Urbanization in Europe and the World

When All The World’s a City:
Europe in an Entirely Urbanized World

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The Singularity - infinite population, immortality, or zero population growth
Doomsday: Friday,
13 November, A.D. 2026

At this date human population will approach infinity if it grows as it has grown in the last two millenia.

Heinz von Foerster, Patricia M. Mora, Lawrence W. Amiot

Among the many different aspects which may be of interest in the study of biological populations (1) is the one in which attempts are made to estimate the past and the future of such a population in terms of the number of its elements, if the behavior of this population is observable over a reasonable period of time.

All such attempts make use of two fundamental facts concerning an individual element of a closed biological population—namely, (i) that each element comes into existence by a sexual or asexual process performed by another element of this population ("birth"), and (ii) that after a finite time each element will cease to be a distinguishable member of this population and has to be excluded from the population count ("death").

Under conditions which come close to being paradise—that is, no environmental hazards, unlimited food supply, and no detrimental interaction between elements—the fate of a biological population as a whole is completely determined at all times by reference to the two fundamental properties of an individual element: its fertility and its mortality. Assume, for simplicity, a fictitious population in which all elements behave identically (equivariant population, 2) displaying a fertility of \( \gamma \) offspring per element per unit time and having a mortality \( \theta = 1/l_m \), derived from the life span for an individual element of \( l_m \) units of time. Clearly, the
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Population is slowing to a steady state, this is the demographic transition but more and more people are living in cities

This can’t go on
Something has to give

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All the World’s A City

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So what happens when all the world’s a city – will we still speak of cities?

Of course, but this still poses an enormous and increasing problem about what a city actually is.
Cities will still display their usual frequencies of sizes – rank-size distributions – approximated by power laws. In fact it looks like the world’s cities are actually becoming more spread out with more small than large.
The world’s largest cities > 750,000
But at the same time defining cities has become more and more problematic.

Take the example of Chongqing, a city on the western Yangtze. It reportedly has reached 32 million.
In fact, defining a city’s boundaries is incredibly difficult, and this city sits in a very wide hinterland.

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For most of history, cities have been tight compact affairs – bounded, walled, contained – for defensive purposes as well as based on limited technologies to travel long distances.
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When we began to develop technologies that could move us farther than the horse and cart – mechanical technologies – the internal combustion engine, towns began to grow beyond 1 million, the limit in the ancient world.
London was the first city to reach 2 million. The story of the last 200 years is well known. First the walls went, then the suburbs came, then national networks, then a global spreading out – all blurring what a city actually is.
Let us begin with population growth, from a long way back ...
How do we then draw boundaries when cities merge into one another? What then is a city if most of its wealth like London’s is generated globally?

Density and connectivity are key.
Urban Britain: based on the road links –

at a very fine density – road intersections and street segments at an average of 100 metres from OSM or Ordnance Survey, we have used both

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Let us decompose this into clusters – where clusters are eventually cities.

We start at the 5km threshold

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Here is a movie of how this decomposition occurs when we reduce what we call the percolation threshold from 5 km to 100 m.
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Here is the hierarchy of clusters

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Before I show you how we can still define cities, I need to note some properties of systems of cities, from our ‘new science of cities’ that measures the way they grow and scale.
As cities get bigger, they appear to grow richer more than proportionately to their population size: This is positive allometry. The Santa Fe complexity group have demonstrated this for US and they call it super-linear scaling.
It is no more or less than what Alfred Marshall, the great economist, said about cities in the late 19th century; cities generate ‘economies of scale’

Agglomeration economies but also diseconomies too

But in the UK?

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We have found that cities do not super-scale by income with size. London of course is a massive outlier. But it appears to examine performance, we cannot separate one city from another. They are all of one piece.
So we have defined cities many different ways – from the bottom up using densities and also commuting fields – here are some of our results.

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There are some poor definitions of cities in the EU such as LUZ – large urban zones and we should not use these but we will use density then commuting thresholds.
We consider 14 persons per acre to be the right density cut-off; here Liverpool & Manchester separate.
The correlation with the EU Corine RS data is good and Zipf’s Law looks stable but we need to look at commuting fields – as they get larger around any place then the cities get bigger and less well-defined.
Defining cities: fractal dimension – maximum space filling; and correlation with RS imagery interpretations
So what does this all mean? Well if all the world’s a city, and it is impossible to define boundaries around individual cities, then does all this break down, and we just have one big city?
Yes and No!
Even if the world is all of one piece in terms of a ‘city’ in 2100, there will be differences within the fabric – this is true already, but it will be increasingly difficult to partition the fabric.

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And the idea of urban economies of scale – agglomeration – will be increasingly hard to detect.

Let me end showing by defining cities in Europe as we did for Britain as cities from ‘all of one piece’
d = 4340m

Luhansk, Donetsk and Mariupol

Balkans
d=4340m

Balkans, Luhansk, Donetsk and Mariupol
d=4040m

Valencia and Catalunya split

Bulgaria
Stockholm splits natural barriers

Valencia and Murcia split

Sicily

Romania

d=3200m
Madrid splits

d=2960m
Belarus, Lithuania, Latvia and Estonia split from Poland
Galicia and Portugal one cluster

d = 2420 m
d=2300m

Apulia
Catalunya splits

d=2000m
Berlin detached
Rome and Naples region split
At $d=200m$

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Thank You

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"We're waiting for the city to come to us..."