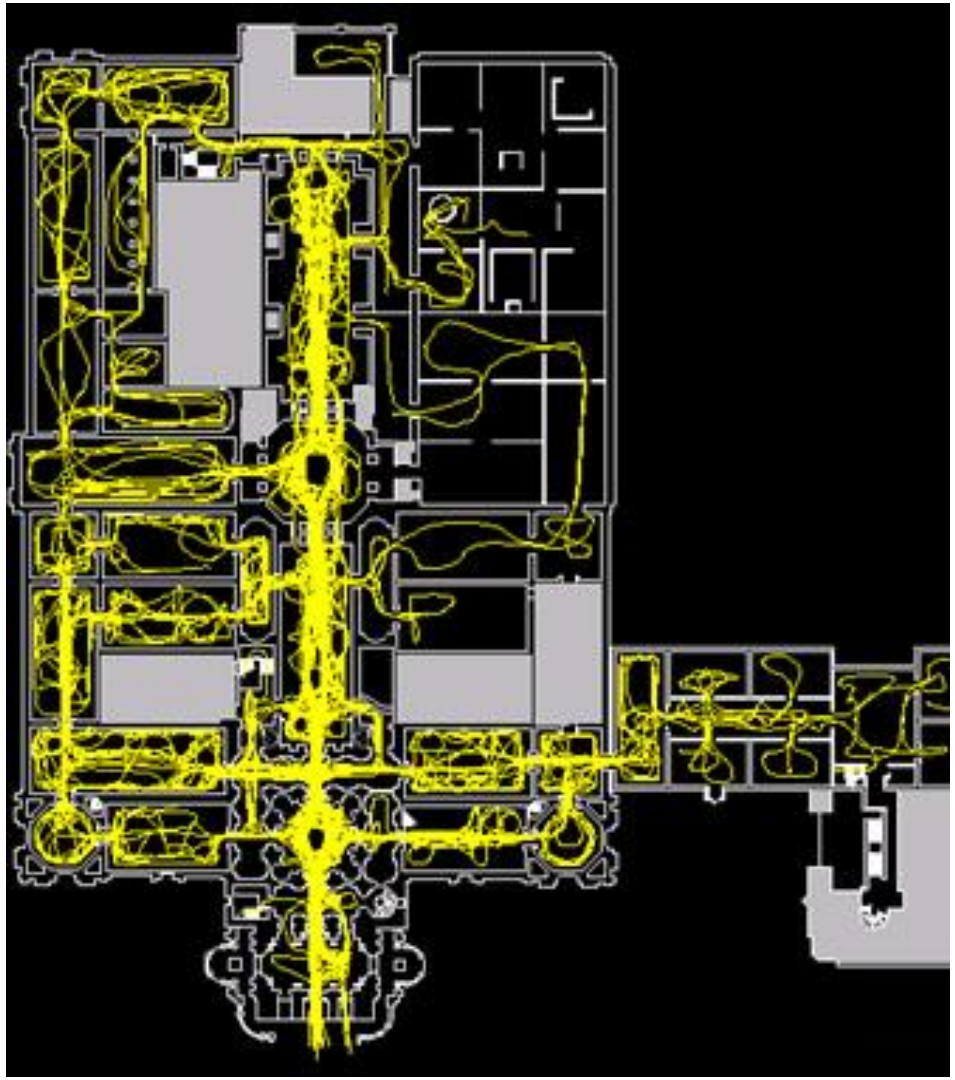

Tate Gallery's visual integration pattern and movement flows - From Space Syntax Online Training Platform

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Principle 3: The Movement Economy

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The theory of the **movement economy**, built on the notion of natural movement, proposes that evolving space organisation in settlements first generates the distribution pattern of busier and quieter movement pattern flows, which then influence land use choices, and these in turn generate multiplier effects on movement with further feedback on land use choices and the local grid as it adapts itself to more intensive development.

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Spatial relations

Relationships between spatial elements result from their **configuration**. These relationships can be objectively analysed using various measures, included among which are **integration** and **choice**.

These two measures reflect the two fundamental elements in human movement: firstly**, the selection of a destination**, and secondly, **the selection of a route**. One measures the ease of access (integration) and the other measures the passing flow (choice).

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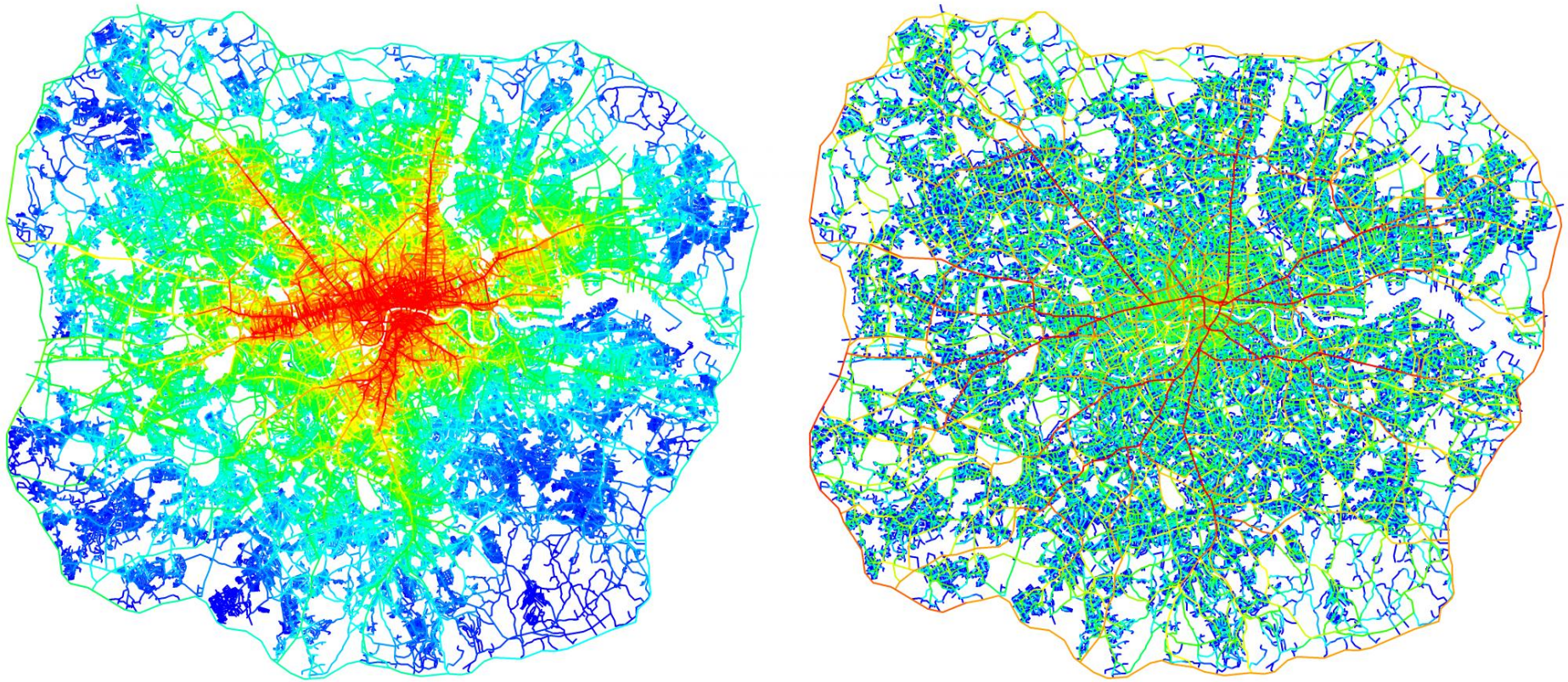

London’s Global Integration pattern (left) and Global Choice pattern (right)

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Centrality as a process is a theory which proposes that urban centres are the outcome of a long-term historical process of the formation and location of centres.

This process entails the configuration of the street network shaping movement flows patterns, which subsequently have an impact on the distribution of land uses to form the busier and quieter areas of the network and the subsequent influence this has on land use choices, and the development of the area as an attractor in the settlement layout as a whole.

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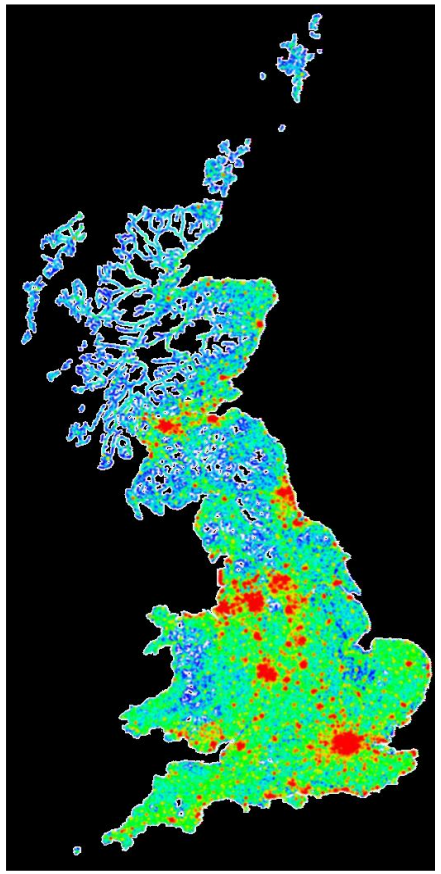
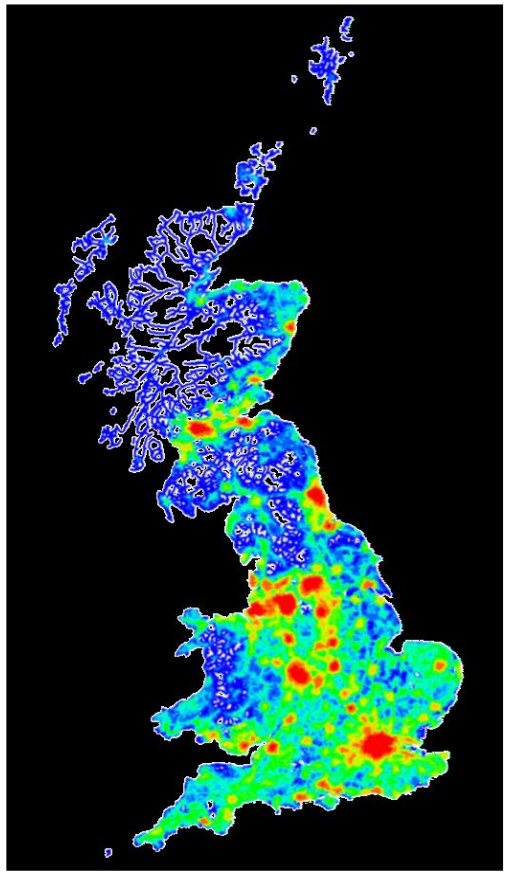
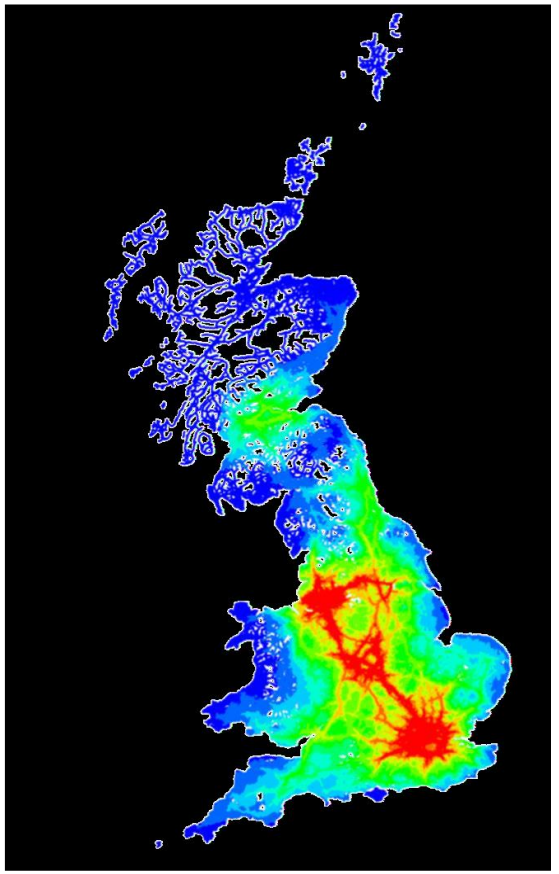
Scales of Movement



Local movement 2 km



Citywide movement
10 km



Country-wide
movement 100 km

What have we learnt

Integration is a normalised measure of distance from any a space of origin to all others in a system. In general, it calculates how many spaces are around the origin space and also how close the origin space is to all other spaces and can be seen as the measure of centrality. In cities, spaces with high integration are where commercial centres are mostly found.

To-movement Potential refers to the movement to a space as a destination from all others. The measure of Integration is said to predict to-movement.

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What have we learnt

Choice is calculated by counting the number of times each street segment falls on the shortest path between all pairs of segments within a selected distance (termed ‘radius’).

Through-movement Potential refers to the movement passing through on shortest routes from all points to all other points in the layout. The ‘shortest path’ refers to the path of least angular deviation (namely, the straightest route) through the system. The measure of Choice is said to predict through-movement.

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thank you!

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