

Spatial Signatures

*Understanding (urban) spaces
through form and function*

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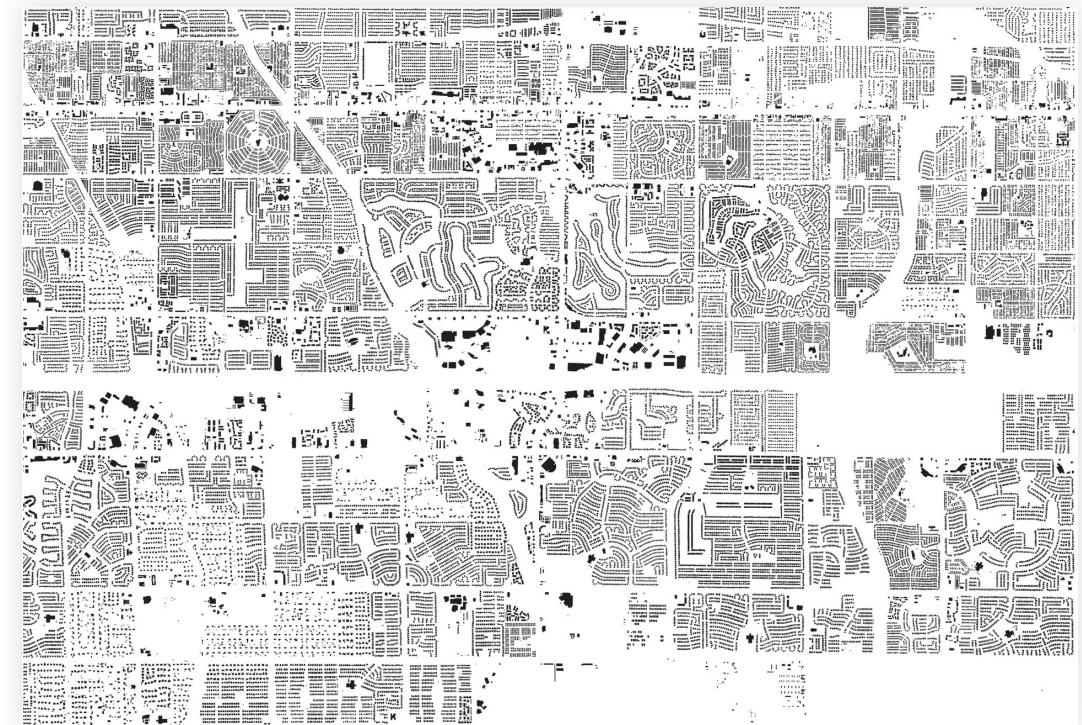
The
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Geographic
Data Science
Lab

“The point”

How we arrange “stuff” in cities matters...



Source: *A map of every building in America* (New York Times)

... it matters *a lot*

Journal of Urban Economics 111 (2019) 93–107
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The economic effects of density: A synthesis[☆]
Gabriel M. Ahlfeldt^{a,1,*}, Elisabetta Pietrostefani^b
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Cities in Bad Shape: Urban Geometry in India - American Economic Association — Mozilla Firefox

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Cities in Bad Shape: Urban Geometry in India

Mariaflavia Harari

AMERICAN ECONOMIC REVIEW
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ARTICLE
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Environmental Science & Technology

Effects of Income and Urban Form on Urban NO₂: Global Evidence from Satellites
Matthew J. Bechle,[†] Dylan B. Millet,^{†,‡} and Julian D. Marshall^{*,†}
[†]Department of Civil Engineering, University of Minnesota, Minneapolis, Minnesota 55455, United States
[‡]Department of Soil, Water, and Climate, University of Minnesota, Minneapolis, Minnesota 55455, United States

Living with beauty: report of the Building Better, Building Beautiful Commission

Independent report on how to promote and increase the use of high-quality design for new build homes and neighbourhoods.

From: Ministry of Housing, Communities & Local Government
Published: 30 January 2020

Applies to: England

Related content
[Creating space for beauty: interim report of the Building Better, Building Beautiful Commission](#)

Rethinking Urban Sprawl MOVING TOWARDS SUSTAINABLE CITIES



OECD

NEW URBAN AGENDA

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Form

What does it look like?

“Physical structure and appearance of cities”

Qualitative, quant. case studies, morphometrics,
remotely sensed

Function

What is it used for?

“Activities that take place within an environment”

Geography, Economics, Sociology, Environmental Sciences, Transport studies...

Form & Function

- Richer picture
- Topography, history, technology, cultural values...
- More robust representations

Opportunities

We don't have good ways of measuring form & function in cities

- Detailed, consistent, scalable: “pick two”
- Fragmented understanding
- Land use/cover - ??? - Geodemographics

Spatial Signatures

*A characterisation of space based on form and function
designed to understand urban environments*

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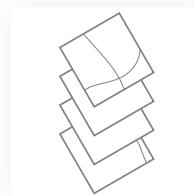
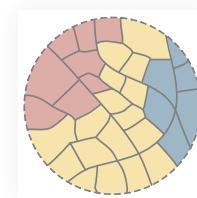
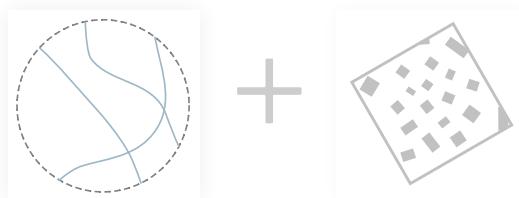
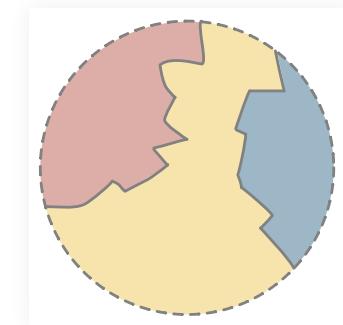
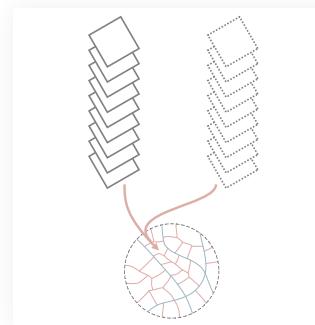
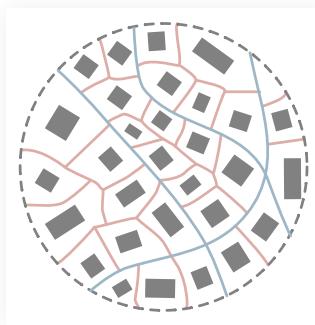
*A characterisation of space based on form and function
designed to understand urban environments*

[STAGE] Barriers Enclosure Morph. Tess. Encl. Tess. Characters Clusters Signatures

Enclosed Tessellation

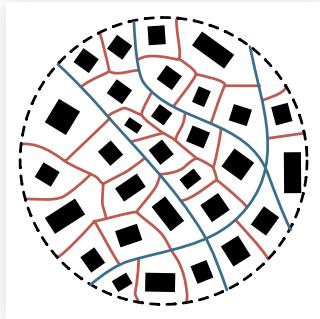
Embedding *form & function*

Spatial Signatures

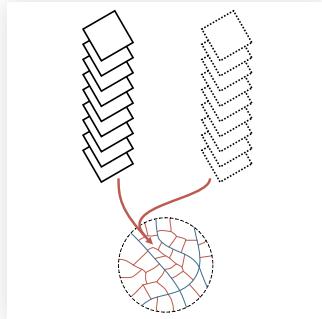


[STAGE] Barriers Enclosure Morph. Tess. Encl. Tess. Characters Clusters Signatures

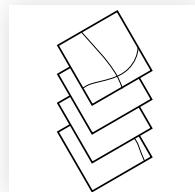
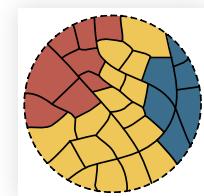
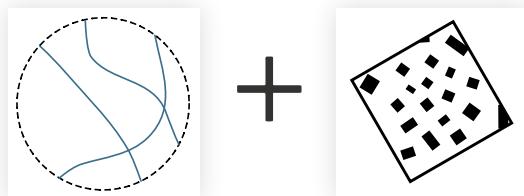
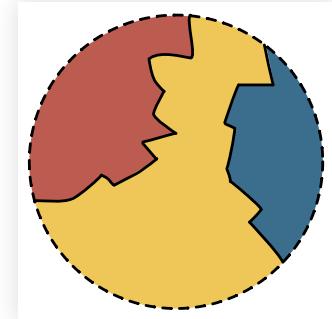
Enclosed Tessellation



Embedding *form & function*



Spatial Signatures



Characters

Form

- Building
- ET cell
- Street segment
- Cell context

Function

- Land use/cover
- Access to uses
- Activity densities

Benefits

- Data-driven & (multidiscipline) theory-informed
- Granular & scalable
- Flexible deployment

Illustration

The Setup

Five *different* cities

- Historical environments
- Geography & culture
- Data landscapes

The Cities

Barcelona

Spain

Dar es
Salaam

Tanzania

Houston

USA

Medellin

Colombia

Singapo

Singapore

The Data

Form

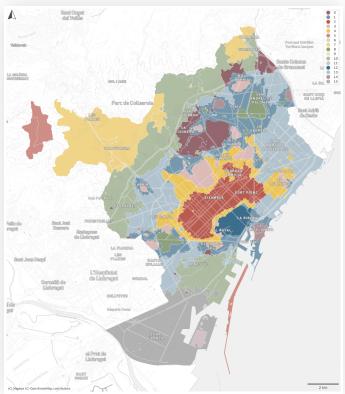
- Local open data
- OpenStreetMap
- Satellite-derived

Function

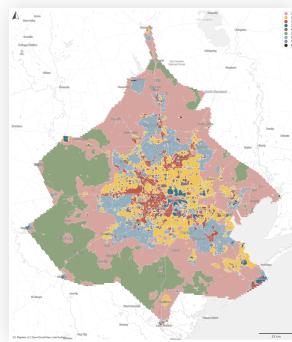
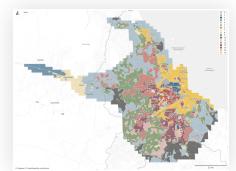
- Local open data
- Land use/cover
- Global grids
- Nightlights

Clustered with K-Means + clustergram

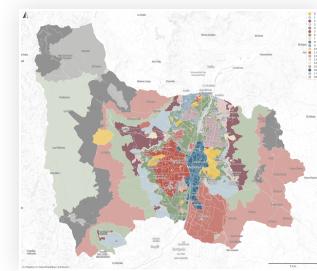
The Signatures



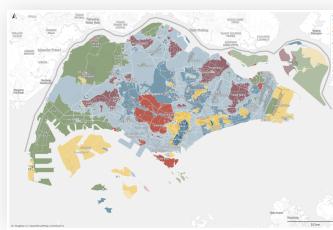
Barcelona
Dar es
Salaam



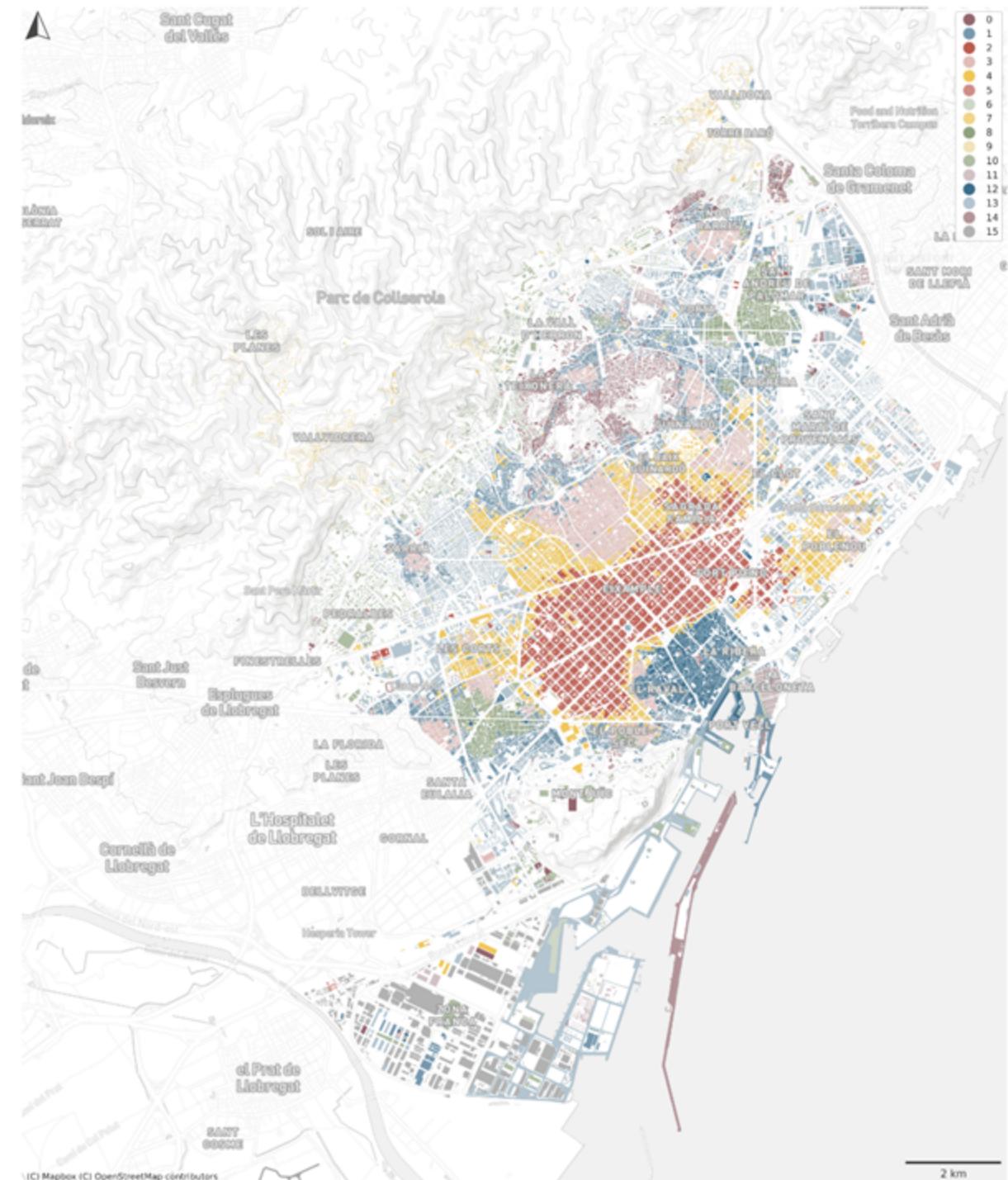
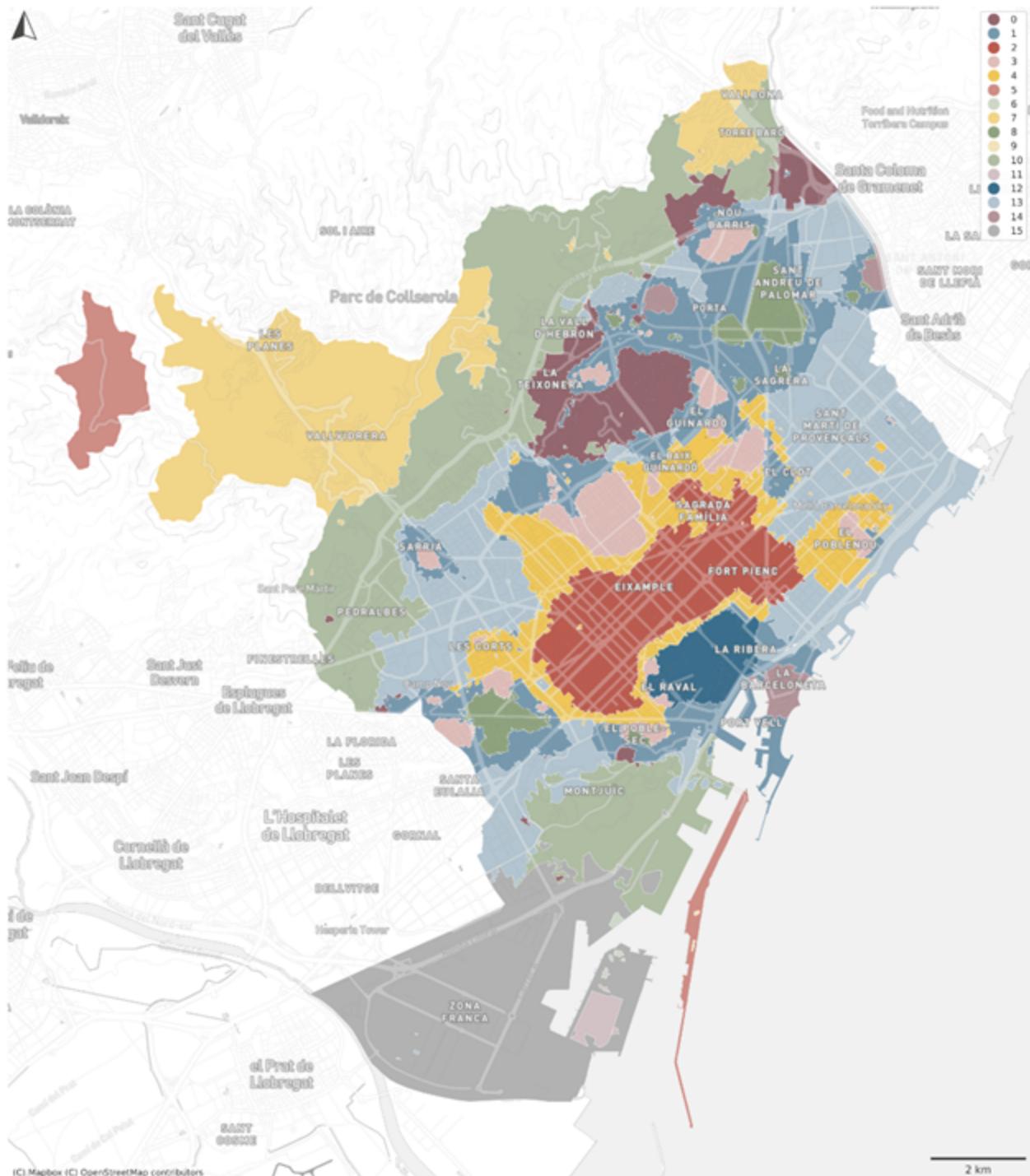
Houston



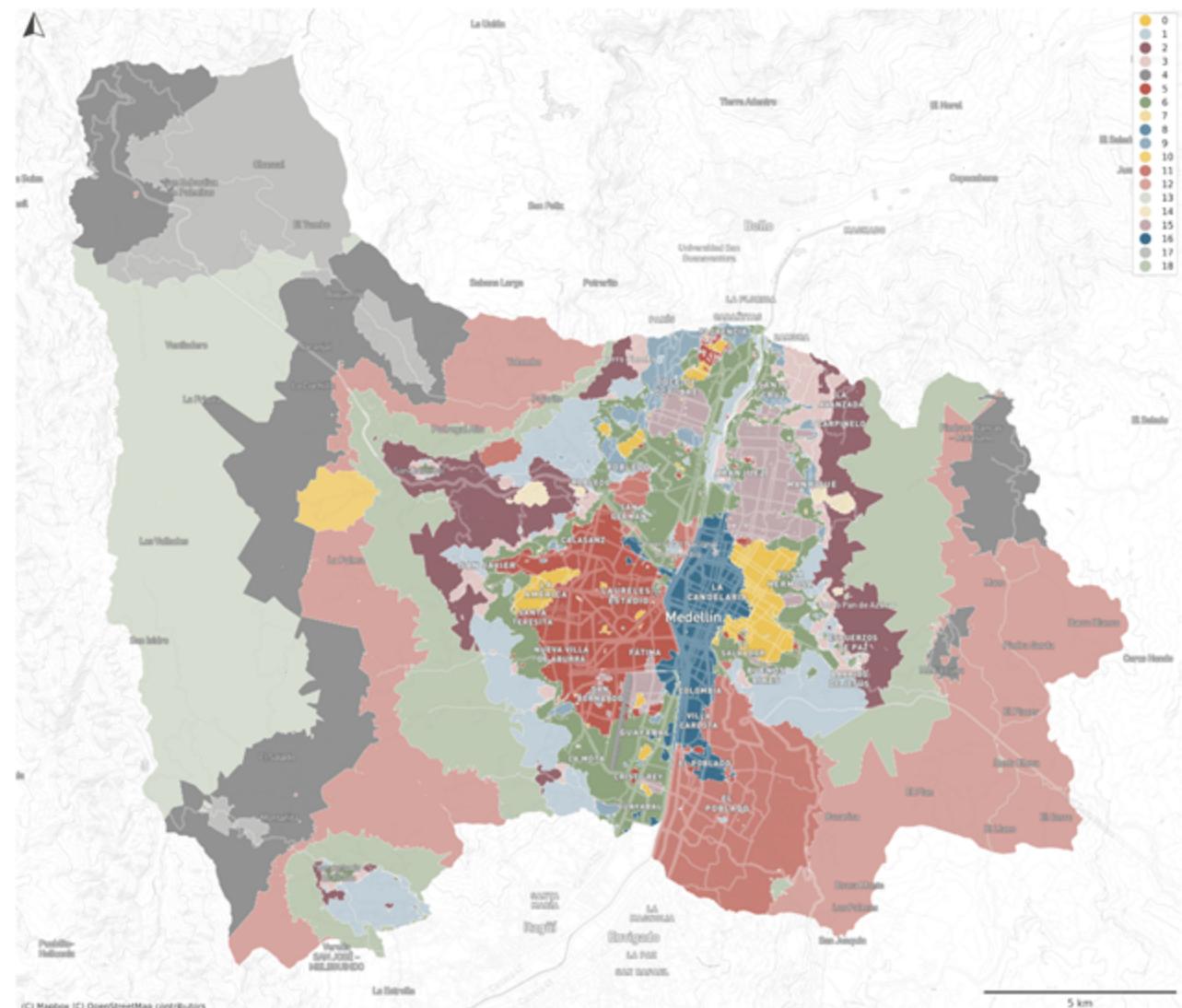
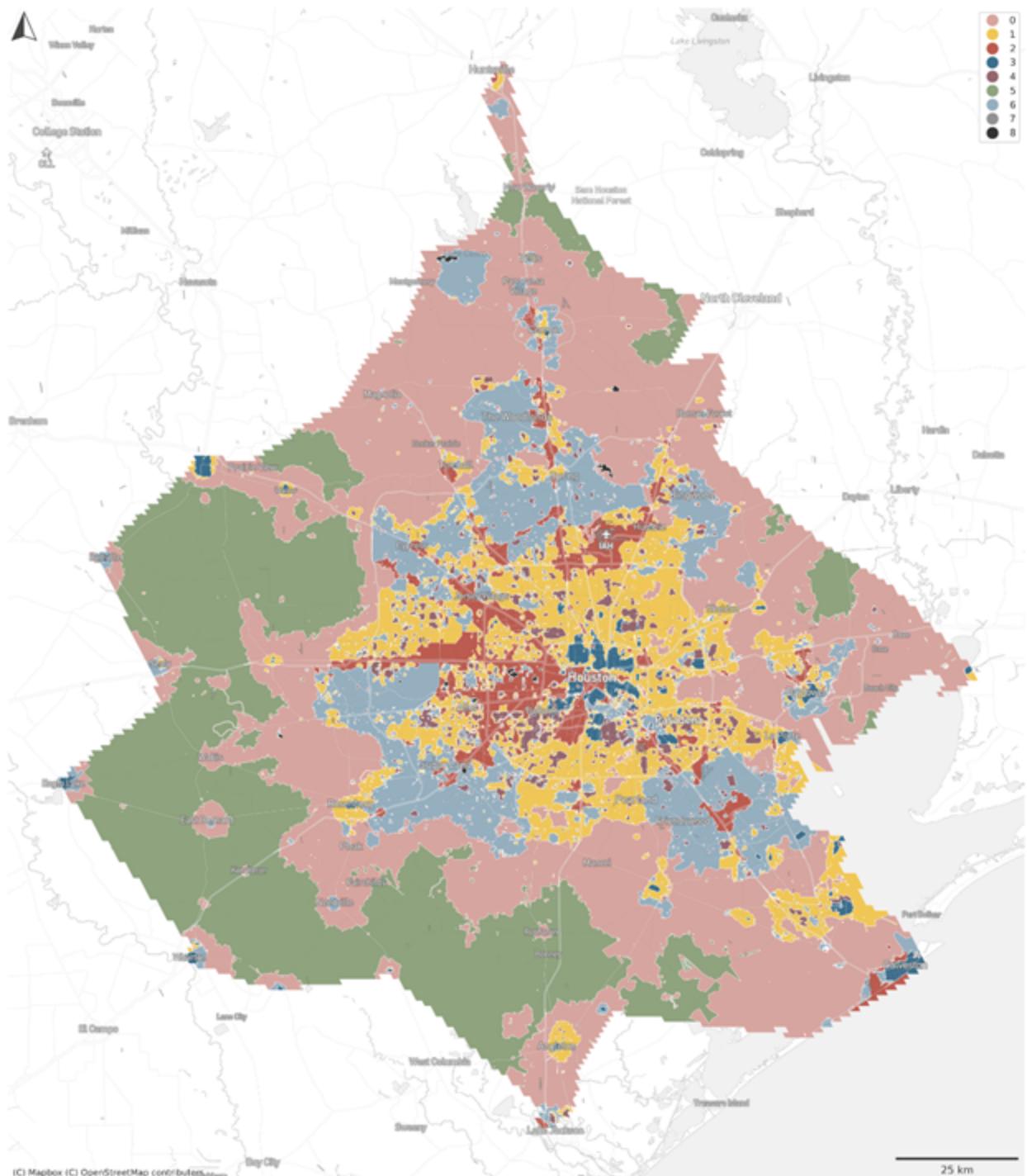
Medellin



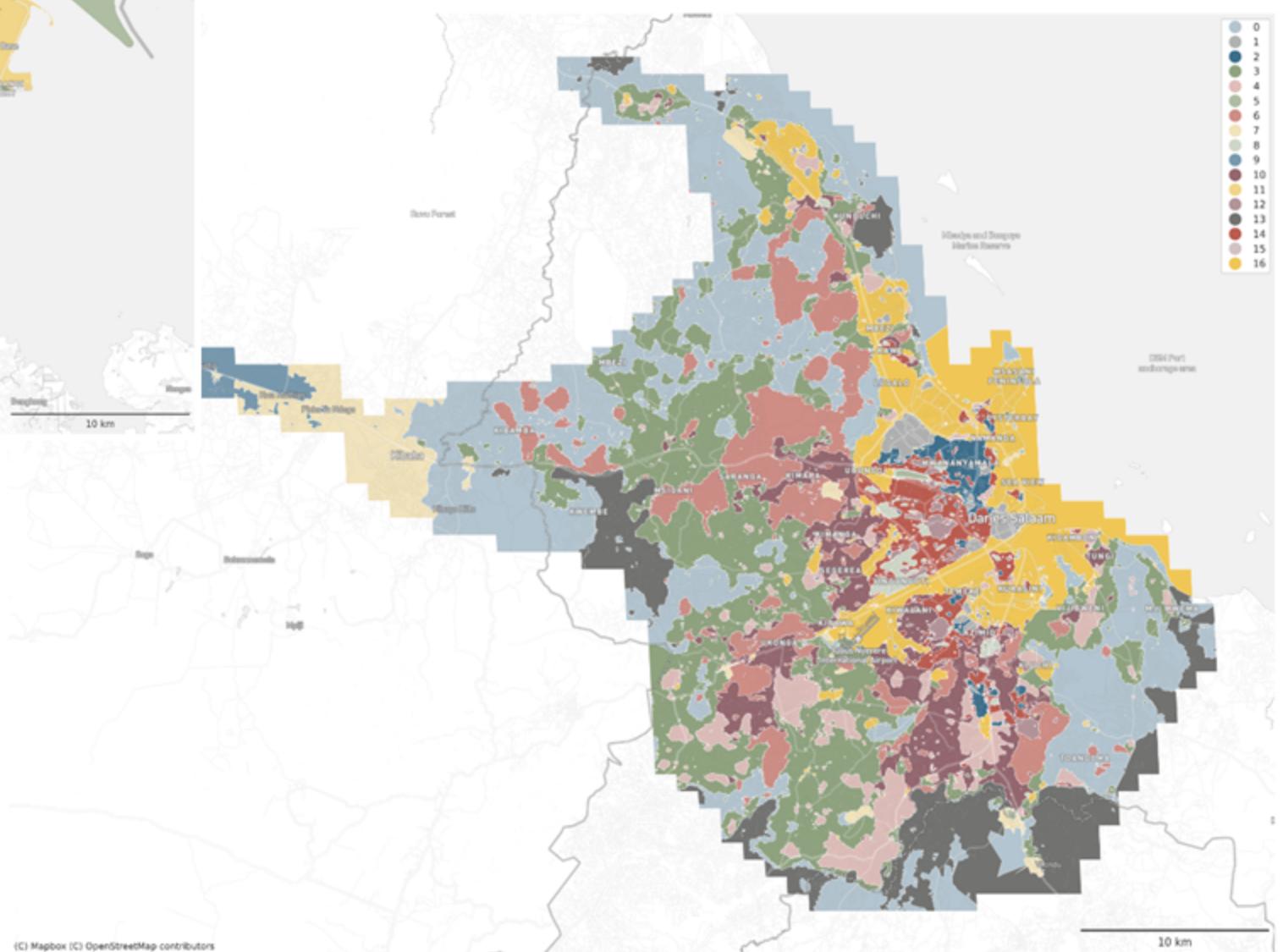
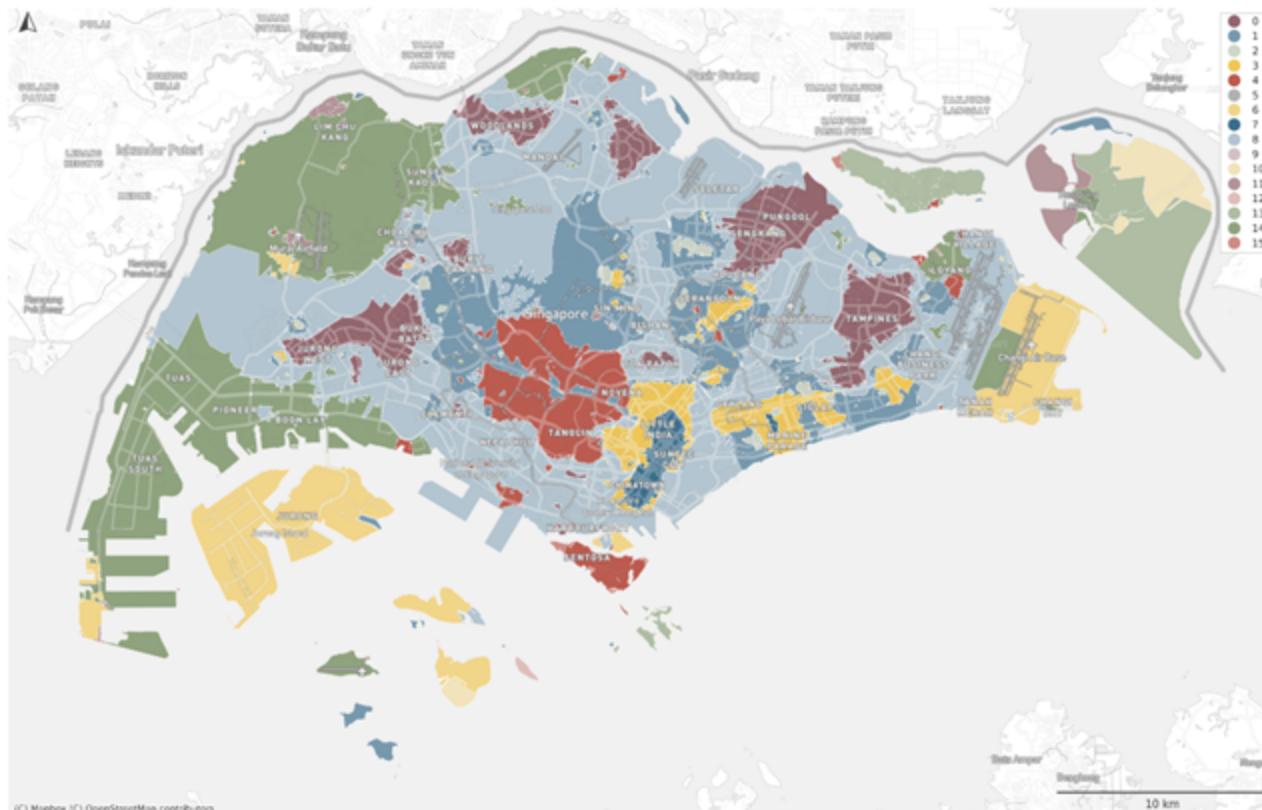
Singapore



Barcelona



Houston | Medellin



Singapore | Dar es Salaam

To take away

1. Urban *form* and *function* matters
2. Spatial Signatures: F&F for cities, in detail, at scale
3. Good measurement → better understanding

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