Bergen Summer Research School: Cities in Climate and Energy Transformations

Urbanisation and Morphology

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Outline

1. Urban form and energy demand

- sustainable urban form
- types of energy demand

2. Defining cities

3. Global urbanisation and morphology

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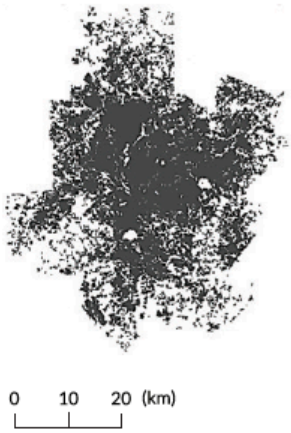
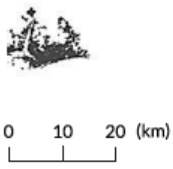
Urban form

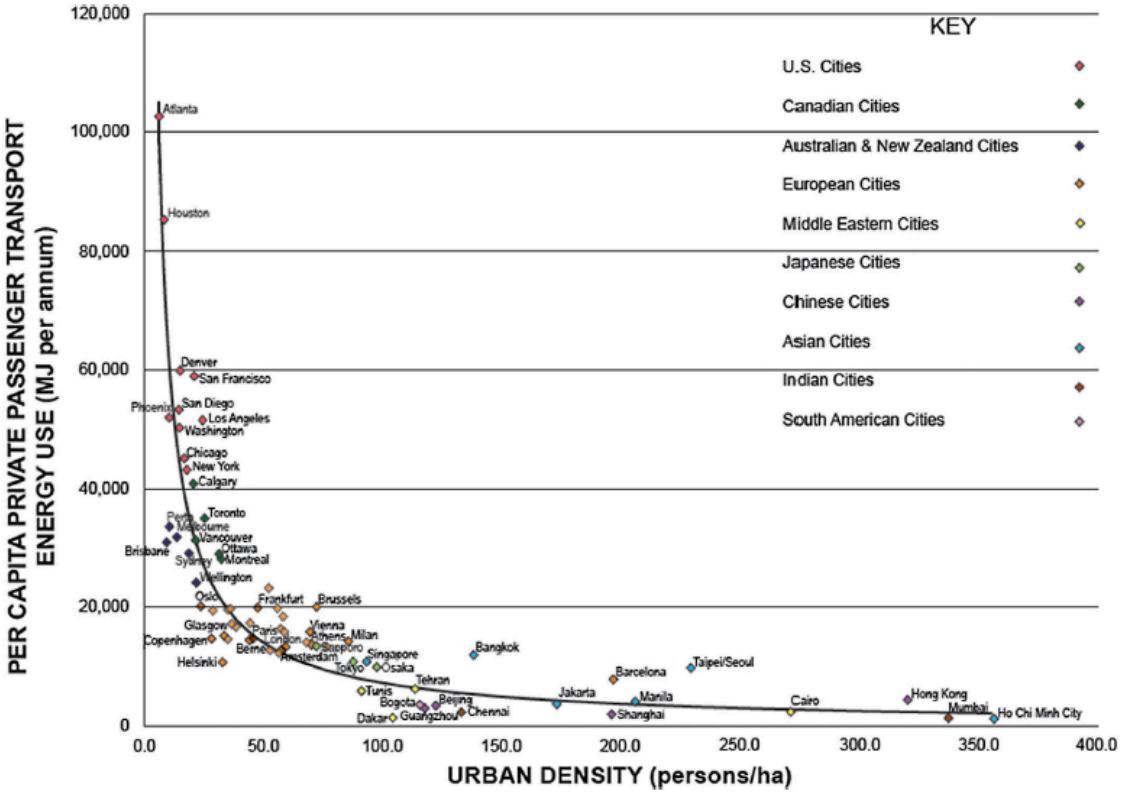




ATLANTA		BARCELONA	
POPULATION:	5.25 MILLION	POPULATION:	5.33 MILLION
URBAN AREA: TRANSPORT	4,280 KM²	URBAN AREA: TRANSPORT	162 KM²
CARBON EMISSIONS: TONNES CO_2 PER PERSON (PUBLIC + PRIVATE TRANSPORT)	7.5	CARBON EMISSIONS: TONNES CO_2 PER PERSON (PUBLIC + PRIVATE TRANSPORT)	0.7

Source: LSE Cities (2014)

Population density and transport energy consumption



Source: Newman & Kenworthy (2015) *The End of Automobile Dependence.*

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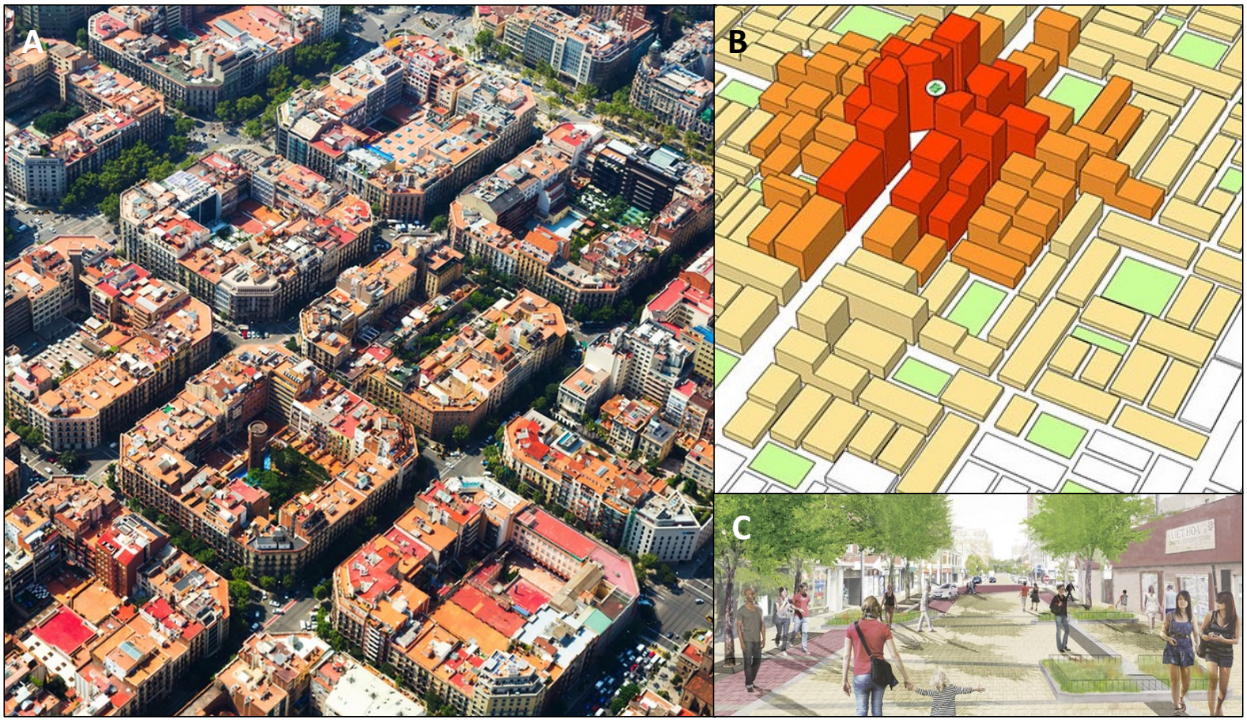
Urban sprawl

Image: brunorodriguezq.wordpress.com

Sustainable urban form



compact cities • new urbanism • smart growth • transit-oriented development • urban villages

Images: vox.com (A); bartonwillmore.co.uk (B); ceosforcities.org (C)

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Density

Activities	
Population density	People per km^2 | dwelling units per km^2
Employment density	Jobs per km^2 | commercial units per km^2
Built form	
Floor area ratio	Gross floor area on all levels / plot area
Coverage ratio	Gross floor area / plot area
Building surface-to-volume ratio	Building surface area / building volume

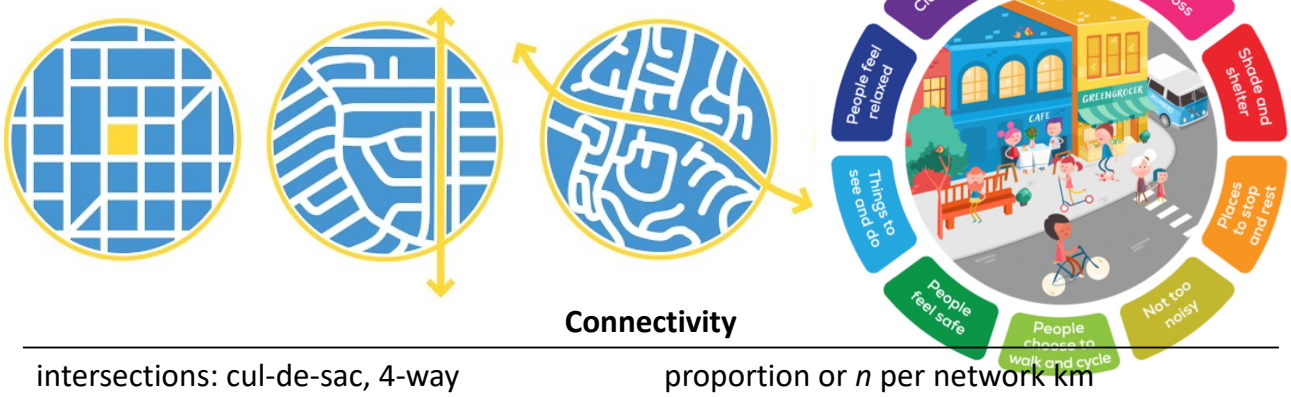
Image: LSE Cities (2020) *Living in a Denser London*; see also Berghauser-Point & Haupt (2005) *The Spacemate*

Diversity

Accessibility	
Non-residential land use *retail, leisure, parks*	proportion or *n* per households
Mixed use buildings	proportion
Walking distance to non-residential use	metres
Travel time to non-residential use	minutes
Distribution	
Land use dissimilarity	ratio
Entropy of land use balance	ratio

Image: NZ Ministry of the Environment *Mixed Use Town Centres Design Guide*

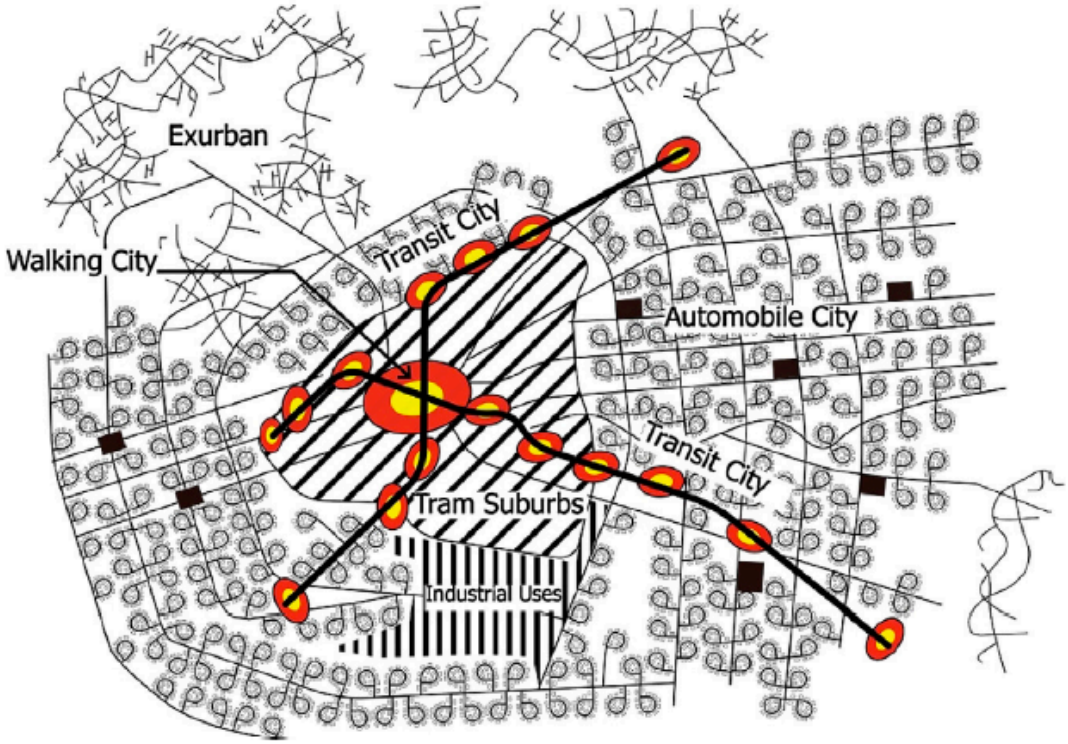
Design



Connectivity	
intersections: cul-de-sac, 4-way	proportion or *n* per network km
network centrality *closeness, betweenness*	ratio
block length	metres
Public space quality	
tree/vegetation density	*n* per hectare
walkability *footpath width & length, planting strips, overhead lights, slope, pedestrianisation*	proportion relative to street segment

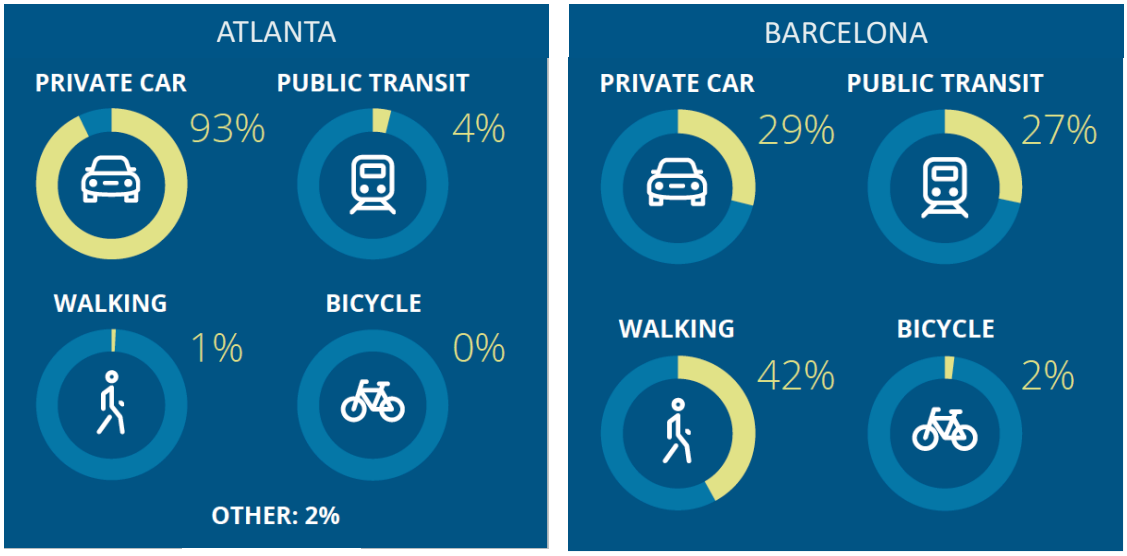
Images: CNU *Street Networks 101* (left), Lucy Saunders *Healthy Streets* (right); see also TfL (2017)

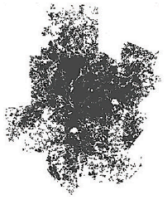
Types of urban form



Source: Newman & Kenworthy (2015) *The End of Automobile Dependence*

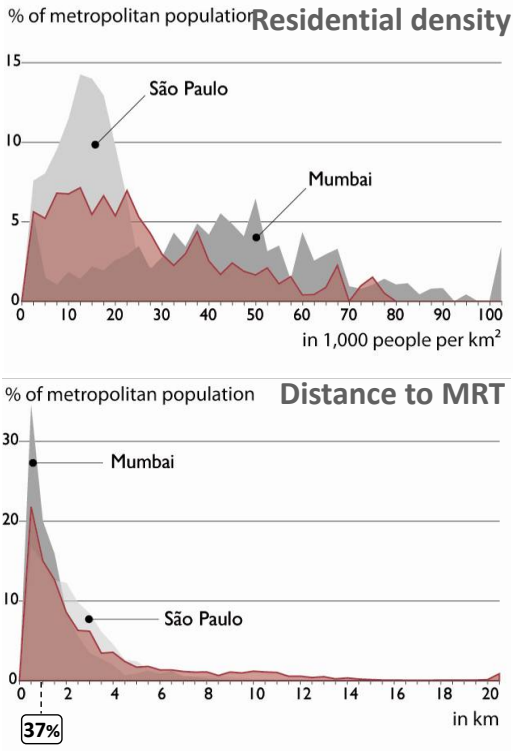
Urban form & travel demand





Source: Deloitte (2019) *The 2019 Deloitte City Mobility Index*

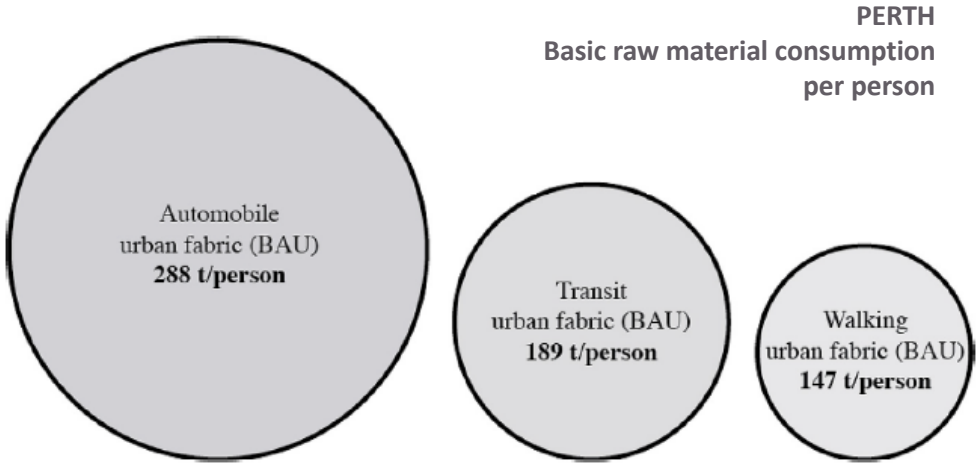
Urban form & travel demand



city	trip	association	elasticity
São Paulo	work	driving ~ slum residence	-.212
		walking ~ slum residence	-.151
		travel time ~ distance to CBD	.243
	non-work	travel time ~ slum residence	.014
Istanbul	work	driving ~ slum residence	-.089
		travel time ~ distance to MRT	.230
		travel time ~ diversity	-.206
	non-work	travel time ~ distance to MRT	.258
		travel time ~ diversity	-.206
Mumbai	work	public transport ~ density	.957
		walking ~ slum residence	.183
		travel time ~ diversity	-.128
	non-work	walking ~ diversity	-.805
		travel time ~ density	-.394
		travel time ~ diversity	-.353

Source: Kandt (2018) *Journal of Transport and Land Use*

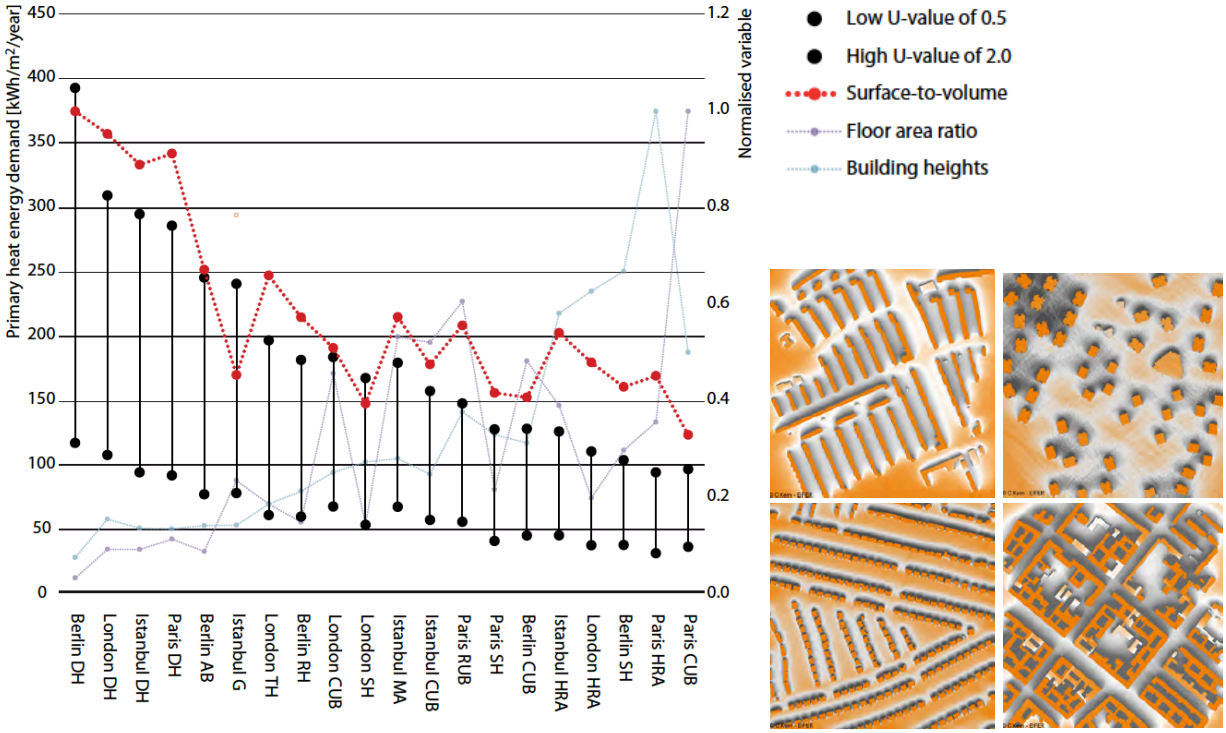
Urban form & demand for resources



Input	Output
Raw materials: sand, limestone, clay, rock	Construction and demolition waste
Fuel	Greenhouse gas missions
-	Household waste

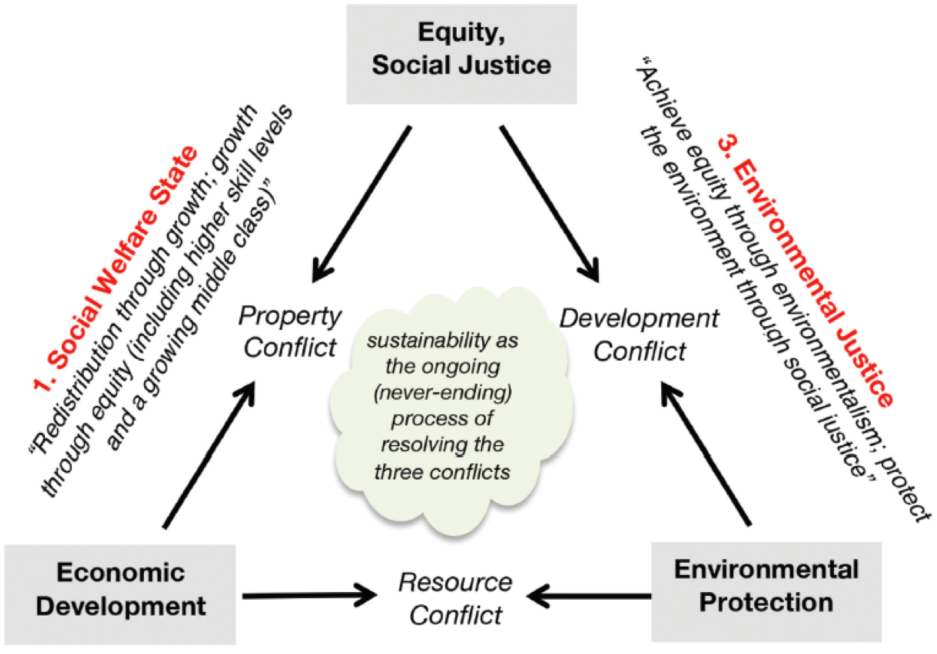
Source: Thomson & Newman (2018) *Resources, Conservation and Recycling* 132

Urban form & heat energy demand



Source: LSE Cities (2014) *Cities and Energy*; see also Rode et al (2014) *Env Plan B*

Urban form & energy demand: contextual factors



2. Environmental Regulation/Resource Management

"Economic development through resource management and conservation; protect the environment through affluence, internalized externalities, and new technologies"

Source: Campbell (2016)

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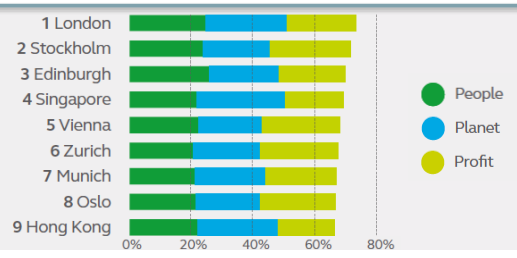
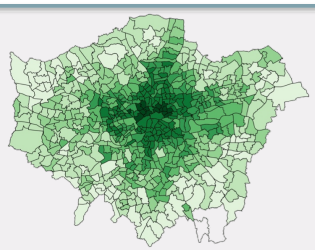
Notions of cities

Arcadis Sustainability Index



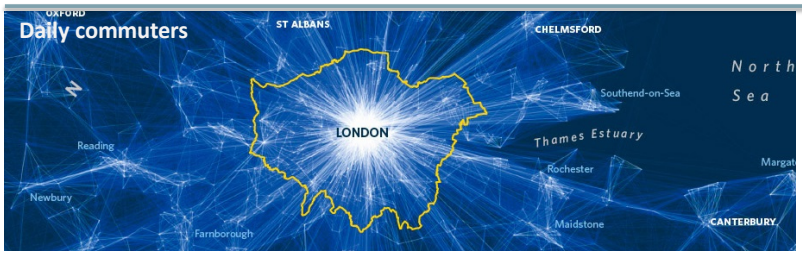
Cities as agents

Household without vehicles



Cities as containers

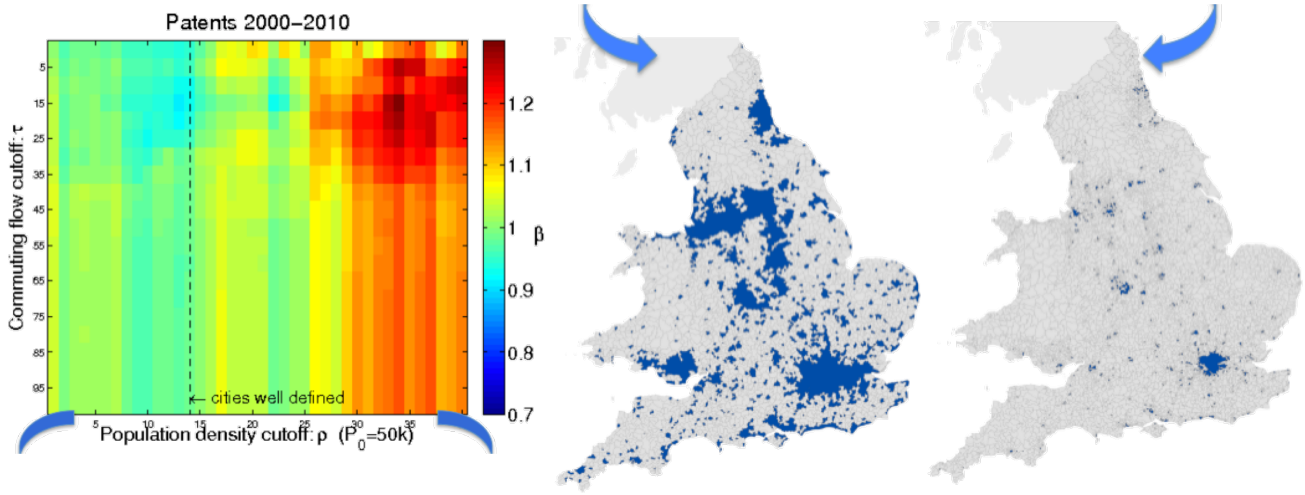
Daily commuters



Cities as open systems

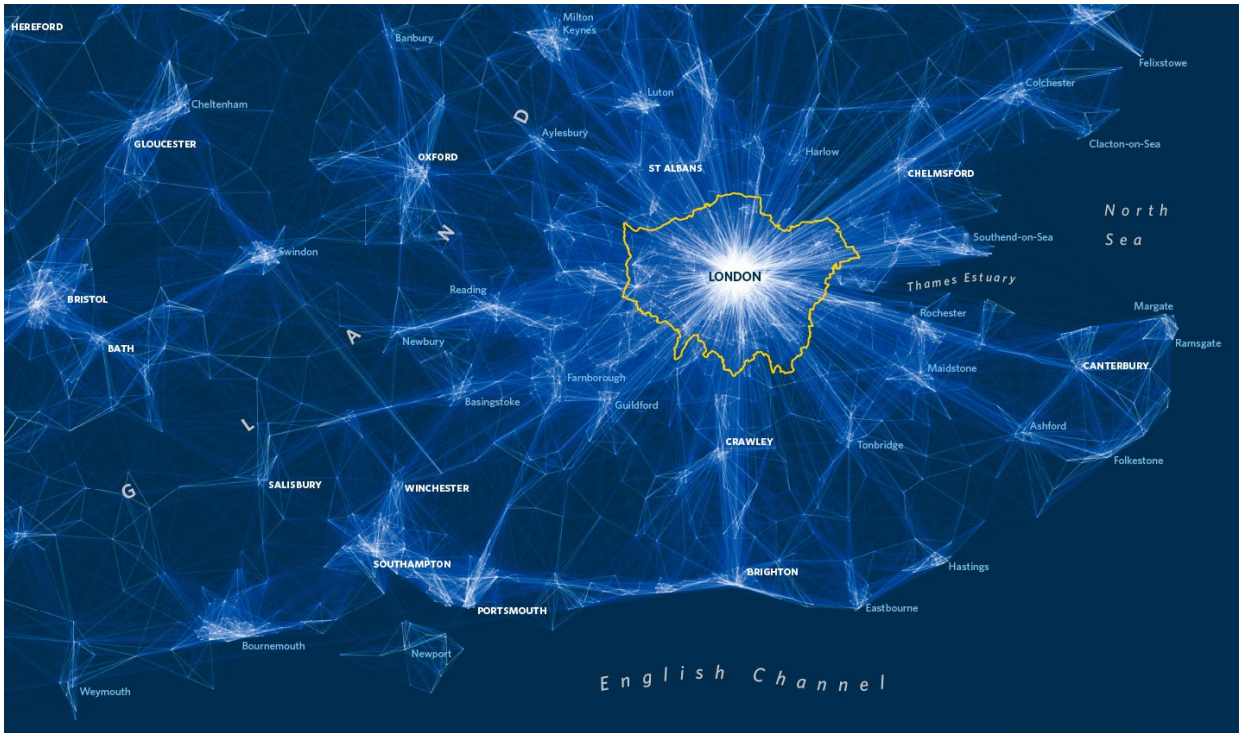
Sources: Arcadis (2018) *Sustainability Index*; bycilyze (2020); Cheshire (2014) *London: The Information Capital*

Defining cities



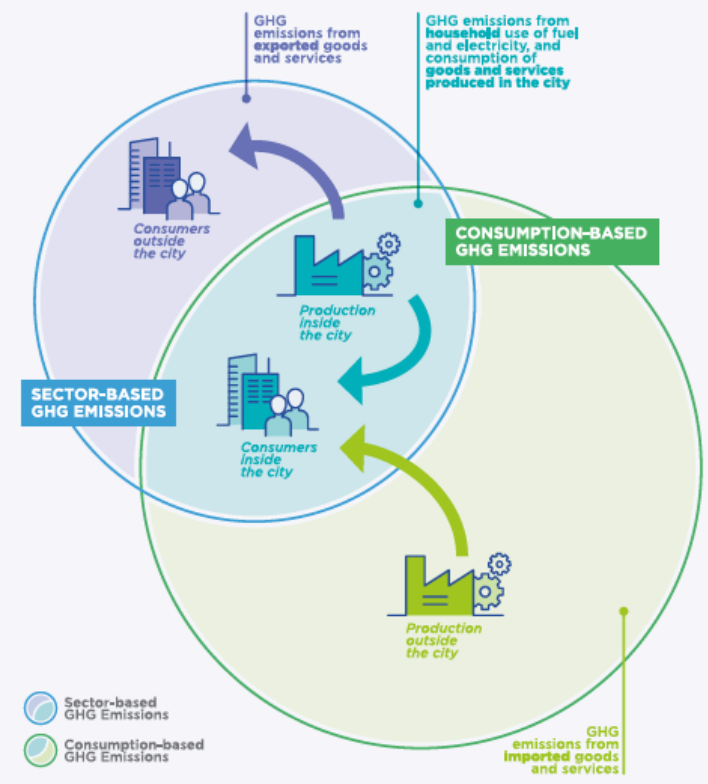
Source: Arcaute et al (2015) *Journal of the Royal Society Interface* 12(102)

Defining cities



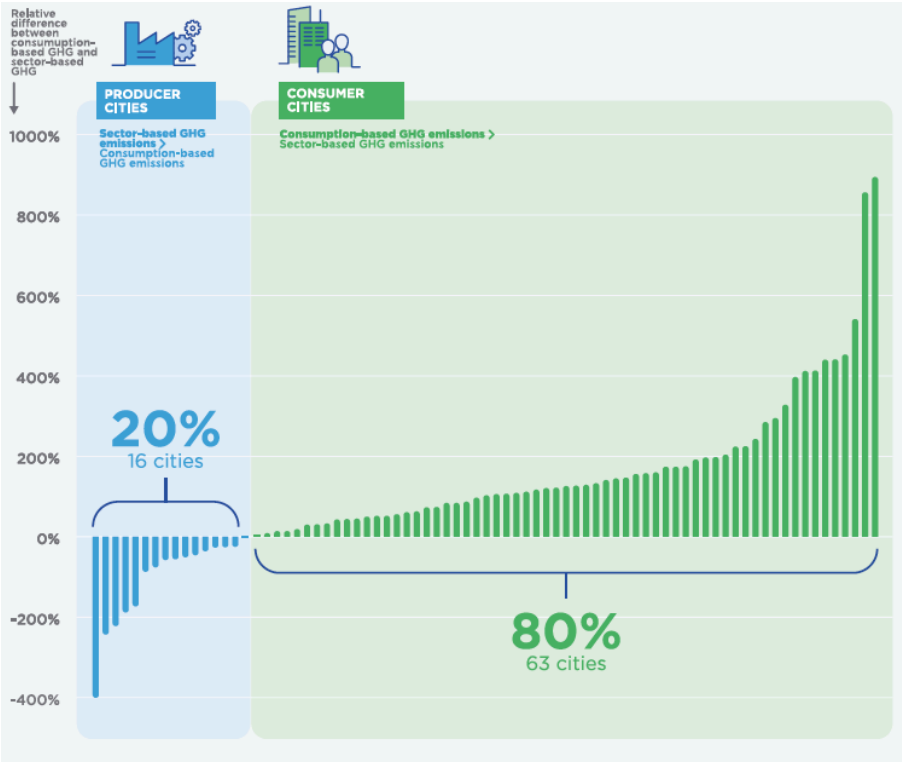
Source: Cheshire (2014) *London: The Information Capital*

Production versus consumption



Source: C40 Cities (2018) *Consumption-based GHG emissions of C40 cities*

Production versus consumption



Source: C40 Cities (2018) *Consumption-based GHG emissions of C40 cities*

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Planetary urbanisation

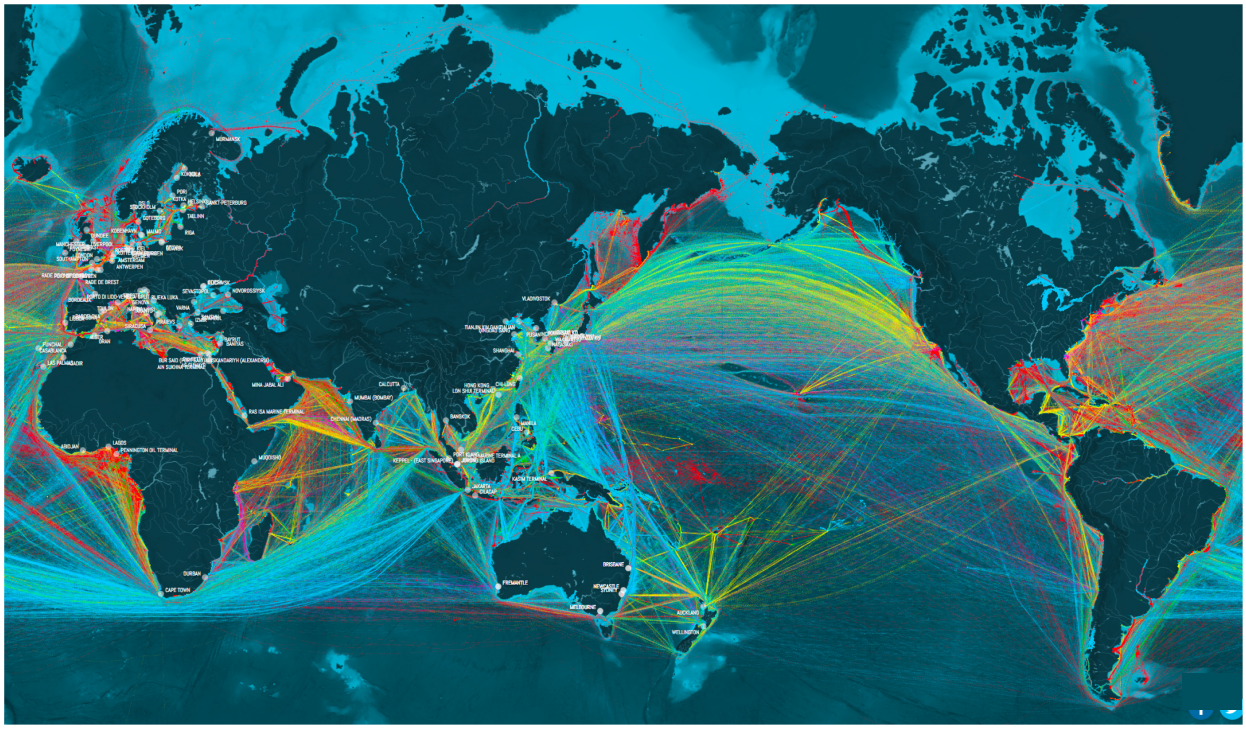

Image: shipmap.org (UCL)

Planetary urbanisation

Urban as nominal essence:
the specific social properties and/or spatial morphologies that are thought to be shared by all urban phenomena, conditions, or landscapes

Urban as constitutive essence:
the various processes (e.g., capital investment, state regulation, collective consumption, social struggle, etc.) through which the urban is produced—whether as phenomenon, condition, or landscape

Concentrated urbanization:
the agglomeration of population, capital investment, and infrastructure in large clusters of settlement space

Extended urbanization:
the processes of sociospatial and socioenvironmental transformation that facilitate and result from urban development across places, territories, and scales

Source: Brenner (2013)

Urbanisation and Morphology

Pearl River Delta

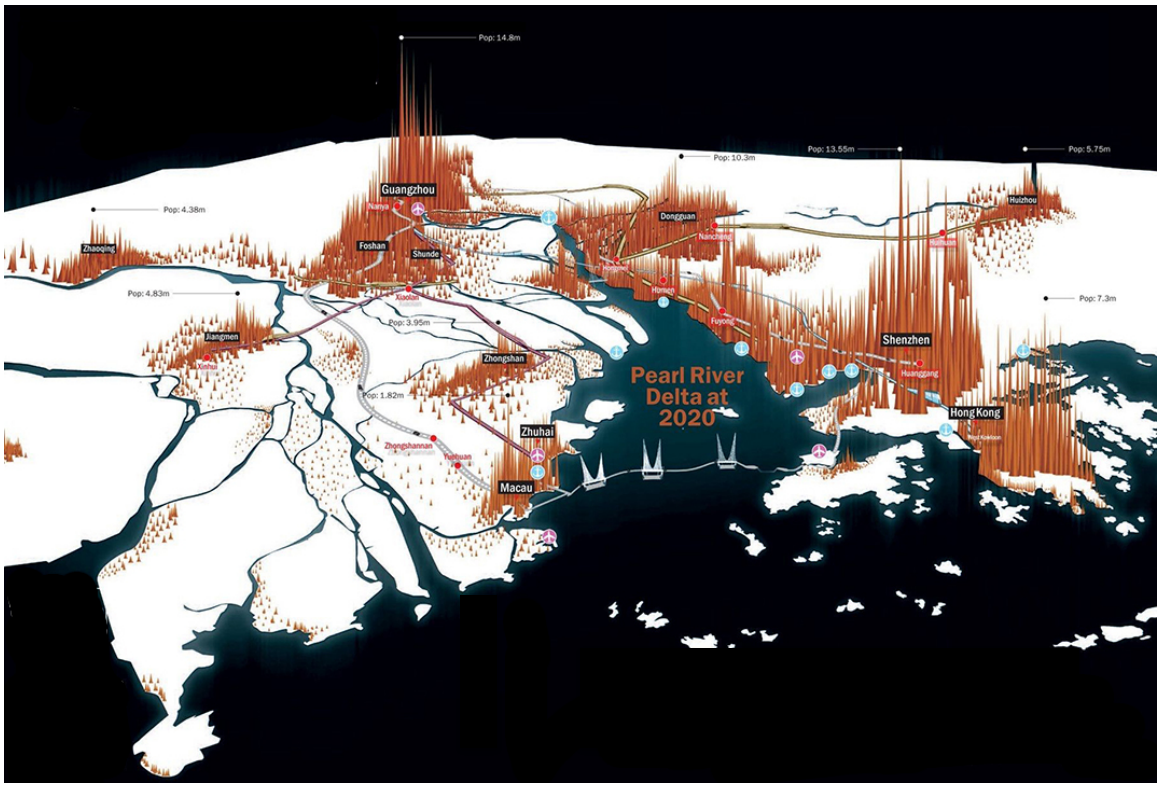

Image: visualcapitalist.com/pearl-river-delta-megacity-2020/

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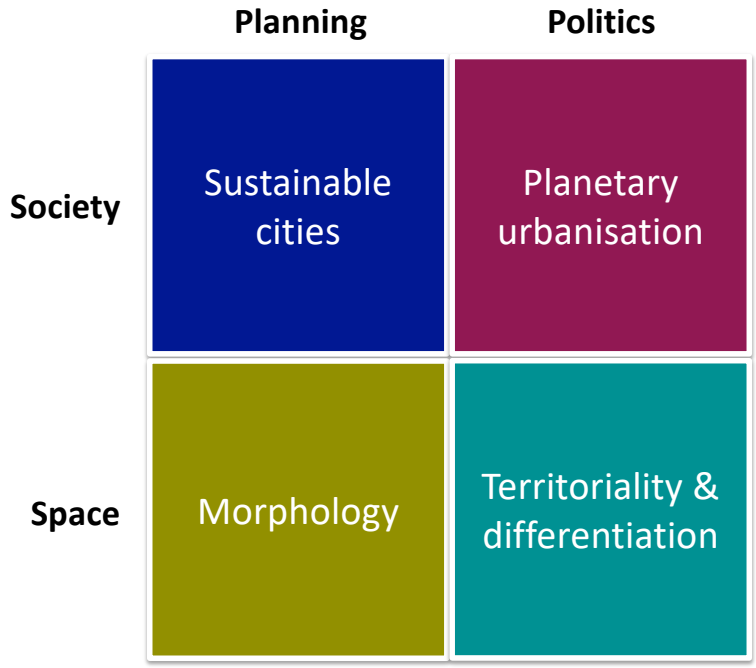

Urbanisation and Morphology

Conclusions

1. Sustainable urban form ≈ compact urban form (density, diversity, design)
2. Compact urban form ⇒ energy efficiency (travel, raw materials, thermal)
3. Cities are open systems and can be defined in many ways.
4. Planetary urbanisation forms the big picture.

Readings

1. Brenner, N. (2013). Theses on Urbanization. *Public Culture*, 25(1 69), 85-114. https://doi.org/10.1215/08992363-1890477

2. Barr, S., & Prillwitz, J. (2014). A smarter choice? exploring the behaviour change agenda for environmentally sustainable mobility. *Environment and Planning C: Government and Policy*, *32*(1), 1–19. https://doi.org/10.1068/c1201

3. Campbell, S. (1996). Green cities, growing cities, just cities?: Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association* 62(3), 296-312. https://doi.org/10.1080/01944369608975696

4. Kandt, J. (2018). Heterogeneous links between urban form and mobility: A comparison of São Paulo, Istanbul and Mumbai. *Journal of Transport and Land Use*, *11*(1). https://doi.org/10.5198/jtlu.2018.1359

5. Kandt, J., Rode, P., Hoffmann, C., Graff, A., & Smith, D. (2015). Gauging interventions for sustainable travel: A comparative study of travel attitudes in Berlin and London. *Transportation Research Part A: Policy and Practice*, 80, 35-48. https://doi.org/10.1016/j.tra.2015.07.008