

How big can a city get ?

Cities usually begin to grow around some central point which acts as a market for the exchange of goods. The Roman agora is the classic example and most cities still show a residual structure which mirrors this historical pattern. Even the car-based cities of the American South West such as Phoenix have a core or city centre that reflects the original source of settlement.

When cities expand through population growth, individuals attempt to get as much space as possible around themselves while remaining as close as possible to other people in the city. This tension between the demand for space, which makes itself felt in lower densities, and the need for proximity to others, which is both a social and economic need, depends intrinsically on the wealth of the population and the level of available technology. The medieval town was limited in size by the how far one could walk to the rest of the town while the early industrial city was constrained by daily commuting using the steam train and tram.

The contemporary city of course is limited by how far one can travel by car. Cities become bigger as people trade-off space for time and diversify their work patterns through the working day and week, while new technologies, which enable high buildings to be constructed, expand city size in the vertical dimension. The skyscraper only became possible after elevator technologies were invented and with new construction technologies and materials, the maximum height of a building has grown ever higher. Somewhat serendipitously the architect Frank Lloyd Wright proposed a scheme for a mile-high building, the Illinois Sky-City, in the 1950s, but only now have technologies reached the point where anything approaching this is possible. The Burj Tower which is under construction in Dubai will be half a mile high when it is finished.

The debate about sustainability of cities is critically woven into this question of size. Urban sprawl, the term now used for cities that grow due to dependence on the car, allow populations to purchase land for living at very low densities far away from city cores while still remaining 'connected'. Such suburbs are often assumed to be unsustainable due to much higher energy use for transport and for heating and cooling such low density structures. If people travel less using less energy and live at higher densities, then it is argued, by some, that cities will be more compact, hence more sustainable in that their carbon footprints will be lower. In a world of rising temperatures and sea levels, and of rapidly diminishing non-renewable fuel sources, the idea of such compact cities appears attractive. However this argument is never straightforward and might even be flawed. Notwithstanding the fact that individuals want to maximise their use of space – lower densities – while remaining attached to the city which is only possible through sprawl, then the amount of energy saved by moving to a more compact form is rather uncertain. It might appear that using less fuel through travel would reduce energy use, but the added congestion and heat posed by crowding could well offset this gain. Moreover, high densities are not



Low density living:
urban sprawl in Phoenix, Arizona

“Our understanding of the way we use energy in cities is so rudimentary that most of the potential solutions to building more sustainable cities remain at the level of speculation”

necessarily compatible with ecological stability in cities and it is not clear that high buildings which are part of the drive for compactness are more energy efficient than lower rise structures. In fact as a building gets larger, it is more difficult to resource through natural lighting and direct energy. The problem is that our measurement of relevant energy use is extremely crude while the multiplier effects of energy flow through the urban economy and population are almost impossible to gauge. In short, our understanding of the way we use energy in cities is so rudimentary that most of the potential solutions to building more sustainable cities remain at the level of speculation.

There is little doubt that if we were to reduce travel and house people in residential areas of higher density constructed of materials that were more energy efficient and if people could be convinced to use less energy, then cities would become more sustainable. We would simply use less energy. But the possibilities of doing this are difficult. Purchasing and using more space which means living at lower densities is largely a function of income in that the greater disposable wealth, the more likely that the individual would live at lower densities. This is compounded by the fact that lower densities can only be sustained by greater expenditures on travel which means more fuel use and this too depends on higher incomes. The much greater carbon footprint of the USA in per capita terms is largely due to two things – greater real incomes and much more available space for living than in Western Europe and other parts of the world. In fact, the rate of change in per capita energy use in the USA is less than in other parts of the world which is reflected in more stringent emissions standards on car pollution and a greater tendency to domestic recycling and related measures.

Moreover technological change could well lead to solutions to the problem of movement in cities which could overturn arguments to reduce conventional energy use by raising densities and pricing out the car. The argument that resource conservation and use might be

High density living:
The half mile high Burj Tower in Dubai

affected by the invention of cleaner and more efficient technologies that process energy more efficiently is an equally difficult one to think through. Already there are quite dramatic increases in efficiency which show every sign of outpacing price rises in non-renewable fuels. The prospect too of substituting information for energy in terms of patterns of travel and other forms of communication is also changing the way people are interacting in cities with much clearer divisions and specialisation of transactions that require face to face versus more remote forms of contact. The prospect of very large cities, where physical movement is not the predominant form of interaction, still appears something of a semi-fiction and ideas about the electronic cottage and the paper-less office have not come to pass, at least not yet.

The question of course remains: how big can a city get? It appears that as we get richer and as our technologies relating to movement get more efficient and we are able to travel longer distances, cities can get bigger, but they are still limited by the capacity to travel during the working day. However if the working day itself is thrown into question and we begin to organise ourselves more flexibly in terms of the use of our time, then this will force up the limits on city size. It is well known that by the end of this century the proportion of the world's population living in cities will have increased from 45% now to some 80%. The world's biggest city at any point in the last 100 years has grown inexorably: in 1900 it was London with 6.4 million; in 1950 it was New York with 12.4 million; in 2000 it was Tokyo with 34.1 million and the forecasts for the next 100 years show that the cities of the developing world will overtake those of the developed. New technologies will determine how big cities can grow as well as how high they will grow in terms of skyscrapers. In 1900, the highest building in the world was in Philadelphia some 167 metres in height; in 1950, it was 381 metres in New York City; and in 2000, it was 452 metres in Kuala Lumpur. The trade-off between space developed, energy used, and the amount of travel required to enable effective and workable communications will determine both the desirability and sustainability of cities. These questions of course are changing as we get better methods of measurement and as we understand the ways in which energy and information underpin the functioning of the modern city. In tackling the problem of the sustainable city, it is essential to measure the size of cities much more effectively and to trace the pathways of energy demand and supply in ways that enable us to get a much clearer view of how we can trade-off space/density for communications. This is the challenge that we urgently need to address, for only then we will get some sense of how big our cities are, how big they can get, and more importantly how big they should be.



Profile / Professor Michael Batty

Michael's research is in the development of computer-based technologies, specifically graphics-based and mathematical models for cities, and he has worked recently on applications of fractal geometry and cellular automata to urban structure.

He was previously Director of the NSF National Center for Geographic Information & Analysis in the State University of New York at Buffalo (1990–1995) and was Professor and Head of the Department of City & Regional Planning in the University of Wales at Cardiff (1979–1990).

Michael has been a member of the Computer Board for British Universities and Research Councils (1988–1990), Chairman (1980–1982) and Vice-Chairman (1982–1984) of the Economic & Social Research Council Environment & Planning Committee, and a member of the Science & Engineering Research Council Transport Committee (1982–1985). He is currently Chairman of the ESRC–JISC Census Advisory Committee and a member of the Advisory Panel on Public Sector Information (HMSO/Cabinet Office). He was a member of the RAE 2008 Geography Panel.

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